The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

United States
Department of
Agriculture

Forest Service

Southeastern Forest
Experiment Station

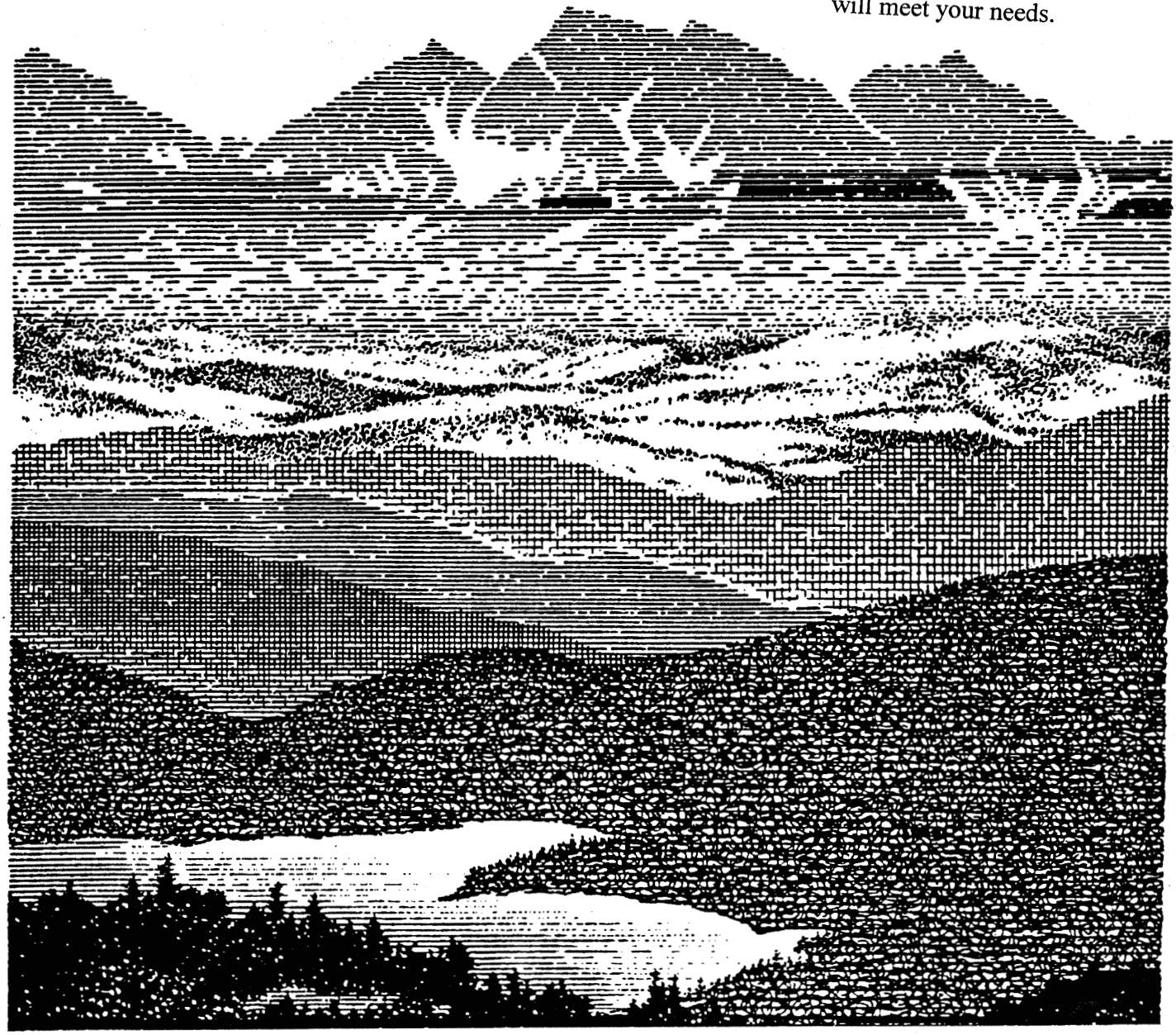
General Technical
Report SE-78

The Economic Value of Wilderness

Proceedings of the Conference

JACKSON, WYOMING
MAY 8-11, 1991

The material you requested is out of print. We hope that this photocopy will meet your needs.



Whenever possible, authors supplied their papers as electronic recordings; they, therefore, are responsible for content and accuracy. Opinions expressed are the authors' and do not necessarily reflect positions of the U.S. Department of Agriculture.

The use of any trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture of any product or service to the exclusion of others that may be suitable.

December 1992

Southeastern Forest Experiment Station
P.O. Box 2680
Asheville, NC 28802

THE ECONOMIC VALUE OF WILDERNESS

Proceedings of the Conference

Jackson, Wyoming, May 8-11, 1991

Compilers:

CLAIRE PAYNE
Southeastern Forest Experiment Station, U.S. Department of Agriculture, Forest Service

J.M. BOWKER
Southeastern Forest Experiment Station, U.S. Department of Agriculture, Forest Service

PATRICK C. REED
Chugach National Forest, U.S. Department of Agriculture, Forest Service

LIBRARY COPY
ROCKY MT. FOREST & RANGE
EXPERIMENT STATION

CONTENTS

Page

Acknowledgements vi

Foreword vii

Part I. Recreation and Wildlife

The Value and Use of Wilderness Lands: Are They Small or Large at the Margin?
E. Bruce Godfrey and Kim S. Christy 3

Importance of Joint Benefits of Wilderness in Calculating Wilderness Recreation Benefits
John B.Loomis 17

Estimating Recreational Demand: A Model for National Forests and Wilderness Areas
Howard A. Clonts 27

The Treatment of Non-Participants in Travel Cost Analysis
Daniel Hellerstein 39

Part II. Economic Methods and Techniques

Valuation of Eastern Wilderness: Extramarket Measures of Public Support
A. Gilbert, R. Glass, and T. More 57

Air Quality, Willingness to Pay and Wilderness: A Review of Methods, Applications, and Implications for Wilderness Management in the Pacific Northwest
Kathleen A. Williams 71

Future Economic Values of Wilderness
John Loomis and Richard Walsh 81

Estimating the Total Value of Forest Quality in High-Elevation Spruce-Fir Forests
Michelle Haefele, Randall A. Kramer, and Thomas Holmes 91

Total Valuation of Wildlife and Fishery Resources: Applications in the Northern Rockies
John Duffield 97

Valuing the Backcountry Resource: A Travel Cost Analysis of an Appalachian Trail Tent Site in the White Mountain National Forest
Christopher E. DeForest and Kenneth J. Andrasko 115

Part III. International Case Studies

International Wilderness: Issues, Progress, and Concerns
Vance G. Martin 121

Wilderness in South Africa
Roland Goetz 127

The CAMPFIRE Program in Zimbabwe: The Economic Benefit of Wilderness Areas to Rural People
Rob Monro 129

Wilderness Issues in Canada
Peter Miller 133

Part IV. Nonconforming Opportunity Costs of Wilderness

Commodity Benefits from Wilderness: Salmon in Southeast Alaska
Ronald Glass 141

Opportunity Cost of Wilderness Designation for Three Roadless Areas within the Lo10 National Forest
Fred Stewart, David Browder, and Jerry D. Covault 155

Streamflow Needs and Protection in Wilderness Areas
Thomas C. Brown 161

Part V. Local Economic Impacts

The Economics of Wildland Preservation: The View From the Local Economy
Thomas Michael Power 175

Economic Significance and Characteristics of Select Wildland-Attracted Visitors to Montana
Neil Moisey and Michael S. Yuan 181

Wilderness-Influenced Economic Impacts on Portal Communities: The Case of Missoula, Montana
Michael S. Yuan and Neal A. Christensen 191

Dynamic Economy Versus Static Policy in the Greater Yellowstone Ecosystem
Ray Rasker 201

Using Market and Non-Market Values of Wilderness Lands in Alternative Revenue-Sharing Strategies
Anne Huebner 217

Part VI. Economic Value in Decision-Making

Economic Value in Wilderness Decision-Making: Some Reflections on Applications
Lloyd C. Irland 231

Wilderness Resource Protection and Economic Resource Production as a Continuum - A Land Manager's Perspective
Bob Moore and Eric Finstick 235

Use of Wilderness Values in Forest Service Policy and Planning
Linda L. Langner 239

The Use and Abuse of Economics in Utah's Wilderness Debate
Ken Rait 245

Wilderness Planning in British Columbia, Canada
Terje Vold 251

Appropriate Suppression Response, A Decision-Making Model for Wilderness Fire Management
Dale Hom 263

Part VII. Noneconomic Benefits of Wilderness

Valuing Wilderness Benefits: Alternatives to Economic Measures
Abby Caul Scott 273

Economic Cost/Health Benefit of Wilderness: Prospects for Assessment
Blair Dillard Erb 281

Wilderness, Its Role in Our Economy
Jerry covault 295

Part VIII. Special Reports

Keynote Address:
The Economic Value of Wilderness
Honorable Wayne Owens 303

The Wilderness Dilemma: Value Vs. Values
W.Victor Rozek 309

The University of Idaho Taylor Ranch Wilderness Field Station
John C. Hendee, Jeffrey J. Yeo, Vito (Sonny) LaSalle, and James Akenson 313

The Economics of Wilderness Recreation: Research in the Southeastern Forest Experiment Station
H. Ken Cordell and Claire Payne 323

The Frank Church Wilderness National Forest: A Proposal
William A. Worf 325

ACKNOWLEDGEMENTS

Many people contributed to making the National Conference on the Economic Value of Wilderness a success and these proceedings a reality. The conference, which took place at Snow King Resort in Jackson, Wyoming, May 8-11, 1991, was one of a continuing series of wilderness conferences sponsored by the Wilderness Management Working Group of the Society of American Foresters. Co-sponsors and financial partners included the USDA Forest Service, Southeastern Forest Experiment Station, the USDI Bureau of Land Management, and the University of Georgia. Special thanks go to Ken Cordell of the Southeastern Forest Experiment Station for giving his staff the time and support to chair and coordinate the conference, as well as produce the proceedings. Gratitude and recognition are due also to Keith Corrigall, Wilderness Branch Chief for the Bureau of Land Management, for providing funds for the conference and proceedings, as well as encouraging conference participation and attendance.

Conference steering committee members included John Bergstrom, Tom Brown, Lloyd Irland, John Loomis, Vance Martin, George Peterson, Tom Power, Pat Reed (chair), Holmes Rolston III, and Paul Weingart. Claire Payne coordinated the conference, with the assistance of Frank Beum and Jean Hearn. As officers of the Wilderness Management Working Group, Paul Weingart, Tom Kovalicky, and Margaret Petersen presided at the conference. Others who contributed to the conference's success included Kirsten Ingebrigtsen, Mike **Hedrick,** Roger Clemmons, Mark Young, Thomas Gionet, Eric Finstick, Jan Beum, Susan Marsh, Charlotte Payne, Mike Tetreault, Marsha Kearney, Linda Merigliano, Loii Ziemann, Fred Kingwill, Gloria Flora, Shirley Longhii, Elaine **Mercill,** Marilyn Howard, and Jackie Bradford and the staff at Snow King Resort.

The following people conducted peer reviews for the proceedings: John Bergstrom, J.M. Bowker, Tom Brown, Don English, Lloyd Irland, John Loomis, Vance Martin, Tom Power, Pat Reed, and Jeff Teasley. We greatly appreciate their suggestions. Also, we want to recognize Ray Souter for contributing his statistical expertise. The compilation and editing of the proceedings has been a joint effort. Jean Hearn assisted in coordinating peer reviews. Much gratitude goes to the team of Ann **Stueck,** Laura Crane, and Marisol **del** Aguila for their professional efforts to produce this publication. We also wish to thank Ray Souter, Shela Mou, Roger Clemmons, and Mark Young, whose technical expertise was valuable.

Finally, we wish to thank our special guests at the conference, including the keynote speaker, the Honorable Wayne Owens, United States House of Representatives (Utah); Dr. Arnold Bolle; and Mardy Murie. Net revenues generated by conference registration fees helped establish the Arnold Bolle Wilderness Management Scholarship offered by the Society of American Foresters.

October 1992

FOREWORD

Wilderness is an integral part of the Federal land system. Since its inception in 1964, the National Wilderness Preservation System (NWPS) has grown to more than ninety million acres. It presents a source of controversy to many in society, while to many others its existence is virtually unknown.

Among those who have an explicit interest in wilderness, there are often strong disagreements about its future. To some it provides society with important and valuable opportunities in recreation, science, education, spiritual growth, conservation, preservation of biodiversity, and rural economic stimulation. To others it is seen as a playground reserved for a small and relatively affluent segment of society, a source of lost jobs in the extractive industries, an impediment to economic development, and a violation of the private land ethic fundamental to American life.

Clearly, wilderness presents a number of enigmas for society in general as well as for those immediately responsible for the allocation and management of the NWPS. The debate in society among those with interests in wilderness is far from being resolved and will likely expand as ecological awareness brings more of the public into the debate. This presents an important and exciting set of challenges to the research community to provide the kinds of information and analyses that can constructively contribute to the debate.

Given the complexity of the issues pertaining to wilderness, it follows that ultimately a multidimensional approach will be needed to better examine and resolve these issues. However, today more than ever, public land management decisions are being subjected to an economic yardstick, and wilderness is no exception. It is on this basis that the National Conference on the Economic Value of Wilderness was convened to identify and discuss the key economic issues surrounding wilderness. Specifically, the mission of the conference was to address three objectives:

1. improving the knowledge of the direct and indirect benefits and costs of wilderness designation;

2. improving the knowledge of the effects of wilderness designation and management on the economic condition of surrounding communities; and

3. improving the knowledge of alternative economic measures of wilderness value.

It is not the intention of the conference to suggest that economic valuation of wilderness and its dimensions is or should be the "bottom line" when decisions are to be made. Indeed, there is considerable debate among economists, let alone other social scientists, as to what constitutes economic value and how it should be measured. Nevertheless, it is recognized that economic values are among the leading current standards by which the nation's land management decisions are made.

To effectively meet the objectives of the conference we sought to include papers and speakers from a broad range of backgrounds and biases, including university researchers, wilderness managers, community leaders, and private sector representatives. By bringing together such a diverse spectrum of knowledge and interest, we feel that the essence of the conference is such that overall an unbiased flavor emerges.

These compiled papers range from philosophical to highly technical and from advocacy to opposition. Herein, the papers are arranged according to the following sections of the conference:

I. Recreation and Wildlife;
II. Economic Methods and Techniques;
III. International Case Studies;
IV. Nonconforming Opportunity Costs of Wilderness;
V. Local Economic Impacts;
VI. Economic Value in Decision Making;
VII. Noneconomic Benefits of Wilderness; and
VIII. Special Reports.

While the reader is left to draw her own inferences from the papers, a number of ideas, concepts, and knowledge gaps seem to permeate the papers. Foremost among them is the problem of defining that which is to be valued. Unlike apples and oranges, wilderness presents dimensions ranging from the tangible to the existential. Is there a holistic system value different from the sum of individual units? What, in fact, are the defining characteristics of individual units and how can they be measured separately and interactively? There are no easy answers.

The economics profession appears to be ready with a theoretical and methodological tool kit to address parts of the problem. Indeed, papers at this conference illustrate advances in measuring components of both

direct and indirect, consumptive and nonconsumptive benefits attributable to wilderness, specific wilderness sites, and particular aspects of individual wilderness areas. Many of the same tools can also be used to ascertain the costs to society of maintaining and expanding the NWPS. Nevertheless, the development of these tools is at its infancy, and they will be very limited until the huge gaps in understanding the physical, psychological, political, and philosophical relationships inherent in complex wilderness systems are better understood.

We can, however, pretty safely conclude that individuals and society appear to value wilderness far more than as a recreational destination and are beginning to recognize its complexity. Hopefully, economists working in conjunction with physical and other social scientists will face the plethora of research challenges related to wilderness in a manner that enhances social well-being.

Part I. Recreation and Wildlife

THE VALUE AND USE OF WILDERNESS LANDS: ARE THEY SMALL OR LARGE AT THE MARGIN?

E. Bruce Godfrey and Kim S. Christy*

ABSTRACT

Recreational use data for lands administered by the Forest Service indicate that use rates per acre declined during the decade of the 80s from the relatively high rates of use that occurred in the 70s. Use data for Utah are used to suggest which wilderness areas are likely to have relatively high (low) recreational use and preservation values. Economic evaluations that are based on average rather than marginal use rates and values are likely to be unduly optimistic.

INTRODUCTION

The decision to designate an area as part of the National Wilderness Preservation System (NWPS) has historically been associated with controversy (Roth, ***1988).*** Legislation introduced to designate Bureau of Land Management (BLM) lands in Utah as part of the NWPS illustrates the differences of opinion that exists. Congressman Owens' bill would designate in excess of 5 million additional acres, while Congressman Hansen's bill suggests designation of just over 1 million acres. A five-fold difference of opinion is not uncommon between those who support and oppose designation of additional lands in the NWPS. One reason for differences of opinion stems from the lack of empirical data concerning the benefits and costs of designating areas as wilderness. Therefore, these decisions will always be subjective to some degree.

Much has been written concerning the benefits of wilderness, but much less has been written concerning the economic tradeoffs that may be involved in these decisions. This paper raises "some flags" that must be considered in evaluating the benefits of designations.[1]

WILDERNESS DESIGNATION: THE FRAMEWORK

The basic methodology needed to evaluate the decision to include an area as part of the NWPS has been developed for some period of time and will not be discussed in this paper. Interested readers should consult one of the many references that are available (Hufschmidt and others, 1983; Smith, 1988; Bowles and Krutilla, 1989; Freeman, 1979). The basic methodology suggests that one must determine the benefits and costs with versus without the action proposed (designation in this case). For example, Walsh and Loomis indicated in their 1989 article (page 183) that "while society as a whole values wilderness (according to information from opinion surveys), the U.S. Congress does not debate whether to have wilderness or not but rather how many areas and where .... The issue is not whether to have natural areas or not but what are the [net] benefits of more or less." These evaluations require estimates of the marginal benefits and costs of adding a site(s) or amount of acreage to the NWPS.

WILDERNESS RECREATIONAL USE: AN HISTORICAL PERSPECTIVE

While the Forest Service **(FS)** only manages about **one-**third of the total NWPS lands, it manages more than 80 percent of the NWPS lands in the "lower 48." It is also the primary agency that has consistent data on recreational use over **time.**[2] The FS employs recreational visitor days **(RVDs)** as the variable that measures use. An RVD represents one person for 12 hours or an equivalent combination, such as two people for six hours.

National Use Data

Data concerning recreational use" of FS lands (wilderness and nonwilderness) indicates that use increased from 160 million **RVDs** in 1965 to more than 242 million in 1988. Most of the rapid increase in total recreational use occurred during the **70s,** whiie use in the 80s has been relatively stable. Similar data for wilderness lands show a more dramatic increase. Wilderness use increased from nearly 4.5 million **RVDs** in 1965 to 11.7 million in 1988. This increase suggests that recreational use of wilderness lands has increased.'

---

* Associate Professor and former graduate Research Assistant, respectively, in the Department of Economics at Utah State University.

Some wilderness proponents have used this large increase in recreational use as a primary reason for justifying the designation of more areas. However, during this same period, the number of acres designated as part of the NWPS was not stable - NWPS lands administered by the FS increased from nearly 1.48 million acres in 1965 to 3.37 million in 1990.[4] These data indicate that the percentage of land administered by the FS, that was part of the NWPS, increased more rapidly than recreational use (Figure 1) - use increased from 2 to 5 percent of total recreational use, while the percentage of land increased from 8 to 18 percent. It is, therefore, necessary to account for any change in acreage when evaluating changes in wilderness recreational use over time. Evaluation of use on a per-acre basis illustrates the effect of these changes. FS data show that use of wilderness areas on a per-acre basis increased until the late 70s and has declined since that time (Figure 2). This is one reason why some have suggested that wilderness use is declining.

While the decision to include an area(s) as part of the NWPS must be done from a national perspective, large differences in use patterns in specific areas are common. Data available for Utah illustrate some of these differences.

Utah Use Data

While the national data noted above suggest some interesting trends, the data for Utah provide some additional insights. Recreational use of the fifteen wilderness areas in Utah are separated into five groups: High Uintahs, Lone Peak, Wasatch Front, Cache Valley, and Southern Utah. Lone Peak was the first area officially designated as a wilderness in Utah in 1978. The High Uintahs were not (de jure) part of the NWPS until 1984 when the other areas were included in the system. But the High Uintahs have always been managed as if they were part of the system (de facto).

The recreational use data for NWPS lands in Utah show the same general pattern (Figure 3) as that for the nation, with three exceptions. First, the general level of use is greater on a per-acre basis. Second, use per acre peaked somewhat later than it did nationally. Third, there is somewhat less evidence of a decline in use - especially the last five years. There are at least two reasons that may be given for these differences. First, Utah's population has the youngest age structure of any state in the nation. As a result, a large portion of Utah's population is of an age class expected to be actively involved in strenuous outdoor activities.' Second, a large portion of these areas are close to most residents of the state. This is one of the primary reasons why some areas are intensively used. For example, use of Lone Peak, which is near the world-famous ski resorts Alta and Brighton, has continued to increase, while use of the more remote areas has been essentially stable (Figure 4).

DECLINING USE OF WILDERNESS?

A combination of factors may cause the declines in use rates per acre shown in Figures 2 and 3. The following possible causes are discussed below: 1) low use rates for new/additional areas, 2) redistribution of use, and 3) declining demand.

If the use rates of newly added acres were less than those previously in the NWPS, use rates per acre would decline. Data are not readily available for all areas in the NWPS, but some indication of the possible use pattern(s) exists for the wilderness areas in Utah. The use rates per acre for areas that were added to the system in 1984 were generally less than they were for areas (Lone Peak and High Uintahs) that were already in the system. Some of the areas near the Wasatch Front had relatively high rates of use, while the areas in the southern[6] part of Utah had use rates much lower than other areas.

If use of existing wilderness areas declines when other areas are added to the system, and if the rate of use for the new areas is less than the decline in the old areas, the overall use rate per acre will decline. Lucas and Stankey (1989) have shown that total use of the original or "instant" wilderness areas (designated in 1964) increased from 1971 to 1979 but declined during the decade of the 80s. Thus, some evidence suggests that additions to the NWPS may not result in increased total use but results in a shifting of use between areas.[7] Data for Utah show a somewhat different pattern. When areas were added to the NWPS, use of Lone Peak did not decline, but use of the High Uintahs did decline. However, recreational use of the High Uintahs was declining before the new areas were added to the system. This suggests a possible decline in demand for some existing areas (e.g., High Uintahs) that may be independent of new additions to the NWPS.

Several authors have suggested that the demand for wilderness use is declining or at least stabilizing (e.g., Lucas and McCool, 1988; Lucas, 1988; Roggenbuck and Watson, 1989). The surveys conducted by Reed (1989), however, suggest that use may not be declining. Neither hypothesis has been clearly tested empirically, but it is generally agreed that recreational use of NWPS lands is not increasing as rapidly as it was

during the decade of the 70s. This suggests that there has been some shift in the use of wilderness lands for recreation.

One would expect the demand for various recreational activities to change over time as socioeconomic factors such as population and income change. In an effort to provide some indication of how these factors might be affecting the demand for recreation on FS lands, Christy (1988) estimated growth rates for wilderness and nonwilderness lands at the national, regional (Region 4), and state levels (Utah). He used a "Chow test"[8] to determine if growth rates changed over time for wilderness and nonwilderness lands. This test indicated that use rates for both wilderness and nonwilderness lands changed in the early 80s. These data indicate that the growth rate in use per acre for wilderness lands has been negative since 1980, while the growth rate has been positive for nonwilderness lands. These data suggest, therefore, a possible shift in the demand for wilderness relative to nonwilderness recreational activities. If the relative value ($ per RVD) of wilderness versus nonwilderness recreation has not changed, allocations of resources from nonwilderness recreation to wilderness at the margin may not be justified as long as use rates for wilderness are declining relative to nonwilderness. This conclusion is not as clear if the value of wilderness recreation is increasing faster than other types of recreation (we have found no studies that have tested this hypothesis). This is clearly a topic where more research is needed.

WILDERNESS USE AND OTHER TYPES OF RECREATION

One of the most perplexing problems associated with making the types of analyses needed to evaluate wilderness designations stems from the lack of information about how these actions may affect recreational use of other areas (see the classic article by Knetsch [1977]) for a discussion of this oft-forgotten issue). For example, some FS district rangers have indicated in discussions with the authors that one reason why wilderness land use decreases following designation is due to incompatible uses (e.g., snowmobiling or biking). These activities shift from wilderness to nonwilderness lands following designation. This change in use may more than offset any increased wilderness use that may occur as a result of the possible "designation effect" (McCool, 1985). This also suggests that an evaluation of wilderness designation must also consider how use in one area may affect the use of other areas. For example, Walsh and Gilliam (1982) suggest that if use in one wilderness area is occurring to the degree that this area is becoming congested, adding a new wilderness area may reduce congestion in the first area if people use the new area and reduce use of the congested area(s). If congestion is not occurring and if designation of one area results in decreased use in another area, the net increase or decrease in use (increased use of one area minus the decreased use of another area[s]) must be estimated. Obviously, if the addition of a new area(s) does not relieve congestion (reduce use) in an existing area, the additional benefits suggested by Walsh and Gilliam would not be valid. For example, data for Utah suggest that the addition of new areas has not relieved congestion of existing areas such as Lone Peak. If the addition of the new area did not increase total use, then no additional recreation benefits would occur because only a shift in use between areas occurred.

While Walsh and Gilliam (1982) emphasized how additions to the NWPS may reduce congestion in existing wilderness areas, thii is only part of the recreational use interactions that one must evaluate. One must also evaluate how designation may affect nonwilderness areas. If designation of an area as a wilderness results in increased use and congestion of nonwilderness areas, the benefits of wilderness designation will be less than an evaluation based on wilderness areas alone. This suggests that wilderness planning should not consider only wilderness use and values. It also suggests that more research is needed that estimates how use may change between areas. Probable changes in use also suggest that it is essential that substitute areas must be included in valuation studies (e.g., travel cost and contingent valuation).

WILDERNESS USERS

The above discussion emphasized wilderness recreational use data, but data concerning wilderness users are also important in making management decisions. Several recent articles (see the excellent summaries by Roggenbuck and Lucas [1987]; Roggenbuck [1988]; Lucas [1988]) have summarized the characteristics of wilderness users. These summaries suggest that most use is by people living in urban areas near their place of residence. This trend is apparently true of recreational use in Utah. Areas near the Wasatch Front are used much more heavily than are the more remote sites (Figure 4). Furthermore, use is increasing in these areas while use in the more remote sites is low and probably stable. This would suggest that areas near urban centers probably have high value for recreation at the margin, while these values are probably low in more remote areas. However, one

must remember that recreation is only one of several uses associated with wilderness lands.

IMPLICATIONS FOR ECONOMIC EVALUATIONS

Walsh, Loomis, and **Gillman** (hereafter referred to as **WLG)** published one of the first applications of economics to the problem of designating an area(s) as part of the NWPS. The basic results of this article are summarized in Table 1 (see also the later study by Walsh and Loomis **[1989])** which summarizes later work in this area).

At the time WLG was published, it was not clear that **nonuse** values (option, existence, and bequest) were to be included in the analysis. That question is no longer a major issue in making these kinds of decisions. However, even if the basic methodology has now been generally agreed upon, the application of this methodology is fraught with pitfalls. It is also an area where the amount of information available for these evaluations is constantly **changing[10].** While WLG provided the general framework for evaluating the benefits and costs of designating an area as wilderness, several modifications" need to be made in the analysis in light of the data that are now available. The following discussion uses the same general benefits suggested by WIG - recreational use and preservation values.

Recreational Use Values

The estimation of recreational use values involves estimating marginal values for both the rate of use **(RVDs)** and the value of this use ($ per RVD). Before one can determine what modifications need to be made in the analysis outlined by WIG, one must first understand how the benefits **(RVDs** and $ per RVD) were estimated. Dividing the 13.2 million dollars shown for the 1.2 million acre scenario by $14 yields 943 thousand visitor days, or **.7857** visitor days per acre **{[$13.2 million/$14]/1.2 = .7857 RVDs** per acre}. Similar data for the other acreages are **.5759, .4729,** and **.4157 RVDs** per acre for the 2.6, 5.0, and 10.0 million acre scenarios. These data suggest a declining use rate per acre for the areas being added to the system, but the rate of decline is not nearly as fast as the decline in use rates for the nation (Figure 2) or Utah (Figure 3). It should also be noted that the use rates per acre used by WLG are higher than they are for the nation as a whole. Not once in the **26-year** period (1964 to 1988) did the use rates per acre for the nation get as high as **.57 RVDs** per acre. But, the data for Utah shows that use rates per acre for some areas (e.g., Lone Peak) may be much higher than the average, while use rates in remote areas tend to be low (e.g., the Southern Utah wilderness areas). One must, therefore, carefully evaluate what level of use is likely to occur in the area(s) being considered for designation before the marginal benefits of recreation can be determined. If the areas being considered for designation are "remote," use rates are likely to be relatively **small.[12]** As a result, aggregate recreational benefits are likely to be small, unless the value of an RVD of use in remote areas is higher than it is for other areas.

Two other use-related considerations must be included in the above analysis before one can determine the marginal recreational benefits of designation. e recreation will likely occur in most areas being considered for designation, even if the area is not designated as part of the NWPS. One must determine what difference in recreation use would occur (with versus without designation) before the marginal recreational benefits can be **determined.[13]** In addition, the impact of designation on the recreational use of other areas (wilderness and nonwildemess) must be estimated because designation decisions are to be made from a national perspective. These considerations suggest that there is potential to significantly overestimate the recreational benefits of wilderness designations unless these use relationships are specifically evaluated for each area being considered, even if one has a "good" estimate of the value of use.

Some studies that have estimated wilderness recreational use values **($** per RVD) have based these estimates on a sampling of residents in a state or area. It is likely that this would underestimate the potential benefits if a large portion of the visitors were from areas not included in the sample. However, as the surveys of wilderness users have shown, most users are from the local area. As a result, surveys that include only locals (residents) may not be as biased downward as some have suspected.

While it is beyond the scope of this paper, one must use care in evaluating the values placed on **RVDs** of recreation. Some (most?) of the studies that have been conducted in the past using travel cost as well as contingent valuation methods result in average, not marginal, values (this issue is discussed in Schuster and Jones **[1982];** Smith and Desvousges **[1986]).** Even if a marginal value is estimated using one of these methods, this estimate is often based on the value of existing wilderness areas and not on the value of additional acreages. Because the marginal value of an RVD is not commonly available for these types of analysis, an average value such as $14 is used. One should recognize that the use of average values will

commonly result in inflated benefit **estimations**[14] because values per RVD will generally decline at the margin as the supply is increased - especially **if** the demand for wilderness recreation is declining. Thus, if one uses average use rates and average values per RVD, the recreational benefits are likely to be larger than if one properly used marginal values. But, one must also recognize that recreational use of wilderness lands is only one reason why lands may be included in the NWPS.

Preservation **Values**

There seems to be little, if any, doubt that preservation values exist with respect to many goods and services (these need not just be natural resources). Literature has shown that preservation values depend on either demand and/or supply uncertainty (Bishop, 1982; Weisbrod, **1964;** Krutilla, **1967).** This literature has also shown (Freeman, 1985; Schmalenese, 1972; and Bishop, 1988) that these values can be positive, negative, or indeterminate. But, most empirical studies have shown that option value is **positive**[15] and that these values can be fairly large. This consensus does not, however, answer the question about what these values may be at the margin. A recent article by Smith (1984) provides a bound for these values. He concludes that 'unique, widely recognized environments must be treated differently from more commonplace resources." When the good in question is not unique and is replaceable, the option value will be bounded by zero (does not exist). "As a result, the degree of demand uncertainty and the uniqueness of the good are the key ingredients in determining the magnitude of option value ...." The degree of "uniqueness," like beauty, will generally be judged "in the eyes of the beholder," but the degree of uniqueness will decline as the number of substitutes increases. One would, therefore, expect "locals" to have a higher option value for a particular wilderness area than would "nonlocals." This is one of the probable reasons why **Barrick** (1986) found that option values for a particular wilderness declined as one moved farther from the area where the resource was located.

The existence of other (substitute) areas is one of the reasons why preservation values decline at the margin. For example, the study by WLG indicated that preservation values (Willingness to Pay [WTP]) declined at the margin in a linear fashion (total WTP = 9.17 + 4.1854 Q - 0.1919 Q^2 or marginal WTP = 4.1854 - 0.3838 Q) as acreage (Q) increased. This rate of decline is, however, subject to some question. The study by Pope and Jones (1987) for Utah, for example, suggests a faster rate of **decline.**[16] If preservation values decline more rapidly than the linear function suggested by WLG, preservation values would not be as high for large acreages as this linear function would suggest.

Supply uncertainty is probably the major reason why lands are included in the NWPS and why option values exist for these lands. However, there is presently an assured supply of lands that have been designated as wilderness even if no additional lands were to be designated. One would expect, therefore, that the option value would approach zero if there were close substitutes for an area(s) that was being considered for designation. Thus, setting aside some lands as wilderness is essentially analogous to the policy of setting a "safe minimum standard" for flow resources having a critical zone that was advocated by **Ciriacy-**Wantrup (Chapter 18) nearly 40 years ago. Once a sufficient number of acres have been designated and a supply is assured, the **marginal** value of additional acres would be expected to drop rapidly. **This,** however, begs the question of what is to be supplied, because the attributes of each wilderness area are not the same. This suggests that research is needed to determine what constitutes a "reasonable" substitute for an existing or proposed wilderness area.

All wilderness areas are not equal and some may be poor substitutes for other areas. For example, many (most?) of the areas presently designated as part of the NWPS in the West have been high mountain areas that are primarily available for use during the summer. As a result, areas being considered for designation that do not differ significantly from areas that are already in the system would not be expected to have high option **values**[17] because many substitutes probably exist.[18] In Utah, the areas that are currently receiving the most attention by wilderness advocates for future inclusion in the NWPS are located in the southern portions of the state. These areas have ecosystems or characteristics that some believe are **unique.**[19] These areas also may provide the opportunity for recreational activities that are different (few substitutes) from other wilderness areas. Moreover, these areas can also be used during periods of the year **(fall-winter-spring)**[20] when most other wilderness areas are not available for use. As a result, some of these lands may have high recreational as well as preservation values at the **margin.** Once some of these lands have been **designated**[21], it is likely that the benefits of designating additional lands as part of the NWPS will be small at the martin. The first "unique" areas that may be designated are likely to have high preservation values and relatively low recreational use values. The reverse will likely be true for additional acreages near high concentrations of people.

CONCLUSIONS

Numerous polls have indicated that Americans favor adding more areas to the NWPS. Careful use of economic concepts can be used to evaluate these decisions. However, as the above data clearly show, these evaluations must be made on a case-by-case basis and the analyses must emphasize the use of marginal not average use rates, as well as marginal recreation and preservation values. This analysis also suggests that preservation values are likely to be high for the first areas that are designated as part of the NWPS. As more areas are added to the system, recreational values will likely increase in relative importance, especially if the areas are close to a metropolitan area. Areas that are remote are not likely to have high recreational values, but their preservation value may be high if the area(s) in question is "unique."

REFERENCES

Barrick, Kenneth A. 1986. Option value in relation to distance effects and selected user characteristics for the Washakie wilderness, northwest Wyoming. In: Lucas, Robert C., **comp.** Proceedings of the national wilderness research conference: Current research. USDA, Forest Service, Gen. Tech. Rep. INT-212.

Bishop, Richard C. 1982. Option value: An exposition and extension. Land Economics. **58:1-15.**

Bishop, Richard C. 1988. Option value: Reply. Land Economics. **64(1):88-93.**

Bowles, Michael D.; Krutilla, John V. 1989. **Multiple-**use management: The economics of public forest lands. Washington, D.C.: Resources for the Future.

Campbell, Gene E.; Countryman, David W. 1981. Comparing estimated wilderness costs among national forests. Journal of Forestry. **(September):605-607.**

Christy, Kim S. 1988. Benefit/cost variables and comparative recreation use patterns of wilderness and nonwilderness areas. Logan, UT: Department of Economics, Utah State University. Thesis.

Ciriacy-Wantrup, S.V. 1968. Resource conservation: Economics and policies. 3rd edition. Agricultural Experiment Station, University of California, Agricultural Experiment Station, Berkeley, CA.

Cummings, R.G.; Brookshire, D.S.; **Schulze,** W.D. 1986. Valuing environmental goods: An assessment of the contingent valuation method. Totowa, NJ: **Rowman** and Allanheld.

Freeman, A. **Myrick,** III. 1979. The benefits of environmental improvement: Theory and practice. Washington, D.C.: Resources for the Future.

Freeman, A. **Myrick,** III. 1985. Supply uncertainty, option price, and option value. Land Economics. **62(2):176-181.**

Hufschmidt, Maynard M.; James, David E.; Meister, Anton D.; Bower, Blair T.; Dixon, John A. 1983. Environment, natural systems, and development: An economic valuation guide. Baltimore, MD: Johns Hopkins University Press.

Jones, J.G. 1976. Estimating economic costs of wilderness areas. Ames, IA: Iowa State University. 220 pp. University Microfilms, **Ann** Arbor, Michigan (Dissertation abstract int. **37:5460B).** Dissertation.

Knetsch, Jack. 1977. Displaced facilities and benefit calculations. Land Economics. **53(1):123-129.**

Krutilla, John V. 1967. Conservation considered. American Economic Review. **57:777-786.**

Learning, George F. 1988. Economic losses in **Greenlee** County and Arizona caused by wilderness designation for land in **Greenlee** County. Western Economic Analysis Center, Marana, AZ.

Learning, George F. 1989. The adverse impact of wilderness land withdrawals in Echo County, Nevada. Western Economic Analysis Center, Marana, AZ.

Learning, George F. 1990. The adverse economic impacts of wilderness land withdrawals in Utah. Western Economic Analysis Center, Marana, AZ.

Livingston, David B.; Kearl, Gordon W.; Buchanan, Jacqueline P.; Phillips, **Clynn.** 1979. Wilderness designation of proposed Forest Service RARE II areas: An assessment of economic impacts. Laramie, WY: Water Resources Research Institute and Division of Agricultural Economics, University of Wyoming.

Lucas, Robert C. 1989. A look at wilderness use and users in transition. Natural Resources Journal. 29(1):41-57.

Lucas, Robert C.; **McCool,** Stephen F. 1988. Trends in wilderness recreational use: Causes and implications. Western Wildlands. **14(3):15-21.**

Lucas, Robert C.; **Stankey,** George H. 1989. Shifting trends in wilderness recreational use. In: Watson, Alan H., **comp.** Proceedings of the national outdoor recreation forum. USDA Forest Service Gen. Tech. Rep. SE-52.

Maddala, G.S. 1988. Introduction to econometrics. New York, NY: Macmillan Publishing.

McCool, Stephen F. 1985. Does **wilderness** designation lead to increased recreational use? Journal of Forestry. **83(1):39-41.**

Mitchell, Robert C.; Carson, Richard T. 1989. Using surveys to **value public** goods: The contingent valuation method. Washington, D.C.: Resources for the Future.

Pope, C. **Arden,** III.; Jones, Jefferey W. 1987. Nonmarket valuation of wilderness designation in Utah. Provo, UT: Agricultural Economics Department, Research Report **TRR:87-1,** Brigham Young University.

Reed, P.C. 1989. The national wilderness preservation system: The first 23 years and beyond. In: Freilich, Helen R., **comp.,** Proceedings of the national wilderness **colloquium.** USDA Forest Service, Gen. Tech. Rep. SE-51.

Roggenbuck, Joseph W. 1988. Wilderness use and user characteristics: **Ending** some misconceptions. Western **Wildlands. 14(3):8-15.**

Roggenbuck, Joseph W.; Lucas, Robert C. 1987. Wilderness user and user characteristics: A state of knowledge review. In: Lucas, Robert C., **comp.** Proceedings of the national wilderness research conference: Issues, state of knowledge, future directions.

Roggenbuck, Joseph W.; Watson, Alan E. 1989. Wilderness recreation use: The current situation. In: Watson, **Alan** H., **comp.** Proceedings of the national outdoor recreation forum. USDA, Forest Service, Gen. Tech. Rep. SE-52.

Roth, Dennis M. 1988. The wilderness movement and the national forests. **College** Station, TX: Intaglio Press.

Schmalemese, R. 1972. Option demand and consumers surplus: Valuing price changes under uncertainty. American Economic Review. **62:813-**824.

Schuster, **Ervin;** Jones, Greg. 1982. Extra market valuation for resource **allocation:** A critique. In: Wagstaff, Fred, **comp.** Proceedings of the range economics symposium and workshop. USDA Forest Service Gen. Tech. Rep. INT-149.

Smith, Kerry V. 1984. A bound for option **value.** Land Economics. **60(3):292-296.**

Smith, Kerry V. 1988. Environmental resources and applied welfare economics: Essays in honor of John V. **Krutilla.** Baltimore, MD: Johns Hopkins University Press.

Smith, Kerry V.; Desvousges, **William** H. 1986. Measuring water quality benefits. Boston, **MA: Kluwer-Mijnoff** Publishing. Utah Wilderness Coalition. 1991.

Utah Wilderness Coalition. 1991. Wilderness at the edge. Utah Wilderness Coalition, **Salt** Lake City, UT.

Walsh, Richard G.; **Gilliam,** Lynde 0. 1982. Benefits of wilderness expansion with excess demand for Indian Peaks. Western Journal of Agricultural Economics. **7(1):1-12.**

Walsh, Richard; Loomis, John. 1989. The nontraditional **public** valuation (option, bequest, and existence) of wilderness. In: **Freilich,** Helen R., **comp.** Wilderness benchmark **1988:** Proceedings of the national wilderness **colloquium.** USDA Forest Service Gen. Tech. Rep. SE-51.

Walsh, Richard G.; Loomis, John B.; **Gillman,** Richard S. 1984. **Valuing** option, existence, and bequest demand for wilderness. Land Economics. **60(1):14-29.**

Weisbrod, Burton A. 1964. Collective-consumption services of individual-consumption goods. Quarterly Journal of Economics. **78:471-477.**

ENDNOTES

1. This conference, as well as most of the literature, emphasizes the benefits of wilderness. Much less has been written concerning costs (e.g., see the studies by Jones [1976]; Livingston and others [1979]; Learning [1988, 1989, 1990]). While this paper provides some "red flags" concerning the estimation of benefits, similar "red flags" need to be used in estimating costs. There is as much need for research that would improve cost estimates as there is in measuring the benefits of wilderness.

2. Other agencies have use data, but have generally not been kept for wilderness (actual or potential) lands. The Forest Service RIM data has been criticized as being unreliable. Lucas and McCool probably summarized the use of this data best when they indicated that the data were ". . ..probably adequate for a look at overall trends," and they are "....the only game in town."

3. Recreational use data used in this paper were obtained from files maintained at the FS offices in Ogden, Utah. Differences exist in the data set for wilderness use in 1971 - 8.103 million versus 6.703 million RVDs. The 8 million RVD figure appears to be "out of line" with data for other years. Therefore, the smaller figure is used throughout this paper. The data for "wilderness lands" used in this paper includes both wilderness and primitive area lands.

4. The total number of acres of land administered by the FS was essentially stable during this 26 year period. Total acreage increased nearly 5 million acres between 1965 and 1990, but this is less than a 3 percent change.

5. No surveys of wilderness users have been made and published that are specific to Utah, but it is not expected that the characteristics of wilderness users in Utah are different from users in other areas that have been surveyed.

6. BLM data for potential wilderness areas in Utah are not available over time. The Utah BLM draft wilderness Environmental Impact Statement indicates that most wilderness study areas receive less that 1,000 total RVDs of use in a year. There are some areas (e.g., North Fork of the Virgin River which borders Zion National Park) where the use rate is at least as high as those areas near the Wasatch Front.

7. The evidence for this is not strong. However, the basic principle alluded to must be considered by recreation planners. Agencies such as the FS must plan using a national perspective. As a result, the benefits of adding a recreation area are not simply the additional RVDs that may occur in that area if this action results in reduced use of other areas. One must estimate what the net increase in use is when evaluating an action from a national perspective. One should note that one of the benefits of an action in one area may be reductions in use in another area which, in turn, could yield positive quality (reduced congestion) as opposed to quantity (more RVDs) benefits.

8. A reviewer suggested that these data need to be subjected to a Dickey-Fuller test (see the discussion by Maddala [1988]). This recently developed test must be used whenever time-series data are involved in a statistical analysis.

9. Data are not available to directly test this hypothesis. If the demand has not shifted for either use (only a shift in use), then no gain in total use is evident. However, if the demand for either type of use(s) has not shifted then an increase in the supply of wilderness (decrease in nonwilderness) would reduce the value of wilderness lands relative to nonwildemess lands at the margin.

10. Conferences such as this are a common source of information. Data in this paper, as well as other papers that are presented, will probably affect decisions that are being evaluated at the present time. This information will probably also affect the research done in the future.

11. The discussion that follows should not be interpreted as a criticism of the original WLG article. The authors would probably make changes if the article were to be rewritten today. It is also highly probable that the discussion in this paper will need to be modified when other information is made available, including papers that are presented at this conference.

12. Most of the areas suggested for inclusion in the NWPS in Utah are found in the southern part of the state (Utah Wilderness Coalition). Furthermore, Congressman Owens has indicated that the designation of additional areas is the "only realistic hope to revitalize Southern Utah" (***Deseret*** News, October 11, 1989). The low and apparently stable use rates in this part of the state, where other types of recreation (e.g., use of the national parks) are increasing, suggests that the suggested boost to Southern Utah economies is not likely. In addition, access to many of these areas is very limited, and the availability of water (the surveys of wilderness users indicate that areas near water are used most heavily, while areas having limited water receive limited use) is even more limited.

13. The authors have found no studies in the literature that have made this determination for an evaluation of recreation-oriented decisions involving wilderness lands. All of the studies reviewed used the expected number of **RVDs** that would occur, **not** the expected **net** number of **RVDs.**

14. The value an RVD of recreation may be more than the average for some areas, but these values would generally be expected to decline at the margin.

15. These values have been estimated using the method of contingent valuation (Cummings and others, 1988; Mitchell and Carson, 1989). All of the studies reviewed that have estimated wilderness values using this methodology have been designed to elicit positive responses. It is, therefore, not surprising that the values derived have been positive.

16. While an equation was not estimated by Pope and Jones, a log linear model is suggested.

17. This is an empirical question that has not been tested. It also represents a question that can only be solved empirically.

18. Those individuals who seek to visit all sites that may be designated as a wilderness may have option values for particular sites that may have many close substitutes. The number of these individuals in society is probably not large. This is, however, a hypothesis that has not been tested.

19. The book published by the Utah Wilderness Coalition suggests that many of the areas being considered are unique. This opinion is, however, not shared by everyone.

20. While these areas may be most suitable for use during these periods (summer use will be low in many of these areas because water and shade are not generally available, and it is relatively hot in these areas), people commonly take vacation periods during the summer season.

21. It should be noted that some of the "most outstanding" scenic spots have been made part of the national parks in Utah. These areas may be "good" substitutes for BLM administered areas that have been proposed for designation. It should also be noted that areas that have been proposed for wilderness designation by the BLM and Park Service are being managed (de facto) as if they were part of the NWPS (de jure). It is also likely that many (most?) of the proposed areas will remain as wilderness even if they are not designated, unless the demand for other uses increases in the future.

Figure 1. Percentage of Wilderness RVDs and acres on FS lands, 19654988.

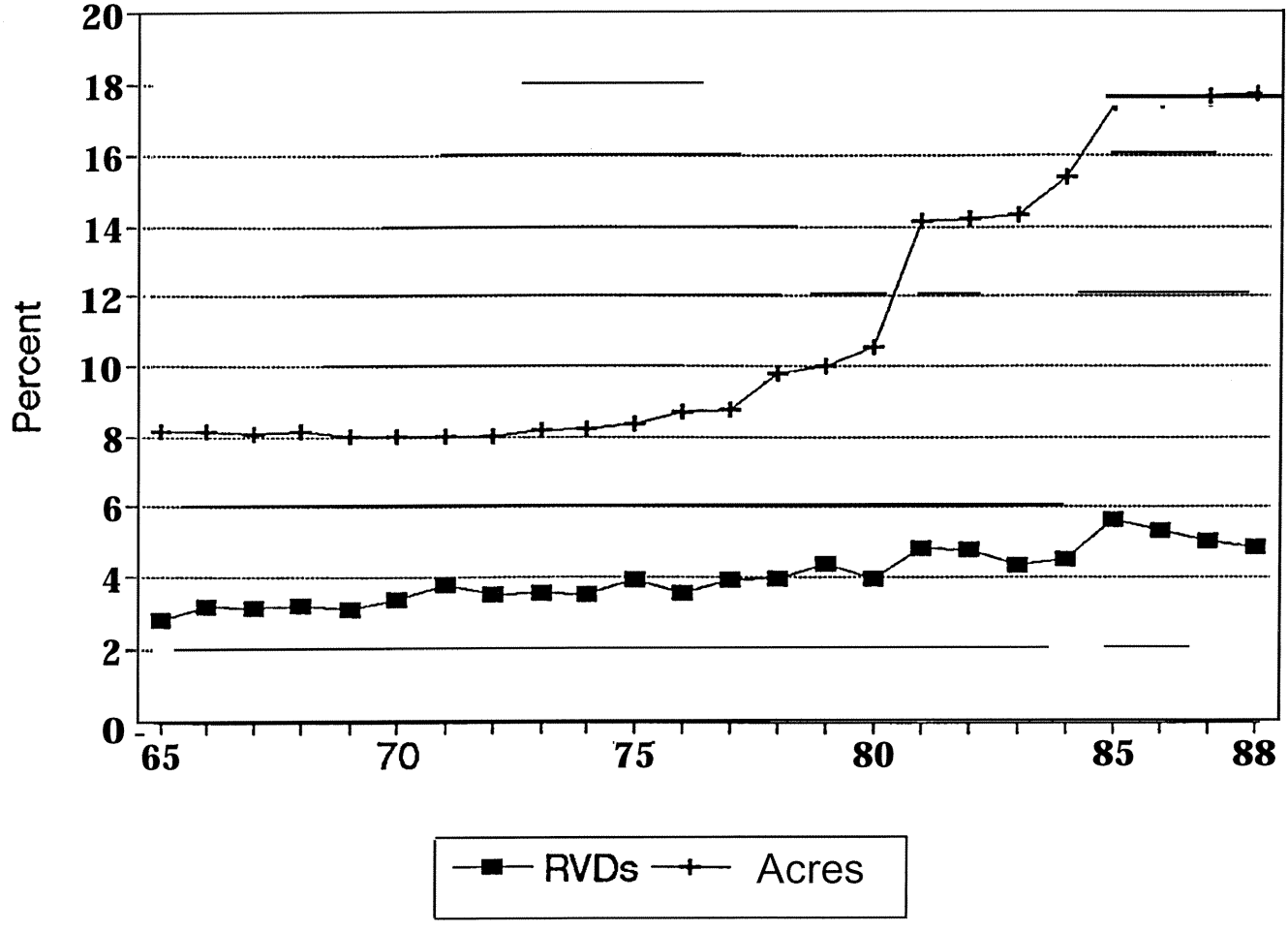


Figure 2. Wilderness RVDs per acre
on FS lands, 1965-1988.

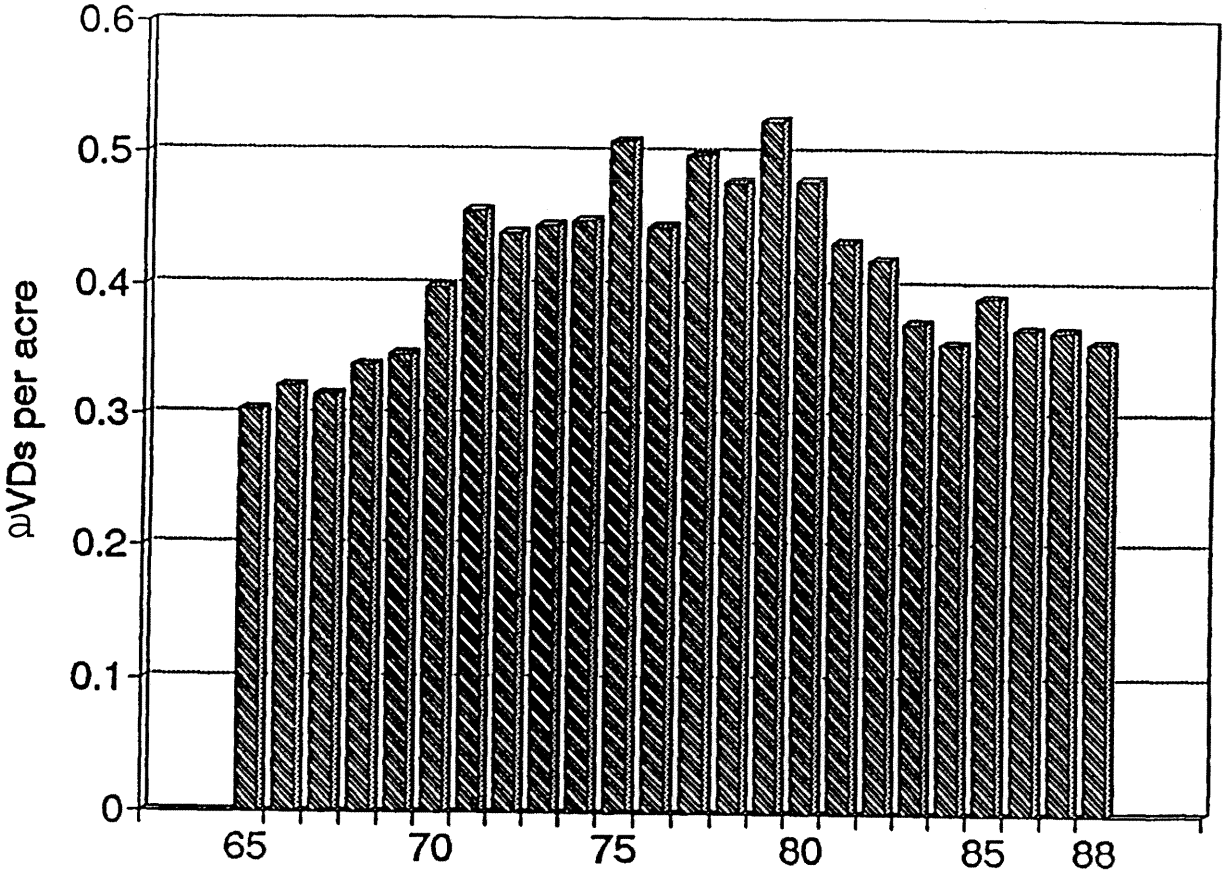


Figure 3. Wilderness RVDs per acre for FS lands in Utah, 19674989.

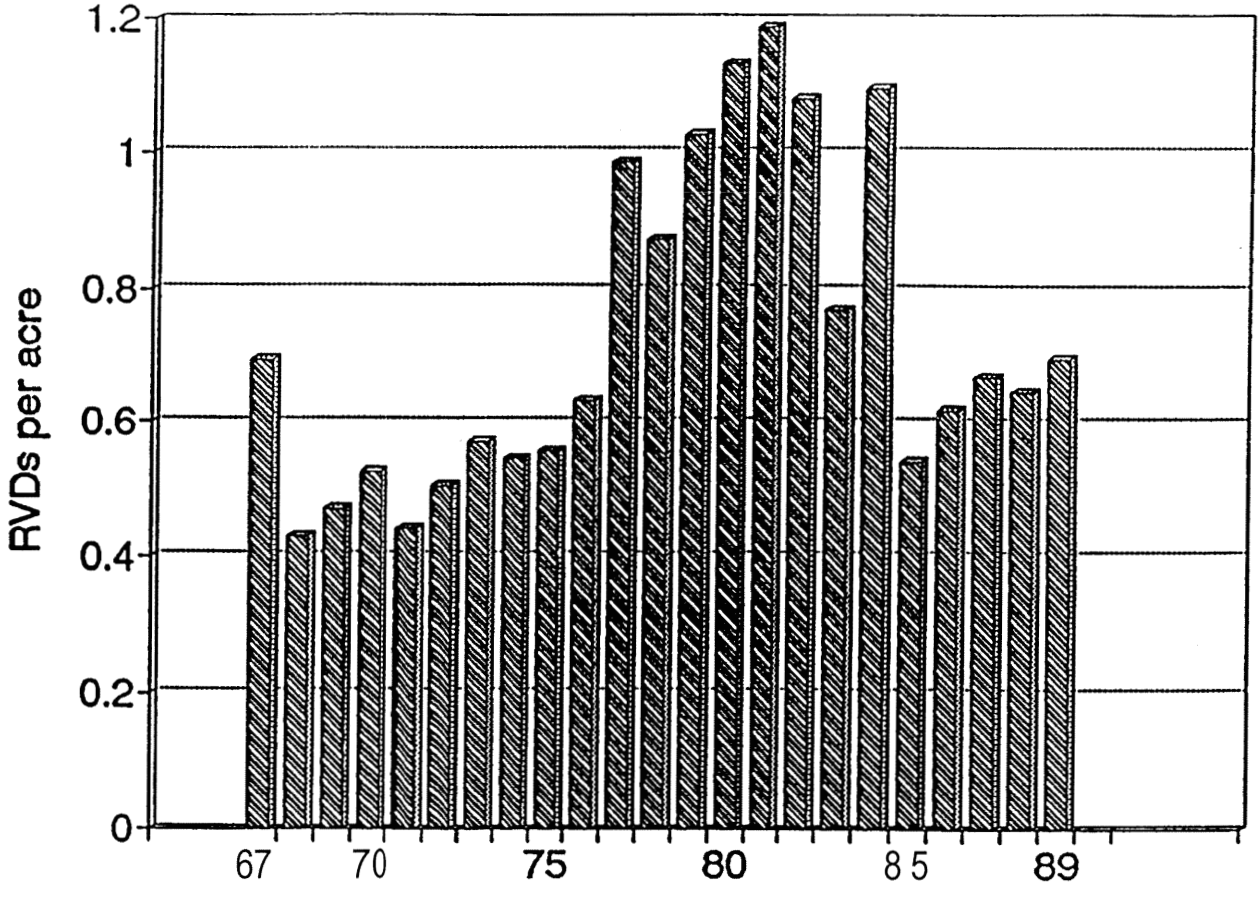
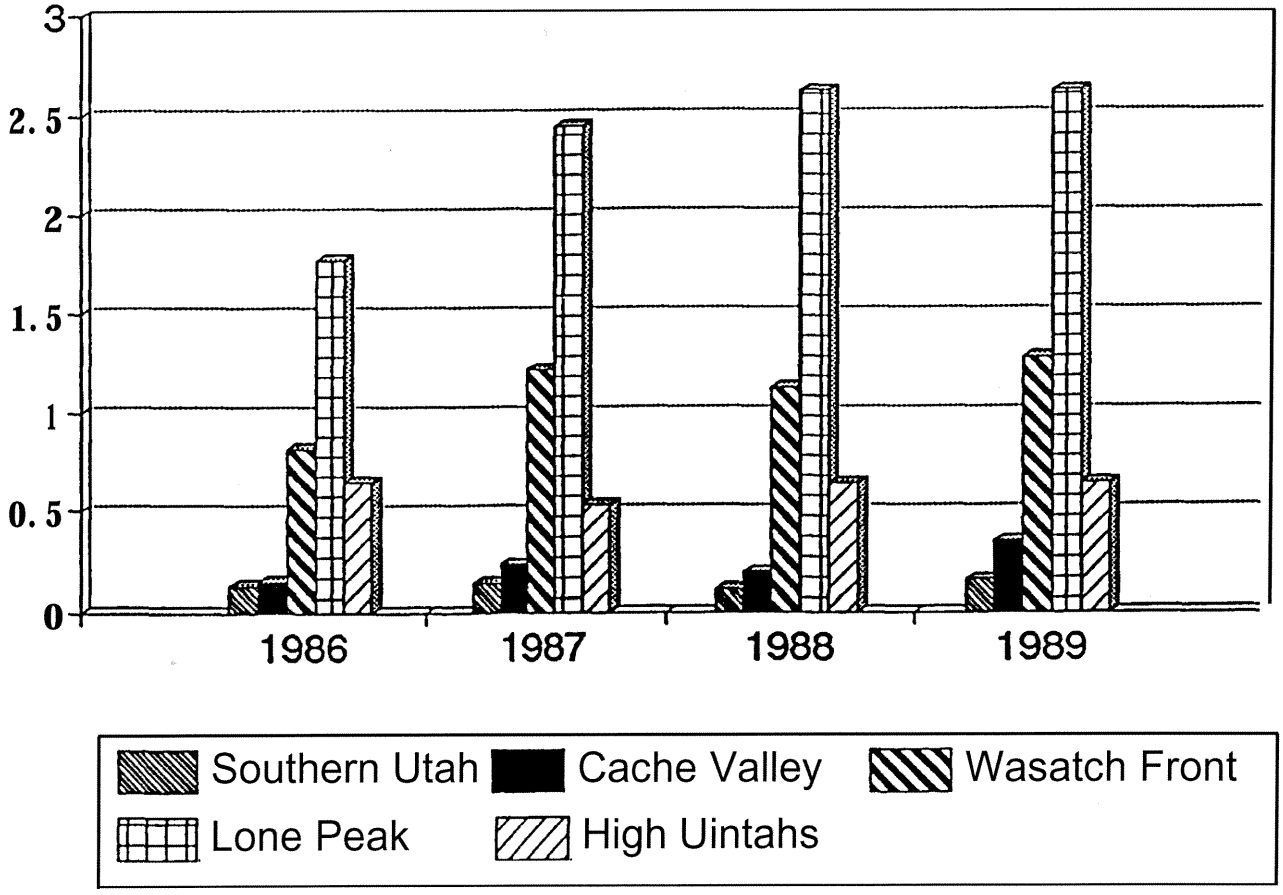


Figure 4. RVDs per acre for wilderness areas in Utah, 1986-1989



IMPORTANCE OF JOINT BENEFITS OF WILDERNESS IN CALCULATING WILDERNESS RECREATION BENEFITS

John B. Loomis*

ABSTRACT

Preservation of a roadless area as wilderness protects water quality for fisheries and maintains wildlife habitat for such species as elk The economic value of maintaining high quality of fishing and trophy elk hunting is a joint benefit, in addition to other wilderness recreation. Recent U.S. Forest Service Forest Plan evaluations of wilderness fail to fully account for these joint values to fisheries and wildlife often resulting in underestimates of wilderness recreation benefits. An example of such error is provided in the Gallatin National Forest. In addition, this paper demonstrates how the travel cost and contingent valuation methods can be used to quantify the joint wilderness benefits of enhanced stream fishing and trophy elk hunting on a roadless area in the Gallatin National Forest in Montana. The paper concludes with recommendations for proper valuation of wilderness recreation in forest planning.

WILDERNESS RECREATION AS A COMPOSITE OF RECREATION VALUES

Wilderness is not only one of the multiple uses but it also is compatible with the production of many other multiple uses. In some sense, preservation of an area as wilderness results in joint production of trout **fisheries,** many species of wildlife, water quality, and primitive type recreation.

Historically the Forest Service has had just one value for wilderness: a value per wilderness visitor day in its Resource Planning Act (RPA) values. This was derived from a few studies of wilderness recreation (Sorg and Loomis, **1984;** Walsh and others, 1990). In this paper, I propose that the appropriate value of wilderness recreation should be a weighted average of the traditional wilderness recreation values plus trophy elk hunting, blue ribbon trout fishing and other high quality recreation activities supported by wilderness preservation. The rationale for developing a composite wilderness value stems from the way in which the RPA values are used in forest planning. Examination of benefit-cost analyses of wilderness designation in Regions 1 and 2 indicates that only the wilderness recreation RPA value is applied to all the recreation that would be provided by wilderness designation. This contrasts with the valuation of non-wilderness recreation, which explicitly recognizes a mix of wildlife and primitive recreation activities in its valuation. Failure to include these other values when computing a wilderness recreation value tends to understate the recreational value of wilderness.

The purpose of this paper is to illustrate how the travel cost and contingent valuation methods will allow quantification of these joint fisheries and wildlife recreation values of wilderness. The emphasis will be on how wilderness preservation enhances the quality and hence value of trout fishing and elk hunting in Montana. The benefits computed by the Forest Service using a traditional wilderness recreation value from the Resources Planning Act value will be compared with the proposed weighted average method. The case study will involve the **Gallatin** National Forest in Montana.

BACKGROUND OF CASE STUDY

Within the **Gallatin** National Forest is the "Hyalite-Porcupine Buffalo Horn" Wilderness Study Area (hereafter referred to as HPBH WSA). This **roadless** area was designated a wilderness study area (WSA) in 1977 when Congress passed the Montana Wilderness Study Act (PL **95-150).** This Act required the U.S. Forest Service to evaluate the HPBH for suitability as wilderness.

The HPBH WSA contains approximately 155,000 acres in the **Gallatin** Range in southwestern Montana. This land includes the mountain divide between the **Gallatin** and Yellowstone Rivers. The importance of this WSA as a case study relates to it being a watershed for these two blue ribbon trout fisheries and as a trophy elk hunting area. The sensitivity of the watershed to development activities was identified during public workshops and written comments as one of the 14

*Associate Professor in Division of Environmental Studies and Department of Agricultural Economics, University of California, Davis, CA 95616.

Issues, Concerns and Opportunities to be addressed in the U.S. Forest Service (USFS) study.

For this paper, the complete wilderness alternative (formally, Alternative #5 in the USFS Analysis) will be evaluated. Alternative #5 protects 145,000 acres out of the 155,000 private and public land within the WSA as wilderness. It provides for no timber harvesting or road construction and no motorized access, but maintains water quality, fishing, trophy elk hunting, and primitive recreation.

DESCRIPTION OF THE ENVIRONMENTAL SETTING AND RESOURCES

The topography of the WSA varies from steep terrain and rugged peaks in the north to more moderately rolling terrain elsewhere. The elevations range from a low of about 5,500 feet to the 10,000 foot level. Soils in the area range from coarse-textured volcanic soils to more erosive sedimentary soils. Some of these sedimentary soils are prone to mass soil movements if disturbed through poorly conducted development activities (U.S Forest Service, 1985).

The WSA provides approximately 126,000 acre feet of water to the Gallatin and Yellowstone rivers each year. The quality of this water is currently quite high and it sustains the Yellowstone and Gallatin Rivers as blue ribbon trout streams. Some smaller streams within the WSA have naturally high sediment yields even in their undisturbed setting. This may put them near the threshold for fish productivity in their current undisturbed state, implying that significant development may push sediment yields over the threshold for trout.

Fish species found in the WSA include several brook, cutthroat, golden and rainbow trout as well as arctic grayling. Big game wildlife species include, elk, mule deer, moose and bighorn sheep. The WSA provides important winter range for 240 elk, many of which originate from nearby Yellowstone National Park.

If not protected as wilderness, timber harvesting and associated road construction has the potential to seriously reduce water quality by increasing sediment yields within the WSA (U.S. Forest Service, 1985). This study will evaluate the benefits from maintaining the current quality of the trout fisheries associated with wilderness designation.

ANALYSIS OF FISHERIES AND ANGLER ECONOMIC VALUE

Modeling of the biological effects of timber harvesting and associated road construction on fisheries was performed by the Gallatin National Forest. In particular, we developed the following estimates of the losses in the catchable trout populations avoided from preserving the roadless area as Wilderness. Table 1 is developed from Gallatin National Forest's Table IV-3 (U.S. Forest Service, 1985).

The average loss avoided each year with wilderness preservation is about 270 fish. The loss avoided is small in relative terms for the watershed, averaging about 3 percent reductions in catchable fish per year since development would occur in absence of wilderness designation on less than 40 percent of the WSA. However, a loss of 270 fish per year for 50 years amounts to a great deal of lost fishing success. To quantify the economic value of this joint fishing benefit of wilderness preservation, a demand equation was estimated. We now turn to a discussion of the data sources and demand equation used to value these losses.

Data Sources

The data used with the travel cost method to estimate willingness to pay (WTP) was collected from two separate angler surveys. The first survey was designed and administered during 1985 by Montana Department of Fish, Wildlife, and Parks.

Of the 36,000 surveys mailed out during this time period, 19,271 were returned for a response rate of 54 percent. This survey provided the basic information on quantity of trips taken to each river or stream, distance driven, number of fish caught, etc. A supplemental angler survey was conducted by Montana Fish, Wildlife, and Parks during the months of September and October of 1985 to provide more detailed information on angler transportation costs, income, travel times, etc.

A sample of 2,000 were interviewed. The response rate for the telephone survey was 75 percent. Once again, both resident and non-resident anglers were interviewed. In both surveys, angler trips were screened to carry forward only trips where the primary purpose was to fish, and the river fished was the primary or sole destination of the trip. This was necessary so that the assumptions of the travel cost method would be met. The two data sets were then merged for analysis purposes. Specific details of this study can be found in Duffield, Loomis, and Brooks, 1987.

Regional Multi-site Travel Cost Model

To measure the net economic values, different travel cost model (TCM) demand equations are used for the general streams within a watershed (tributaries to the upper **Yellowstone #31** and the **Gallatin #32)** and the **mainstem** rivers themselves **(Gallatin** X90 and Upper Yellowstone **#98).** The details on the demand estimation are provided in **Duffield,** Loomis, and Brooks, 1987. The basic approach **follows** the regional TCM recommended by the U.S. Water Resources **Council** (1979, 1983) and U.S. Department of Interior (1986 **).** The models reflect pooled **zonal** travel cost demand equations. The equations selected for this analysis (Equation 1 and Equation 2) are more amenable to the site specific **analysis** required here as they predict each stream's **angler** trips somewhat better than the statewide equations.

The equation for general watershed streams is:

(1) LTRIPCAP = 2.471 **-2.619(LRDIST)** + **0.246(LSTROUTC) -0.885(LYRSFISH)**

(t-statistics) (2.810) (-53.387) (3.897) (-8.530)

+ **1.492(LEDUC) -0.017(LSUBTRTC) +0.079(LSOTHRSPTC)**

(4.180) (-3.221) (1.955)

where:
LTRIPCAP = log of trips per capita from origin i to site j
LRDIST = log of round trip distance plus 90 (miles)
LSTROUTC = log of sum of trout catch at j
LYRSFISH = log of average years fished of anglers in origin i
LEDUC = log of average years of education at origin i
LSUBTRTC = log of substitute index based on trout catch per mile at site k with higher catch per **mile** than site j
LSOTHRSPTC = log of sum of other sport **fish** catch at site j (mostly whitefish)

Equation 1 has an adjusted **R-squared=0.819** and a F-statistic of 550.60. With 727 observations (origin-destination pairs), the F **value** is highly significant. The individual coefficients are significant at the 95 **percent** level or better. The coefficient on distance (our price variable) is highly significant. The **small** standard error on this coefficient indicates it is precisely estimated. The R-squared is quite high, indicating that nearly 82 percent of the variation in trips per capita is explained by the set of independent variables. Equation 1 also contains statistically significant variables for substitutes and **fish** catch.

The demand equation **(Duffield,** Loomis, and Brooks, 1987) used for the **mainstem** rivers is:

(2) LTRIPCAP = 1.855 **-2.753(LRDIST) +0.314(LSTROUTC) -1.072(LYRSFISH)**

(t-statistics) (1.508) (-36.742) (3886) (-7.622)

t **2.052(LEDUC)** t **0.328(LNOSITER) -0.015(LSOTHRSPTC)**

(4.330) (2.691) (-2.170)

where: LNOSITER =log of the number of recreational sites (other variables as previously noted).

Equation 2 has an adjusted R-squared of 0.808 and a F-statistic of 254.81. With 361 observations, Equation 2 is highly sign&ant. All of the coefficients are significant at the 95 percent level or better.

The coefficient on trout catch is statistically **significant.** The very high t value of distance implies our price variable is highly significant.

LINKING DEMAND EQUATION TO CHANGES IN FISH CATCH

In order to normalize the expected trout numbers into change in trout population, the expected number of trout for the wilderness alternative in decade one is used as a baseline for which the change in trout values are calculated. A change in the trout population for the with and without wilderness preservation in any decade is the difference between the baseline value and the expected trout number for that decade.

The recreational fishing survey performed in conjunction with Montana Fish, Wildlife, and Parks did not ask directly about **fishing** in the HPBH WSA. Rather the survey asked about fishing on major rivers (i.e., the Madison, the Gallatin, etc.) and for tributaries within the drainages of these major rivers. Therefore, it was necessary to prorate the total catchable trout under each alternative to specific rivers and drainages. For this study, consumer surplus values were estimated for alternative uses of two Montana watersheds and for each of their **mainstem** rivers. The Upper Yellowstone and the **Gallatin** watersheds are coded as general water sites 31 and 32, respectively. The Upper Yellowstone and the **Gallatin** Rivers themselves are coded as unique water sites 90 and 98, respectively. Consumer surplus estimates for unique water sites 90 and 98 and general water sites 31 and 32 were calculated for current wilderness conditions' expected trout catch and then under development. The primary effects are assumed to occur on streams directly flowing off the HPBH, with lesser effects on streams further down the watershed, such as the Yellowstone and **Gallatin** Rivers. Each of these changes in expected trout numbers must then be allocated among the sites according to their expected share of the total fish population. The percentage shares for sites 31, 32, 90, and 98 are, respectively, 50, 25, 15, and 10 percent. This change in annual trout catch is the total annual loss of catchable trout in the streams on and related to the HPBH WSA.

With the change in trout population numbers and the estimated demand equations which contain a variable for catchable trout, total consumer surplus values can be estimated. A site's total consumer surplus under an alternative is estimated with the site's existing trout catch, and then catch is reduced by the loss in catchable trout expected under the timber alternative. The reduction in catchable trout variable in the demand equation shifts the travel cost method demand curve. This process is repeated for each river for each decade. The present value of the change in **fishing** benefits is calculated as the present value of the annual difference in consumer surplus over the affected rivers over fifty years. The change in recreational fishing benefits so calculated is $2.073 million in 1978 dollars or $3.5 million in 1986 dollars.

JOINT BENEFITS OF WILDERNESS PRESERVATION ON TROPHY ELK HUNTING

In addition to increasing sediment in streams, timber harvests reduce the effectiveness of habitat for elk. An interagency research project recently concluded that elk will generally not use habitat within a half mile of a road open to traffic (Lyon and others, 1985). With spacing of logging roads as close as every quarter mile, large areas of habitat are effectively lost to elk when timber harvesting occurs. Thus the second major joint benefit of wilderness preservation is maintaining existing elk habitat.

The additional human access afforded by logging roads results in greater hunting pressure. When combined with the effect of timber harvesting reducing security cover for elk, the net effect appears to be a change in the structure of animals harvested. Specifically, greater access and less cover result in a higher harvest rate, particularly of younger animals. Over time this results in the harvest of fewer large bulls (6 point or better) and a greater proportion of the harvest made up of younger bulls (2 point or less). Some hunters identify opportunities to bag a trophy bull elk as a higher quality elk hunting experience.

To evaluate the joint benefits of maintaining the trophy elk hunting opportunity, a series of willingness to pay questions were asked using the contingent valuation method (CVM). The questions were asked of Montana elk hunters visiting the two hunt districts which contain the HPBH WSA. Details of this portion of the study follow.

Data Sources

A questionnaire in booklet form was mailed to a sample of elk hunters. Details of the survey and response rate can be found in Loomis, 1988. The contingent valuation (willingness to pay) questions were asked for two different scenarios. First, the elk hunter

was asked to value the most recent elk hunting trip. The elk hunter was **first** asked the dichotomous choice contingent valuation method (CVM) question:

> . ..would you **stlll have made the trip if your share of the expenses had been $X more?" The hunter would then circle either Yes or No. The dollar amount ($X) was varied across respondents, but the maximum amount any elk hunter was asked to pay was $1,100 more** (Loomis, Cooper, Allen, 1988).

Note the question is very specific in that it does not measure the value of elk hunting in general, but rather the value of elk hunting at a particular site. The next **CVM** question was asked regarding value of having double the chance to harvest a **6-point** or better bull elk. The dichotomous choice question was asked first. Specifically, the dichotomous choice question asked:

> Imagine **that everything about this last trip were the same, except that your chance of getting a 6-point or better bull elk was twice as great and that your trip costs were $X more than your actual costs. Would you still have made the trip under these circumstances? (Please check one) (Loomis,** Cooper, Allen, 1988).

The elk hunter was required to check Yes or No. Once again, different hunters received different dollar amounts **($X).**

Proposed Logit Equations for the CVM Questions

The answers to the "Yes, I would pay" or the "No, I would not pay" are analyzed using a statistical technique called a **logit** model. The name is derived from the 'logistic distribution' the error term is assumed to follow in the utility difference model (See Hanemann, 1984, for more details).

The candidate independent variables that are required by economic theory include trips (measure of quantity), income, and the amount the respondent was asked to pay ($X). In addition, certain other variables would be expected to influence the **probability** of saying yes they would pay. These might vary by scenario, however. For example, in asking willingness to pay for the current trip, variables reflecting the quality of the current trip, such as number of elk seen, number of other hunters seen, etc., would be expected to influence the probability an elk hunter would say yes to a given dollar amount.

Equation 3 provides our initial specification of the **logit** equation which relates the log of the odds ratio to our candidate independent variables.

(3) **ln[P(Y))/1-P(Y)] = B0-B1(BID) + B2(INC)-B3(TRIPS) + B4(ELKSEEN)**

-B5(HTRSEEN) + B6(HTRYS)

Where:

P(Y) = probability of Yes Would Pay
BID=dollar amount of increased trip cost the hunter was asked to pay
INC = hunter's household income
TRIPS=number of elk hunting trips to this area
ELKSEEN=number of elk seen while hunting in this area
HTRSEEN=number of hunters not in your party that were seen while hunting in this area
HTYRS = number of years hunting elk in this area

Basically, these same set of factors would be expected to affect **willingness** to pay for double chances of bagging a six-point buck or better. In this scenario, willingness to pay to increase chances of bagging a bull elk might not be affected by variables such as number of other hunters seen.

Estimation of the **Logit** Equation

Equation 3 is inherently non-linear and cannot be accurately approximated by using linear regression. Therefore, it is estimated using logistic regression. Since the dependent variable is the log of the odds ratio, the coefficients cannot be directly interpreted as the change in the probability of paying a given dollar amount. Sellar, Chavas, and Stoll **(1986)** have demonstrated the relationship between Equation 3 and standard demand function.

That is, a demand equation often relates quantity demanded to price and other variables such as income, etc. From Equation 3 it is possible to derive an inverse demand function that relates price or value to quantity demand, income, etc. In particular, Sellar, Chavas and Stoll **(1986)** indicate that for the resulting demand function to be downward sloping with respect to quantity consumed (i.e., trips), the **logit** equation must be of log-linear functional form and the coefficient on trips (B3) be less than one. This would mean that what should be estimated is of the form:

(4) **ln[P(Y))/1-P(Y)] = B0-B1(lnBID) + B2(lnINC)-B3(lnTRIPS) + B4(lnELKSEEN)**

-B5(lnHTRSEEN) + B6(lnHTRYS)

Where **ln** represents the natural log of the variables previously defined above and **1> B3>0.**

This functional form was used and trips included as the quantity variable. It should be noted that in the estimated **logit** equations, the coefficient restriction on trips is met.

As can **be** seen from the t statistics, the **logit** equations perform fairly well. The coefficient on bid amount (CRBID or **BULBID)** are significant at the 99 percent level. Generally, the other variables are significant at the 95 percent level and have the sign expected by theory.

As Table 3 indicates, hunters are willing to pay about $108 more for a hunting trip where their chances of bagging a 6 point or better bull elk were double what they are now. In the two hunt districts lying within the HPBH WSA and analyzed in this report (HD 301 and HD **314),** only 26 percent of the harvest is bulls of 6 points or better. Therefore, an average hunter would view doubling chances of harvesting a 6 point bull or better as about **50** percent. If we wish to value the benefits from actually bagging a 6 point bull elk, we might raise the percentage to **100** percent. That is, a hunter that actually bagged a 6 point bull elk in this unit had (ex post, or after the fact) a quadrupling of the average chances of bagging a 6 point bull elk. The added trip benefits for those hunters actually harvesting a 6 point or better bull elk would be about $215.

To apply these relationships to the HPBH WSA, it was necessary to estimate how the harvest of 6 point or better bull elk changed relative to 5 point or less bull elk as roading would occur. The current harvest mix is roughly, 26 percent 6 point or better and 74 percent 5 point or less. Using this distribution, the value of this existing mix of hunting could be quantified. But to forecast how this mix would change, it was necessary to perform a paired comparison between two hunt districts that were generally **similar** except that one had an extensive amount of roads and the other did not. Montana Department of Fish, Wildlife, and Parks, suggested Hunt Districts 332 and 319 would make a fair comparison. Based on this comparison, the percentage of 6 point or better was expected to drop by approximately 5 percent a decade for each of four decades as roaclmg increased in the HPBH WSA if it was logged. Of course, the percentage of 5 point or less bull elk harvested was expected to increase by 5 percent a decade over the four decades. Thus, holding hunter days constant, the mix of hunters having a higher valued hunting experience associated with bagging a 6 point or better bull elk will decrease. The mix of hunters having a lower valued hunting experience bagging a 5 point bull elk or smaller will increase. While this approach may be somewhat simplistic, it illustrates an important point: even with the same number of hunters visiting an area, the value can fall over time if the quality of the hunting experience decreases.

COMPARISON OF USFS TRADITIONALLY CALCULATED BENEFITS OF WILDERNESS AND THE JOINT BENEFITS APPROACH

Table 4 provides a comparison of the traditionally calculated recreation benefits of wilderness and the proposed joint benefits approach to wilderness valuation.

The original USPS HPBH WSA report follows the standard USPS practice of using the RPA wilderness

recreation value for wilderness recreation and not explicitly valuing the joint benefits to **fishing** and trophy elk hunting. Thus, not only was the qualitative improvement associated with wilderness preservation overlooked, but even the baseline fishing and hunting values were ignored in computing wilderness recreation benefits. Specifically, the traditional USFS practice is to value all wilderness recreation at the RPA wilderness recreation value and not separately value the current amount of hunting and fishing as being maintained by wilderness preservation. However, when **valuing** the non-wilderness recreation, the current amount of hunting and **fishing,** along with newly created non-wilderness dispersed recreation, is valued in the traditional USFS approach. While other National Forests, such as the San Juan, have used similar simplifications (Loomis, **1987),** the net effect is to greatly under value wilderness preservation due to failure to include the joint benefits of wilderness preservation.

In particular, the **"official"** 1980 RPA value per Recreation Visitor Day of wilderness was $8.00. However, the 1980 value of non-motorized (dispersed type) recreation had an official value closer to $3.50. However, the **Gallatin** National Forest correctly recognized that some of the non-motorized dispersed recreation included **fishing** and hunting, Using the **Gallatin** National Forest average percentage of **fishing** and hunting occurring as non-motorized dispersed, the value per Recreation Visitor Day was increased to $9.34. While this upward revision makes sense for non-wilderness status, it certainly makes sense for wilderness status! Since wilderness designation would result in more catchable trout, more fishing **RVDs** would be produced with wilderness.

The same is true for elk hunting. The quality of elk hunting (in terms of long term average of 6 point or larger bulls harvested) is expected to be higher under wilderness designation.

To remedy this simplification, the change in the economic value of **fishing** relative to the change in number of catchable trout associated with wilderness is broken out separately in the revised analysis for both the wilderness and non-wilderness alternatives. The same is true for elk hunting. The number of **RVDs** of non-wildlife primitive recreation in the wilderness alternative is reduced for both **fishing** days and elk hunting days, now accounted for separately. The non-wildlife primitive **RVDs** are valued at the 1980 RPA value for wilderness.

Table 4 displays the present value of wilderness calculated using the USFS traditional method and using the proposed joint benefits of wilderness. The analysis shows the present value of wilderness recreation benefits would be understated by about $10.6 million over a fifty year planning period.

CONCLUSIONS AND RECOMMENDATIONS

The development of the 1995 RPA values for wilderness recreation should be computed using a weighted average of the values of the many types of compatible recreation activities that take place in wilderness areas. Special attention should be paid to locating studies for trophy big game and trout **fishing** as these activities are increased in value by the protection of habitat afforded by wilderness preservation. When the economic values of these activities are used along with the economic value of traditional wilderness backpacking and hiking values, the resulting RPA wilderness recreation value will better match the recreation benefits provided by wilderness preservation. To provide the weights associated with the mixture of types of wilderness recreation, USFS District personnel should improve existing data collection on recreation activity type from wilderness permits.

REFERENCES

Duffield, John; Loomis, John; and Brooks, Rob. 1988. The net economic value of fishing in Montana. Department of Fish, Wildlife **&** Parks, Bozeman, MT.

Hanemann, Michael. 1984. Welfare evaluations in contingent valuation experiments with discrete responses. American Journal of Agricultural Economics. **66(3):332-341.**

Loomis, John. 1987. Economic efficiency analysis, bureaucrats and budgets: A test of hypotheses. Western Journal of Agricultural Economics. **12(1):** 27-34.

Loomis, John. 1988. The economic effects of timber harvesting on recreational and commercial **fisheries** and municipal watersheds: A case study of the Siuslaw and **Gallatin** National Forests. Davis, **CA:** University of California, Davis.

Loomis, John: Cooper, Joseph: Allen, Stewart. The Montana elk hunting experience: A contingent valuation assessment. Montana Department of Fish, Wildlife, and Parks. Bozeman, MT.

Lyon, Jack; **Lonner,** Terry; Weigand, John; Marcum, Les; Edge, Daniel; Jones, Jack; **McCleery,** David;

Hicks, **Lorin.** 1985. Coordinating elk and timber management. Montana Department of Fish, Wildlife and Parks. Bozeman, MT.

Sellar, Christine; Chavas, Jean-Paul, Stoll, John. 1986. Specification of the **logit** model: The case of valuation of nonmarket goods. Journal of Environmental Economics and Management. **13(4):382-390.**

Sorg, Cindy; Loomis, John. 1984. Empirical estimates of amenity forest values: A comparative review. Gen. Tech. Rep. **RM-107k.** Fort Collins, CO: U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

U.S. Department of Interior. 1986. Natural resource damage assessments. Final Rule, Federal Register **51(148),** August 6, 1986.

U.S. Forest Service. 1985. Hyahte-Porcupine Buffalo Horn Wilderness Study Report & Environmental Impact Statement. Bozeman, MT: **Gallatin** National Forest.

U.S. Water Resources Council. 1979. Procedures for evaluation of national economic development (NED) benefits and costs in water resources planning (Level C). Federal Register. **44(243):** 72892-72976.

U.S. Water Resources Council. 1983. Economic and environmental principles for water and related land resources implementation studies. U.S. Government Printing Office. **137pp.**

Walsh, Richard, Johnson, **Donn; McKean,** John. 1989. Issues in nonmarket valuation and policy application: A retrospective glance. Western Journal of Agricultural Economics. **14(1): 178-188.**

Ward, Frank, Loomis, John. 1986. The travel cost demand model as an environmental policy assessment took A review of the literature. Western Journal of Agricultural Economics. **11(2):** 164-178.

ENDNOTE

I wish to thank John **Duffield,** University of Montana, and Rob Brooks, Montana Department of Fish, Wildlife, and Parks, for their assistance in developing the data and initial statistical analysis which served as the starting point for this study.

TABLE 1.

ADDITIONAL CATCHABLE TROUT NUMBERS WITH WILDERNESS

Decade	**Annual Gains** with Wilderness
1	130
2	380
3	255
4	130
5	485

TABLE 2.

LOGIT EQUATIONS FOR CURRENT CONDITIONS

SITE #	CONST.	LCRBID	LTRIPS	LINCOME	LELKSEEN
40	1.8159	-0.4418	-0.3218		0.16%
	(3.19)	(-3.87)	(-2.27)		(2.94)
41	-3.2554	-0.5315	-0.0924	0.5602	0.1223
	(-1.72)	(-3.8)	(-0.59)	(3.07)	**(1.97)**

LOGIT EQUATIONS FOR TROPHY ELK

SITE #	CONST.	LBULBID	LTRIPS	LINCOME
40	-0.7567	-0.7505	-0.1522	0.4963
	(-0.4012)	(-5.273)	(-1.0)	**(2.7)**
41	-2.9033	-0.8586	-0.3879	0.7733
	(-1.59)	(-5.57)	(-2.34)	(4.23)

TABLE 3.

NET ECONOMIC VALUES OF DIFFERENT QUALITY ELK HUNTS

	Site 0		Site 1	
	current Condition	Double Chances 6pt Bull	current Condition	Double Chances 6pt Bull
Mean WTP	$371.04	$478.80	$375.98	$483.72
Add WTP		$107.76		$107.74

TABLE 4.

COMPARISON OF TRADITIONAL AND JOINT BENEFITS OF WILDERNESS PRESERVATION

(Thousands of 1978 dollars)

RECREATION TYPE	ORIGINAL USFS ANALYSIS	JOINT BENEFIT ANALYSIS
Wilderness	$11,620	$7,794
Elk Hunting	a	$12,343
Added Fishing	a,b	$2,073
Present Value of Benefits	$11,620	$22,210
Error From Omitting Joint Benefits	-$10,590	

a. Not addressed separately; total use estimate all assigned to wilderness recreation use category.

b. Not reported as benefits' change over the entire watershed affected by land use in the wilderness area, not just visitation to the area. Only the difference is applicable for fishing.

ESTIMATING RECREATIONAL DEMAND: A MODEL FOR NATIONAL FORESTS AND WILDERNESS AREAS

Howard A. Clonts*

ABSTRACT

Estimating resource demand for non-consumptive purposes has always beendifficult. This is especially true for primitive and wilderness areas where there is no definable market. However, probability analysis using preferences of the general population shows promise as being of value to forest and other natural resource managers and planners.

Probability modeling, probit, was used to estimate recreational forest use in an area representative of the types of national forest areas typical in the eastern United States. Aspreadsheet allocation model also was developed to allocate aggregate visitation estimates throughout the forest on the basis of Recreation Opportunity Spectrum (ROS). Wilderness use was shown to be correlated closely with other less primitive use, as well as travel distance to the forest.

Visitor expenditures showed the relative economic benefit of the wilderness compared with other forest areas and resource uses. Economic potential may be estimated with the probit model for future forest and wilderness planning. Reasonable success was achieved in applying models developed for use in predicting recreational demand for conditions within a national forest.

INTRODUCTION

The U.S. Forest Service (USFS) follows a 10 to 15 year planning cycle for management strategies for the various National Forests in the U.S. Contained within forest plans are projections regarding resource use by the public, which must be correlated with timber management as well as other uses under the mandate of multiple use. Outdoor recreation is one of the uses that must be considered when forest plans are developed. The fact that many national forest management units contain or adjoin designated wilderness areas complicates management procedures. In order for planners and managers to adequately address forest resource use so that the public's varied desires can be met, forest managers need reliable information regarding the expected demand for a variety of recreation activities on the forest. This is especially true in wilderness areas for which the potential use or demand is uncertain. The purpose of this research was to determine if a particular modeling procedure **(probit)** could be used to estimate future recreational use of the forest and also allocate this use across Recreation Opportunity Spectrum (ROS) classes.

The ROS is based upon the principle of diversity. The objective is to provide a diverse range of recreational opportunities on public lands in order to satisfy a wide range of recreational demands. A key assumption of the ROS concept is that quality in outdoor recreation can best be insured by providing such diversity. Underlying ROS is the assumption that people seek satisfactory recreational experiences by participating in their chosen recreational activities in a preferred environmental setting. To provide varied recreational opportunities on public land, the land managing agency applies the ROS criteria (a mix of physical, social, and managerial parameters) to match specific recreational opportunities with compatible resource qualities. Using the ROS system, land areas are identified as belonging to one of six classes, depending on the level of existing or planned development and human influence. Characteristics chosen for distinction among classes were remoteness, size, evidence of humans, user density, and managerial regimentation and noticeability. The classes are, in order of decreasing development and human influence: urban (U), rural (R), **roaded** natural (RN), semi-primitive motorized (SPM), semi-primitive non-motorized (SPNM) and primitive (P) (USDA Forest Service, 1986). Criteria for delineating ROS classes were developed and presented in the ROS Users Guide (USDA Forest Service, **1986).**

A primary management objective under the ROS system is to manage the resource base to either maintain the present ROS classification or to manage it in a manner designed to bring about a change in the classification according to the ROS criteria. This may

* Professor, Department of Agricultural Economics and Rural Sociology, Auburn University, Alabama, 36849-5406.

be especially important in wilderness areas of the eastern United States. Eastern wilderness, in contrast with that in the West, typically is smaller and perhaps less diverse. There is greater **probability** that uses of lands near the wilderness can negatively impact the area or that excess use of the wilderness may do the same. The ROS criteria may be useful in planning the use of wilderness areas, and certain modeling techniques may help in estimating the use pressures on them.

Having the ability to predict recreational use across ROS classes with a model that **utilizes** data that are relatively easy to obtain and keep current will be especially helpful for agencies that are attempting to be more productive by providing enhanced recreational opportunities for the general public. Successful application of such a model would give land managing agencies an improved tool for use in developing management plans that encompass the multiple goals each must meet.

THE **PROBIT** MODEL

Models for projecting participation in recreation have received much attention in the past two decades (Committee on Assessment of Demand for Outdoor Recreation Resources, 1975; Cordell and others, 1985). The result of this attention has been a large volume of literature on recreation choice ("demand") and a maturation of the methods used. This maturation has led to a move from a dominance of linear and gravity models toward the use of discrete choice models (Stynes and Peterson, 1984). Several studies in the early 80s emphasized binomial or multinomial **logit** models for the analysis of recreational choice. Peterson and others (1982) and Peterson and others (1983) applied discrete choice models to recreational site choice and demand situations in 1982 and 1983. Later Stynes and Peterson (1984) reviewed **logit** models and the implications of their use in modeling recreational choices. Other studies comparing four techniques - generalized least squares, ordinary least squares, **logit,** and **probit** - showed similarity in power of the four alternatives (Smith and Munley, 1978). However, little work to date has documented the use of the **probit** model in predicting decisions to visit or not visit selected recreational sites and, once on site, decisions on what activities to pursue.

There are other advantages to utilizing a **probit** model. Fist, probability models require endogenous random variables that take only discrete values. This characteristic makes it suitable for analysis of recreational demand, which is participation measured in recreational visitor days. Participation reflects the individual's discrete choice of whether to use the recreational resources of a recreation area. Cross-sectional data are valid for use with a discrete choice model because of the finite nature of the choices available to the individuals. Second, since adequate data relating prices over time are not available, it is appropriate to look at the subjective choices made by visitors to a particular recreation site. Although time-series data are better for the purpose of prediction, the lack of such data for many recreational areas presently precludes this possibility. A general lack of adequate time-series data is a common reality in outdoor recreation research. It was the experience of Brothers and Clonts (1988) that a **probit** model works reasonably well under such data limitations. Thus, this limitation should not deter investigation of important problems in the field of outdoor recreation.

The **probit** model is basically a regression type model which estimates coefficients associated with predictor variables. The model itself is based on the standardized normal probability density function which has a mean of zero and a variance of one (Amemiya, 1981; Hillier and Lieberman, 1980).

The functional form of the model used to estimate forest visitor-days relied on the discrete nature of the decision to visit the forest. Once the choice is made to visit, selected visitor survey data may be used to project total visitor-days and activity participation. This procedure has been documented in the economics literature for a variety of discrete choice decisions (Amemiya, 1981; and Daganzo, 1979) and has appeared in the recreation literature for predicting participation decisions (Smith and Munley, 1978; and Cordell and others, 1985).

A predictive model based upon user characteristics was developed with the independent variables and is presented as:

$$Z = f(X1...Xn, W1...Wn).$$

Where: Z = recreation visitor days,
Xl . . . **Xn** = demographic characteristics, and
W1 . . . Wn = interest shown in recreational activities by participation.

EMPIRICAL APPLICATION

The **probit** procedure is well suited to the task of predicting recreational activity utilizing cross sectional, discrete, data on visitors' preferences because it is a qualitative response model. For the research described in this paper, participation in a particular activity within a national forest unit was considered a revealed expression of interest in a particular activity. Since

recreational demand (participation) lends itself to analysis within a framework of a discrete choice (to use or not to use the resource), models focusing on the probability of consumer choice often are used in the analysis and study of the "demand" for recreational resources. Such a model, developed in 1986 to estimate aggregate future participation in selected recreational activities by both state residents and nonresidents, was extended to this research (Clonts and Brothers, 1986). The earlier model was first used to estimate visitation to the Alabama state park system and allocate total use among the various state parks, as well as across activities available within each park (Brothers and Clonts, 1988). The research reported here was a further extension of that model to federally managed public land.

A survey of visitors to the **Bankhead** National Forest (BNF) in Alabama, **N=596,** was made in **1987-88.** A stratified random sample of recreational visitors was obtained through the use of personal interviews. The BNF in Alabama was chosen for study because it provides a variety of forest recreational opportunities. Within the BNF are representative selections of the recreational opportunities available throughout the Southern Region of the USFS system. The interview sampling sites were typical of the types of facilities provided by the USFS for recreational purposes. The locations of visitor participation in various recreational activities within the forest were correlated with the several ROS classes. A modification of the Public Area Recreation Visitor Survey (PARVS), developed primarily by the U.S. Forest Service, was used to conduct personal interviews with the forest visitors. Survey data were utilized to develop a representative assessment of forest visitor use on an annual basis. The sampling procedure allowed identification of recreational use patterns on a seasonal, daily, and site (ROS class) basis. Recreational site stratification provided a representative sample of the diversity of ROS settings within the forest. Socio-economic data, as well as visitor use data recorded as participation (in hours), were obtained. Respondent selection was done in a random manner, with the exception that the respondent must have been at least 12 years old.

A specialized approach to resource use planning using combined mainframe and microcomputer spreadsheet analysis was developed which utilized statewide consumer response data. Characteristics of a potential recreational forest visitor were drawn from two prior studies of statewide residents who visit state parks. A telephone survey taken in 198586 was used to collect data on recreational patterns from statewide residents **(N=406).** A 1986 on-site survey of state park visitors **(N=928)** was used to develop information on the activities of park visitors. This procedure allowed determining the amount of participation in selected recreational activities throughout the state and, particularly, activities pursued in a park setting. Data collected on visitors to state parks included population characteristics, indicated interest in specified recreational activities, and annual park use rates. The statewide resident survey provided insight into recreational patterns and preferences of the general population. A generalized least squares (GLM) model of both data sets allowed determination of parameters which influenced both general recreation decisions and visitation to state parks. The GLM models revealed significant differences between park visitors and the general population. Results of the park visitor GLM model were incorporated into the national forest **probit** analysis for estimating visitors to the BNF. In addition, a GLM model of the 1987-88 forest visitors was used to test the reliability of regression parameters developed with the statewide and park visitor models. This procedure allowed the relative weights of forest user preferences to be expressed in the **probit** and allocation models. Predicted use estimates from the model were compared to actual recreational use of the forest, as determined from the visitor survey, to assess the accuracy of the model's estimates.

Predictor variables used in this analysis included socioeconomic characteristics and recreational interests of each respondent. Specific predictor variables utilized included the respondent's level of income and level of interest for a variety of activities. Having visited **Bankhead** National Forest in the past year was used as the affirmative choice criterion variable.

A **probit** model has the advantage over typical linear regression models in that it realistically constrains the probability of an activity occurrence to lie between zero and one, and, thus, unrealistic negative probabilities and probabilities greater than one are avoided. Thus, the **probit** model was **utilized** to (a) predict the probability that participation in recreational activities within the **Bankhead** would occur, (b) estimate the total visitation resulting from that probability of participation, (c) estimate the activity participation of visitors once on-site in the forest setting, and (d) distribute recreational activity across ROS classes. Distribution across ROS classes was based initially on survey results which indicated the 1988 distribution patterns. However, the procedure also allowed distribution based on activities available (or allowable if constraints are established) in the respective ROS classes, as shown below.

A primary assumption of the **probit** model was that the choices made by individuals are constrained by available recreational opportunities, as well as their own tastes and preferences. The predictive ability of such a model depends on the correlation between demographic characteristics and the preferences for various recreational activities.

The forest model was designed to estimate total recreational use in recreation visitor days (RVD), and distribute use among the ROS classes within the **Bankhead** National Forest **(BNF)** by season and recreational activity. The BNF was assigned five ROS class designations based upon these modified criteria (Table 1). In order for this to be accomplished, the criteria for assigning areas of the forest to a particular ROS class were modified to more accurately reflect the recreational diversity found in the eastern U.S. as represented by the BNF (Table 2) (Lichtkoppler and Clonts, 1990).

Variables used in the regression to estimate **RVDs,** their impact (+ or -) on visitor use, and level of **significance** are shown in Tables 3 and 4.

The impacts were as expected. The coefficient of determination was affected by the fact that the data were gathered from a population of forest users.

RESULTS

Approximately **156,000** recreation visitor days **(RVDs)** were determined to have taken place on the BNF during the one-year study period (Table 5). This figure was derived by expanding survey data to determine the total recreational use of the BNF during the study period. The **probit** model was then run to estimate the total recreational use for the BNF in 1988 and other selected years.

Comparison of actual forest use with predicted use showed that the model estimated the number of 1988 visitors within 8.0 percent of the number estimated in the on-site survey, an error of one standard deviation. This difference was considered acceptable, especially in of light the lack of data on the number of state residents annually visiting all national forests in Alabama. **Official** Forest Service estimates of visitation to the BNF were significantly higher than those shown here. Annual visitation in 198788 was estimated by the USFS to be approximately 220,000 **RVDs.** USFS personnel revealed that this estimate was considered a rough approximation, and possibly somewhat inflated.

ESTIMATES OF SELECTED ACTMTY PARTICIPATION

Estimates were made of the proportion of visitors participating in selected activities. The number of visitors participating in a given activity and the participation rate are necessary components for assessing the total activity occasions for a given time period. Thus, estimates of the number of visitors participating in selected activities were made on basis of participation reported in the on-site interviews.

In addition, the visitor interviews provided data on the proportions of the sample which participated in selected activities (Table 6). These proportions were used as multipliers to determine approximately how many people participated in a given activity on at least one of their visits to a forest. There were several assumptions made for these calculations, including 1) the proportions of the on-site sample participating in an activity were representative of the year-round proportions of visitors participating; and 2) the proportions of groups participating in an activity, the sample unit of the on-site interview, were the same as for individual visitors. The latter assumption was necessary because even though estimated visits are a measure of individual trips to a forest, the sample unit for the on-site interview was the group visiting the park rather than the individual. Data used in these estimations were the best available rather than the best possible that might better represent a theorized system of relationships.

The total number of visitors expected to participate in an activity is presented in Table 7. This analysis provides an indication as to the type of site preferred by visitors and a relative measure of the magnitude of participation. To illustrate, among the site categories, the largest share of number of visitors chose the more developed, rural ROS site. Yet, the second most preferred setting was primitive, or the Sipsey Wilderness. In contrasting the various activities, a large proportion of visitors to all ROS sites participate in some sort of camping, with over 50,000 visitor days recorded. The other activities most frequented by visitors were picnicking, swimming boating (all types), walking for pleasure, and family gatherings. Although not shown here, the model also allowed distribution of visitors on basis of frequency of visitation. In other words, the activities of the most frequent and least frequent visiting groups may be estimated. Additionally, contrasting recorded activities with preferred activities showed that at least one activity, camping, was used as a means to pursue other activities. This finding is similar to that of many other recreation studies.

As the population composition changes, the distribution of visitors over activities will also change. Thus, the **probit** model can provide an indication not only of changes in the number of visitors, but also activity demands which will be important to park managers and administrators.

ECONOMIC IMPACTS OF FOREST AND WILDERNESS USE

A sign&cant question still remaining is the economic value of recreation on the national forest. If indeed there were over 170,000 **RVDs** on the forest in 1990 (Table **5),** what are the benefits to the local community or the state? Spending patterns of visitors shown in Table 8 clearly show that only 6.0 percent of total visitor spending occurred while in or "on-site" in the forest. Nearly $270,000 out of $4.5 million in total direct travel costs were spent locally in 198788 by forest visitors (Table 9). The multiplier for this type rural area in Alabama was estimated to be 1.7 (Holmes, 1981). Thus, the total spending attributed to BNF locally was approximately $455,500 during the study period. Multiplied spending by visitors on all travel related items totaled nearly $7.6 million, assuming the multiplier remained the same at all levels of spending. Since so much of the impact of travel to the **Bankhead** is non-local, communities on the fringe of the forest have not **benefitted** greatly from forest development.

There are other events which are likely to have greater impact. Recent additions to the BNF camping and day use areas have shown potential to be far more significant than first imagined. A new development, Clear Creek Recreation Area, located at the extreme opposite side of the forest (about 40 miles) features a highly developed campground and day use area with picnicking, hiking and biie trails, and a swimming area with modern comfort stations. Use has been near capacity during the primary season since the facility opened in late 1988. Studies are now underway to determine impacts on the Sipsey Wilderness as a result of attracting a new and diierent clientele group, the recreational vehicle camper and urban day user, to the national forest. Preliiinary evidence suggests that the new clientele will not add significantly to wilderness use.

Wilderness visitation at present is relatively low. Only 11 percent of all forest visitors reported they had been in the wilderness as a main activity for visiting BNF (Table 10). However, this rate of use is not considered abnormal nor unusual for several reasons. First, the Sipsey Wilderness is relatively new and unknown. Second, the area was only recently increased in size to near 25,000 acres from 12,000 acres. Third, there are few other natural features or developed facilities in the immediate area to act as complementary attractions for drawing visitors to the area. One exception is the Sipsey Fork River, recently designated as a National Wild and Scenic River. However, access to the river remains somewhat limited.

Sipsey Wilderness attracted 11.0 percent of the BNF visitors, and, interestingly, they accounted for 11.6 percent of all visitor spending in the local area. On the other hand, visitors to the developed campgrounds in the Rural ROS represented 40 percent of visitors, but accounted for over 70 percent of local spending. In other words, wilderness visitors typically do not spend substantial amounts on-site for their activities. Thus, unless circumstances change, projected increases in forest or wilderness visitation (Table **5),** will not significantly impact the local area. In fact, there are some indications that the wilderness expansion may have reduced the number of local visitors. Road closings eliminated the possibility of short treks of less than 1.0 mile to popular scenic areas. Now the more popular areas are at least 2.5 miles, one way. Such remoteness may be an attraction for the more distant traveler; the dominant local user may be less inclined to return to the scenic areas, even on an annual basis. Future research will be needed to verify this hypothesis.

CONCLUSIONS

General reliability of the RVD estimates indicates that the initial **probit** model may have successful application in other recreational settings. Although the procedure discussed was developed initially for estimating statewide recreation patterns and refined by application in a state park setting, the real success lies in its general applicability. Obviously, one application in a highly similar setting, such as the **Bankhead** National Forest, does not indicate that technology transfer may be indiscriminate. There are definite limitations and needed changes in the procedure. For example, the analysis showed the populations visiting the BNF and state parks to be similar, but significantly different. Thus, there is an indication that a more comprehensive statewide survey of residents visiting national forests for recreation in general will provide much more accurate visitation estimates.

Additionally, time series data on use patterns within a forest are needed to verify the results of the allocation model. Such data traditionally are kept only on a few select sites, namely those for which user fees are charged. Despite these limitations, the model seemed to perform satisfactorily for the purposes intended in

this study. Thus, it can be recommended that such procedures be tested at other recreational sites or settings. The recreational demand dilemma may possibly be at least partially managed through this statistical procedure or its modifications. Discrete choice models generally appear to be more relevant in demand analysis since consumer choice for recreation frequently is expressed in non-market situations. Continued reliance on the more traditional gravity models, such as travel cost or the contingent valuation methods, may limit the researcher's ability to estimate "demand." This, in turn, continues to force resource managers into the unenviable position of "flying by the seat of the pants" in allocating public resources among competing land uses. This is especially true for national forests in the United States. Competing land uses such as timber production, forest recreation, and even wilderness preservation require proper resource allocation. Managers of these resources can in no way provide optimum resource use opportunities for society at large unless more accurate demand estimates are developed. The procedure as presented here may provide an important step in that direction.

REFERENCES

Amemiya, **Takeshi.** Qualitative response models: A survey. Journal of Economic Literature, XIX (December **1981):1483-536.**

Brothers, Gene L.; Clonts, Howard A. 1987. Projecting recreational use of state parks: Application of a **probit** model in management decisions. In: Proceedings of 1987 Southeastern recreation research conference. Asheville, North Carolina: January, **1988:91-103.**

Clonts, Howard A.: Brothers, Gene L. 1986. A comparison of discrete choice models for estimating recreation activity participation. Paper presented at Southern Agricultural Economics Association, annual conference, Orlando, Florida, Feb. 1986. Auburn, **AL:** Department of Agricultural Economics and Rural Sociology. Alabama Agricultural Experiment Station, Auburn University.

Clonts, Howard A.; Smutko, Steven; Brothers, Gene L. 1986. Technical manuals for recreation research and planning in Alabama and Alabama state parks. (Technical Report) Alabama statewide comprehensive outdoor recreation plan, 1986. Alabama Department of Conservation and Natural Resources, Montgomery, AL 1986. Auburn, **AL:** Department of Agricultural Economics and Rural Sociology, Alabama Agricultural Experiment Station, Auburn University.

Committee on Assessment of Demand for Outdoor Recreation Resources. 1975. Assessing demand for outdoor recreation. Washington D.C.: U.S. Government Printing **Office.**

Cordell, H. Ken; Fesenmaier, Daniel R.; Lieber, Stanley R.; Hartmann, Lawrence A. 1985. Advancements in methodology for projecting future recreation participation. Proceedings: 1985 National outdoor recreation trends symposium II. I: 89-109.

Daganzo, Carlos. 1979. Multinomial **probit:** The theory and its application to demand forecasting. New York: Academic Press.

Hillier, Frederick S.; Lieberman, Gerald J. 1980. Introduction to operations research, 3rd ed. San Francisco, **CA:** Holden-Day, Inc.

Holmes, Mac R. 1988. An input-output model of the economy of the state of Alabama for 1982 with associated economic multipliers. Troy, AL: Center for Business and Economic Research, Troy State University.

Lichtkoppler, Richard J.; Clonts, Howard A. 1990. Recreation opportunity spectrum reevaluated: Its application to the eastern U.S. In: **Vining,** Joanne, ed. Social science and natural resource recreation management. Boulder, CO: **Westview** Press.

Peterson, G. L.; Anderson, D.H.; and Lime, D.W. 1982. Multiple use of site demand analysis: An application to the BWCA Wilderness. Journal of Leisure Research. **14:27-36.**

Peterson, G.L.; Dwyer, J.F.; Darragh, A. 1983. A behavioral urban recreation site model. Leisure Science. Vol. 6.

Smith, V. Kerry; Munley, Vincent G. 1978. The relative performance of various estimators for recreation participation equations. Journal of Leisure Research. **10(3):165-176.**

Stynes, Daniel J.; Peterson, George L. 1984. A review of **logit** models with implications for modeling recreation choices. Journal of Leisure Research. **16(4):295-310.**

U.S. Department of Agriculture. 1986. ROS book. USDA, USFS. Washington D.C.: U.S. Government Printing **Office.**

United States Forest Service. 1985. Public area recreation visitor survey (PARVS). Athens, GA: Southeastern Forest Experiment Station.

Table 1. Recreation Opportunity Spectrum Classes

Class	Symbol
Urban	U
Rural	R
Roaded, Natural	RN
Semi-Primitive, Motorized	SPM
Semi-Primitive, Non-Motorized	SPNH
Primitive	P

Source: U.S. Department of Agriculture, Forest Service 1986 ROS Book USDA, USFS, 1986, p. 11-12.

Table 2. Composite Presentation of Recreation Opportunity Spectrum Classes and Limits to Acceptable Change Values and Terminology

Class	Class Value	ROS Access	Development Level	User Density	Vegetation Condition	Environmental Change
	25	Primary highuay	Intensively developed area	Intensive use area	Intensively altered area	Intensively changed
Rural	23	Primary or secondary highway	Very highly developed area	Very heavy use area	Very severely altered area	Very severely changed
	20	Secondary highway	Highly developed area	Heavy use area	Severely altered area	Severely changed
Roaded Natural	18	Secondary	Significantly roaded	Significant use developed area	Significantly altered area	Significantly changed
	15	Improved light-duty road	Moderately developed area	Moderate use area	Moderately altered area	Moderately changed
Semi Primitive Motorized	13	Unimproved dirt road	Lightly developed area	Frequent use area	Obviously altered area	Obviously changed
	10	Jeep trail	Developed access area	Slight use area	Slightly altered area	Slightly changed
	9	Way				
Semi Primitive Non Motor-ized	8	Primary horse trail area	Trai l development	Noticeable use area	Noticeably altered area	Noticeably changed
	7	Horse trail				
	6	Primary foot trai l				
	5	Foot trail	Minimally developed area	Minimun use area	Minimally altered area	Minimally changed
	4	User trail				
Primi-tive	3	Visible game	Unobtrusively	Obtrusive	Unobtrusively	Unobtrusive

Table 3. Variables Used in the Forest Recreation Probit Model, Recreational Use of National Forests Study, Alabama, 1988

Variable	Variable Description	Expected Impact
Demographic variable:		
Income	Respondent's income $5,000-10,000	
Activity variables:		
Camping	Respondent had positive interest	+
Hiking	Respondent had positive interest	+
Picnicking	Respondent had negative interest	
Boating	Respondent had positive interest	+
Swimming	Respondent had negative interest	
Other	Respondent had positive interest	+

Table 4. Parameter Estimates for Variables Used in the Forest Recreation Probit Model, Recreational Use of National Forests Study, Alabama, 1988

Variable	Parameter Estimate*
Demographic variable:	
Income $5,000-$10,000	-70.4
Activity choice variables:	
Camping	88.6
Hiking	57.9
Picnicking	-40.7
Boating	88.4
Swimming	-22.3
Other	227.1

* Estimates are in recreation visitor days (RVDs).

Table 5. Comparison of Actual and Predicted Recreational Use of the Bankhead National Forest for Selected Years by ROS, Location of the Activity, Alabama, 1988

ROS Class	Actual use 1987-1988	Recreation Visitor Days (Rounded) Predicted Use			
		1988	1990	1995	2000
R	75,643	76,520	78,100	81,100	85,500
RN	11,926	11,950	12,200	12,800	13,300
SPM	24,570	27,470	28,400	29,700	31,100
SPNH	2,638	2,970	3,200	3,300	3,500
P	42,099	47,910	50,100	52,500	54,900
Total	156,876	168,820	171,900	180,100	188,300

U - Urban; RN - Roaded Natural; SPM - Semi-Primitive Motorized; SPNH - Semi-Primitive Non-Motorized; P - Primitive

Table 6. Recorded Recreational Use of the Bankhead National Forest, All Activities in Recreational Visitor Days, Survey Period May 1987 to March 1988, Alabama, 1988

Activity ROS/ Class	Rural	Roaded Natural	Semi-Primitive Motorized	Semi-Primitive Non-Motorized	Primitive/ Uilderness
Backpacking	----	876	----	1,636	15,492
Developed Camping	53,896	8,694	----	----	___
Primitive Camping	----	94	14,634	32	8,198
Canoeing or Kayaking	109	----	___	54	62
Motorboating	1,706	105	___	___	___
Uaterskiing	742	105	___	___	___
Other Boating	35	12	___	___	___
Other Outdoor Swimming	5,249	19	___	8	16
Wildlife Observation	442	205	366	111	1,815
Other Nature Study	59	159	108	27	1,462
Photography	194	76	31	64	2,112
Day Hiking	549	293	259	62	4,516
Ualking for Pleasure	1,621	324	33	93	306
Running or Jogging	57	----	6	___	___
Bicycling	506	10	60	----	31
Horseback Riding	----	___	4,278	----	___
Driving ORVs	___	___	100	___	___
Freshwater Fishing	2,648	56	----	----	___
Big Game Hunting	----	___	1,452	365	694
Small Game Hunting	----	70	102	27	194
Picnicking	3,241	543	26	14	446
Other Outdoor Sports	234	8	----	----	___
Sightseeing	695	104	1,380	81	3,580
Driving for Pleasure	47	10	899	___	___
Dining for Pleasure	206	___	4	___	8
Family Gathering	2,648	56	----	___	___
Collecting Firewood	330	41	130	___	81
Collecting Berries, etc.	174	37	----	___	78
Visiting Prehistoric Sites	13	___	39	___	120
Visiting Historic Sites	14	___	109	___	4
Reading Roadside Markers	59	27	81	27	93
Using Self-Guided Trails	75	___	___	___	2,807
Other Activities	94	___	19	37	54
	------	_____	-------	-------	_____
Sub Totals	75'643	11,926	24,570	2,638	42,099
Grand Total					156,876

Table 7. Predicted Recreational Use of the Bankhead National Forest, All Activities in Recreational Visitor Days, Alabama, 1988

Activity/ROS Class	Rural	Roaded Natural	Semi-Primitive Motorized	Semi-Primitive Non-Motorized	Primitive/ Wilderness
Backpacking	---	710	---	1,320	12,530
Developed Camping	3,590	7,030	---	—	---
Primitive Camping	—	80	11,870	30	6,670
Canoeing or Kayaking	180	—	---	90	100
Motorboating	2,760	170	—	—	—
Waterskiing	1,200	170	—	—	—
Other Boating	60	20	—	—	—
Other Outdoor Swimming	8,490	30	—	10	20
Wildlife Observation	710	330	600	180	2,930
Other Nature Study	90	260	170	40	2,360
Photography	310	120	50	100	3,420
Day Hiking	890	470	420	100	7,300
Walking for Pleasure	2,620	520	50	150	490
Running or Jogging	90	---	10	—	—
Bicycling	820	20	100	—	50
Horseback Riding	—	—	7,650	---	---
Driving ORVs	—	—	50	10	---
Freshwater Fishing	2,060	500	110	100	110
Big Game Hunting	—	—	2,350	590	120
Small Game Hunting	—	180	120	40	310
Picnicking	5,240	880	40	20	720
Other Outdoor Sports	380	10	10	—	---
Sightseeing	1,120	170	2,230	130	5,790
Driving for Pleasure	80	20	1,460	—	---
Dining for Pleasure	330	—	20	—	—
Family Gathering	4,280	90	—	—	—
Collecting Firewood	530	70	210	—	130
Collecting Berries, etc.	280	60	---	—	130
Visiting Prehistoric Sites	20	—	60	—	80
Visiting Historic Sites	20	—	180	—	10
Reading Roadside Markers	100	40	1,680	—	—
Using Self-Guided Trails	120	—	---	—	4,540
Other Activities	150	—	30	60	90
	------	———	———	———	———
Sub Totals	76,520	11,950	29,470	2,970	47,910
Grand Total					168,820

Table 8. Estimated Expenditures of Visitors to Bankhead National Forest While Visiting the Forest, By ROS Classification and Expense, Forest Recreational Visitor Survey, Alabama, 1987-88

Visitor origin	Expenses While Visiting Bankhead National Forest*								
	Non-camp lodging	Food	Travel to BNF	Fishing	Hunting	Camping	Other	Total	Percent
	dollars								pct.
ROS 1 Rural	5,800	71,530	54,960	2,240	----	57,425	1,545	193,500	72.2
ROS 2 Roaded Natural	465	790	10,355	___	----	___	___	11,610	4.3
ROS 3 SP Motorized	----	----	4,490	----	----	___	___	4,490	1.7
ROS 4 SP Non-Motorized	----	5,725	11,100	----	10,470	----	___	27,295	10.2
ROS 5 Uilderness	350	12,870	5,585	140	1,515	9,775	840	31,075	11.6
All Visitors	6,615	90,915	86,490	2,380	11,985	67,200	2,385	267,970	100.0
Percent	2.5	33.9	32.3	0.9	4.5	25.1	0.9	100.0	

*Amount will not add due to rounding. Ueighted averages reported.

Table 9. Estimated Expenditures of Visitors to Bankhead National Forest While Visiting the Forest, By Visitor Origin and Expense, Forest Recreational Visitor Survey, Alabama, 1987-88

Visitor Origin	Expenses While Visiting Bankhead National Forest*								
	Non-camp lodging	Food	Travel to BNF	Fishing	Hunting	Camping	Other	Total	Percent
	dollars								pct.
Local Visitors	465	9,130	14,490	360	1,395	6,300	390	32,530	12.1
State Residents	5,800	52,550	61,035	2,020	115	43,650	1,390	166,640	62.2
Non-Residents	270	29,240	10,970	0	10,470	17,250	600	68,800	25.7
All Visitors	6,615	90,920	86,495	2,380	11,980	67,200	2,380	267,970	100.0
Percent	2.5	33.9	32.3	0.9	4.4	25.1	0.9	100.0	

*Amount will not add due to rounding. Ueighted averages reported.

Table IO. Estimated Number of Visitors To Bankhead National Forest, and Average Party Size by Visitor Origin, Forest Recreational Visitor Survey, Alabama, 1987-88

Visitor origin	All Visitors			Yilderness Visitors		
	Visitor number	Percent distri-bution	Average party size	Uilderness number	Uilderness percent of total	Percent distri-bution
Local visitors (travel < 25 miles)	10,650	23.1	2.9	418	3.9	8.2
State residents (travel > 25 miles)	28,035	60.8	4.0	3,723	11.7	73.1
Non-residents	7,455	16.1	6.7	954	12.8	18.7
All visitors	46,140	100.0	4.3	5,095	11.0	100.0

*Numbers may not add due to rounding.

THE TREATMENT OF NON-PARTICIPANTS IN TRAVEL COST ANALYSIS

Daniel Hellerstein*

ABSTRACT

Sample design is important when estimating the demand for visits to recreational sites. Biases are introduced if the sampling framework is inconsistent with the statistical assumptions underlying the chosen model. In this paper, three types of bias are examined: censoring truncation, and endogenous stratification. Methods for controlling for these sources of bias are considered in the context of both continuous and count models. Zonal models are also discussed as an alternative to models that utilize on-site surveys. To illustrate the consequences of sample design, artificial data are constructed and modeled using several techniques.

INTRODUCTION

When comparing alternative uses of public land, a common measure of value is required. For commodity oriented uses, such as the harvesting of timber from forestland, net revenue is an obvious gauge of value. However, for non-commodity uses, such as hiking in forestland, these price-based measures are rarely available. Instead, a method of imputing the value of these activities, in terms commensurable with price-based measures, is required.

Travel cost analysis is one method by which values for one important class of non-commodity output, those related to on-site human use, can be obtained. Travel cost analysis uses an opportunity cost, the cost of obtaining access to a site (Clawson and Knetcsh, 1966), to derive a demand curve for visits to the site. Armed with derived demand curves, policy analysts can investigate the relative value of a range of possible outputs. For example, the consumer surplus accruing to potential site visitors can be computed (Freeman, 1979), and compared to the potential revenue from commodity oriented uses of the land. In fact, a wide range of the potentially competing "on-site non-commodity" uses possible for most sites, such as roaded recreation vs. wilderness designation of forestland, can be compared using consumer surplus.

Abstracting from end use, travel cost analysis has one distinguishing feature: it is based on an econometric model. As such, a number of issues need to be considered prior to an exercise in travel cost analysis, such as the functional form used for curve fitting, the nature of random influences, the role of substitutes, and the proper set of socio-economic variables to include. Decisions on all these criteria will be a function of theoretical plausibility, ease of estimation, and data requirements. In addition, sample design, especially the procedures used to collect data, must be considered. The purpose of this paper is to review the consequences of different sample designs, and discuss techniques for controlling the potential ill-effects due to suboptimal sampling. In particular, the important issues of censoring, truncation, and endogenous stratification are reviewed.

CENSORING AND TRUNCATION

When conducting travel cost analysis, a fundamental consideration is where to collect the data. Data can be collected via an on-site survey, or a more extensive general census of the population can be performed. On-site surveys have the advantage of focusing on the actual users, while a population census furnishes information on both users and non-users. Both have implications on how estimation should be performed.

If an on-site survey is chosen, one must recognize that the minimum number of observed visits is one. This feature is known as truncation, that only those who actually choose to visit will appear in the sample. In addition, frequent visitors are more likely to be selected even if a seemingly random procedure is employed, say consisting of interviewing everyone passing a checkpoint. The sample is said to have endogenous-stratification (Shaw, 1988), with the probability of being sampled not constant across visitors, but rather a function of observed behavior.

When a general population survey is performed, truncation is not an issue. Rather, given the specialized interests of the population and the unique aspects of most sites, it is likely that the number of

*Natural Resource Economist, Economic Research Service, Resource and Technology Division, 1301 New York Ave., NW, Washington DC 20005.

non-zero observations will be quite small. Although the typical demand may be zero visits, it will never be less than zero. This feature is known as censoring, that a lower bound exists on possible trip demand.

Censoring, and the combination of truncation and endogenous stratification, can lead to biased estimates of the parameters of the postulated demand curve. To facilitate discussion of why this occurs, consider the simple linear demand curve with an additive random component: $Y = \beta_0 + \beta_p P + \epsilon$. Based on this formula, an artificial data set is constructed, with demand $\beta_0 = 35$, $\beta_p = -1$ and ϵ drawn from a normal random variable. Note that for the purpose of illustration, negative values of Y are permitted. Figure I displays the generated data, with each point shown as a +. Also displayed are regression lines (using OLS in all cases) for sample designs where censoring, truncation, and truncation with endogenous stratification occur. Let us consider each case separately:

Figure la) Predicted demand when a complete sample is undertaken, and non-zero values are permitted. In this case, bias is absent. Note that the behavioral implications of this model are questionable, since less-than-zero demand for recreational trips is impossible. For now, the reader is asked to overlook this point, as the main purpose of this section is to illustrate the consequences of censoring, truncation, and endogenous stratification.

Figure lb) The data are censored, with all values less than zero set to 0.0. Coefficients appear to be biased toward 0 - with predicted demand less price elastic. This bias will increase as the number of censored observations increases, as more observations are "recoded" away from their "true" value, given the assumption that negative values are possible. It is important to note that even when the predictable component of demand (e.g., $\beta_0 - \beta_1 * P$) is positive, a sufficiently large negative random term will induce censoring. It helps to consider that the permissible distribution of the random term, for any individual, will be "conditional" on the observed component of demand: when the observable component is small, then to prevent less-then-zero demand the random term can not have a large negative value. Hence, the mean of the random term is conditional on the observed component of demand, and will not equal zero.

Figure lc) The data are truncated, with only those who actually participated observed. Note that this is not data that would be gathered on site. Rather, this sort of data are generated by two-stage population surveys (such as the National Fishing and Hunting Survey), where the first stage identifies participants, and the second stage elicits the visitation rate of these participants. The bias due to truncation arises from a tendency to select those with a large positive random term, those with large negative random term tending to drop out of the sample. As with censoring, the mean of this "conditional" random term will not equal zero.

Figure **1d)** The data are truncated, and endogenous stratification occurs. Note that this particular plot is not unique; it is one example of a stratified sample drawn from the user population, with higher **probability** of selection for those with higher levels of demand. This process exacerbates truncation bias, since we will tend to oversample those with large positive random terms, and undersample those with large negative random terms.

THE **TOBIT** AND RELATED ESTIMATORS

Faced with censoring, truncation, or endogenous stratification, analysts commonly apply econometric techniques that specifically account for the peculiarities of the sample. A familiar example of these **"limited-dependent variable"** techniques is the **TOBIT** estimator (Maddala, 1983) of the linear model in the presence of censoring. Truncation can be accounted for in similar fashion, as can truncation with endogenous stratification (Shaw, 1988).

Although such econometric techniques are mathematically appropriate, they beg a fundamental behavioral question: is there a sensible story that describes how a random term comes to be censored? In other words: is there a behavioral model that generates observations consistent with the statistical assumptions on which limited-dependent variables techniques are based?

One possible story admits the possibility of negative demand, and presumes that censoring is simply an artifact of consumers' inability to obtain these **less-then-zero** quantities. While this may make some sense for tangible commodities (with negative demanders selling from their excess), for goods such as "visits to recreational sites" it makes little sense (Pudney, 1989). Another story postulates that the distribution of the random term is sensitive to the observable component of demand, possessing a large **probability** mass at just the value that yields zero observed demand (see Figure 11). Requiring non-independence (but a correlation of zero) between the random term and exogenous variables, it would seem that such a story is incompatible with the usual assumptions about orthogonality of omitted and excluded variables.

Another explanation views the visitation decision as a two stage process. Fist, the potential visitor decides

whether or not she has any interest in the site. Second, given a decision to participate, the level of participation (number of visits) is chosen. A single (or several) random term(s) **influences** both stages. For example, participation (the first stage decision) occurs when the random term exceeds a value that is dependent on the observable component of demand. The level of demand (the second stage), given a **first-**stage decision to participate, is a function of the observable component plus a random component. The second stage random component is either identical to that from the first stage (yielding the **TOBIT** model), or a new random component, distinct from the random component influencing the participation decision, is drawn (say, yielding the **Heckman** or Cragg model, see Bockstael and others, 1990).

While two-stage models have intuitive appeal, they do pose some problems. First, the continuous functional forms used in **TOBIT** and similar estimators do not conform to the integer-only possible demand quantities. In other words, the model may predict fractional trip demand (say, **3.6),** while the consumer is limited to demanding whole-number quantities (say, 3 or 4). The consequences of this may be severe, especially when observed demand is low (Mullahy, **1986;** Stapleton and Young, 1984). Second, the **TOBIT** and related techniques are quite sensitive to distributional assumptions. If the assumed distribution of the random term is incorrect, biased estimates will be produced (Maddala, 1983; Nelson, **1981).**[2] Lastly, any two-stage model must make assumptions about the relationship between the two stages. Typically, the random component of each stage is assumed to be orthogonal. If this assumption proves false, then the estimator is **inefficient** and hypothesis tests will be biased.

With more complicated models that use a more general error structure, these problems can be partially overcome. But instead of constructing elaborate continuous models, it might be wiser to adopt a model that specifically recognizes the peculiarities of site-demand. In particular, count models are worth exploring.

COUNT MODELS

Count models are based on probability distributions which have mass only at the non-negative integers; under a count distribution, it is impossible to observe a fractional outcome, or a negative outcome (although zero outcomes are allowed). Since trip-demand is only obtainable in non-negative integer quantities, it is sensible to use count-based demand curves to estimate site visitation. Recognizing this, a short review of count models is appropriate.

The classic example of a count distribution is the Poisson, several examples of which are displayed in Figure III. Notice that the Poisson is defmed by single parameter, A, where λ equals both the expected value and the variance of the Poisson. In demand curve estimation based on the Poisson, λ is modeled as function of price and other exogenous variables. Since the Poisson is defined only for positive values of λ, λ is usually modeled as $\exp(X\beta)$, with X a vector of exogenous variables estimation and β the vector of parameters to be estimated.

Given the stringency of the mean/variance equality restriction imposed by the Poisson, in practice several modifications to the Poisson are often made. First, a compound Poisson such as the Negative Binomial, where the λ is modeled in probability, say with $\lambda = \exp(X\beta)\gamma$ (y distributed according to a known probability law), can be estimated (Hausman, Hall, and Griliches, 1986). Second, robust estimation techniques that remain consistent, even when the true distribution deviates from the presumed distribution, can be used for the Poisson and Negative Binomial models (Gourerioux, Montfort, and Trognon, 1984; Cameron and Trivedi, 1986). The existence of these robust techniques compares favorably with the case for **TOBIT** and similar estimators that are biased when the actual distribution is not normal.

It is interesting to compare the $\lambda = \exp(X\beta)$ Poisson model to the continuous model with $Y = \exp(X\beta)\epsilon$. Typically, $Y = \exp(X\beta)\epsilon$ is estimated using a semi-log regression, with the log of the dependent variable regressed against the explanatory variables and ϵ assumed to posses a lognormal distribution. However, since log of zero is undefined, the analyst must decide how to account for zero-valued observations. One solution is to recode zero values to some small quantity before logging. Although convenient, if the proportion of zeros is large, this will introduce a bias strictly dependent on the heuristic decision of the "small quantity." Another technique is to drop zero-valued observations, truncating the data set in order to facilitate estimation. A two-stage approach may also be used, the first stage using all data to predict the participation decision, and the second stage using only the non-zero observations. Although this two-stage with truncation approach has some **appeal,**[3] it still fails to recognize the integer-only nature of trip demand, an especially bothersome problem given that we start by discarding zero demanders but then allow predicted demand that is arbitrarily close to zero!

Count models, as presented above, control for censoring directly. However, when truncation occurs (as with on-site samples), these count models must be modified. In off-site surveys that focus on distinct user groups, the required truncation is trivial (Creel and Loomis, 1990; Smith, 1988). When endogenous **stratification** is also prevalent, as with on-site surveys, the required correction is somewhat more complicated (Shaw, **1988**).[4]

As with continuous models, count models can also be put into a two-stage framework. Now the transition from 0 to 1 trip is modeled separately from the probability of choosing **n** trips, given **n>0.** For example, a modified Poisson distribution with $\lambda = I$, can be used for the probability of zero visits, with a different modified Poisson, with $\lambda = \lambda_n$, used for the probability of **n>0** visits (the modification guarantees that the Count Data Models [CDF] over all integer equals unity; see Mullahy, 1986).

Summarizing this section, the use of count data models is primarily motivated by the appropriate match between statistical model and observed data. Count models, appropriate under a variety of sampling frames, and under different assumptions about the structure of demand, are available to the travel cost analyst. Given the apparent problems associated with the continuous alternatives, a strong case can be made for the adoption of count models. Granting this, let us now consider a special case where the advantages of count models are less obvious: that of aggregate (zonal) models.

ZONAL MODELS

Site-visitation data often cannot be assigned to specific individuals. The worst case of this is when all that is known is total site visitation, perhaps for several different sites. In such a case, where nothing is known about the characteristics of site visitors, only rough estimates of absolute and relative site value can be made. For example, the product of the number of visitors and an average value per visitor day is often used to measure site value, for example, the U.S. Forest Service's use of RVD values in the forest planning process (Bowes and Krutilla, 1990). Somewhat more sophisticated versions of this model incorporate characteristics of the surrounding population, in order to control for gross differences in accessibility.

If visitation data can be partially disaggregated, these rough "reduced form" measures can be improved upon. In particular, if the analyst can identify an origin-zone from which each visitor came, then an aggregated zonal travel cost model can be computed. For example, an entry permit that identifies hometown zip-code is often collected from all visitors. After aggregating all permits by origin (say, by zip-code or by county), a visitation rate can be computed, using origin population as the denominator and the total number of permits issued to this origin as the numerator. This visitation rate is then used as the dependent variable in a linear regression of per-capita visitation rate against an average travel cost to the center of the origin and census measures of population characteristics (such as per capita income, or average education).

Since a ratio is used as the dependent variable, the "integer only" problem of continuous models is less severe. Nevertheless, count models still have considerable appeal, especially given their explicit recognition of censoring.' In the count model domain, the **adding** up property of the Poisson (and related models) is exploited, with total zonal visitation used as the dependent variable, and zonal population entering as a weight.

One of the appeals of this aggregate zonal model is the reduction of zero observations, without truncation. Note that all origin zones that can reasonably be included in the site's market area are included in the analysis. Thus, even zones producing zero visits are included, hence truncation bias is largely avoided. Furthermore, the probability of at least one individual from a zone visiting the site is higher then the probability of a particular person (chosen at random from the zone) visiting the site. Thus, censoring is reduced; but not altogether removed, since even after aggregation there are usually origin-zones producing **zero** visitors.

Although avoiding truncation and reducing the extent of censoring, the lumping together of many individuals required in zonal models introduces an aggregation bias. Basically, for unbiased estimation, the aggregate demand curve must reproduce the behavior of the sum (over all residents of the zone) of individual demand curves. For example, if $\mathbf{X}_{zone}$ is a vector of zonal averages (say, per capita income or average age), and $\mathbf{X}_i$ are the same variables measured for all individuals **(i=1,...)** in the zone, unbiased estimation requires that $\mathbf{X}_{zone}\boldsymbol{\beta} = \Sigma_i(\mathbf{X}_i\boldsymbol{\beta})$. In the linear model, this requires an exact measure of $\mathbf{X}_{zone}$; with values **based** on a partial sample introducing bias due to an errors-in-variables effect (Deaton and Muelbauer, 1980). This bias is exacerbated in non-linear models (Maddala, 1983). For example, in the $\lambda = \exp(\mathbf{X}\boldsymbol{\beta})$ count models,

$$e^{(x+\Delta x)\beta} + e^{(x-\Delta x)\beta} = e^{x\beta}\left(e^{\Delta x\beta} + \frac{1}{e^{\Delta x\beta}}\right) \neq 2e^{x\beta}$$

Obviously, as within zone variance of X increases (as the range of Ax increase) so will bias. The accuracy of zonal models is therefore, a function of the homogeneity of the zones.

A SIMULATION

To investigate the performance of different sampling/estimation strategies, a simulation is conducted. The simulation consists of two components: 1) Generation of demand, and 2) Prediction of models and associated consumer surplus. For this simulation, it is assumed that an individual's trip demand is a Poisson distributed random variable, with λ a function of travel cost (P) and income (I): $\lambda = \exp(\beta_0 + \beta_p P + \beta_I I + \epsilon) = \exp(X\beta + \epsilon)$. Thus, count models are used to estimate coefficients, and the expected value of consumer surplus (E[CS]) is computed using the formula: $E[CS] = -\exp(X\beta)/\beta_p$.[6]

To generate demand, a population is created and spread randomly around some central "site." Individuals are then assigned to a zone, where the zones may consist of concentric rings, or may be squares in a grid. Given randomly generated zone averages, each individual in the sample is assigned a random wage, and non-wage income are generated. Wages are used to compute both a time-component of travel cost, and to compute the wage-income. Both wage-income and non-wage income are included in the income (I) variable. A λ is then computed for each individual, with ϵ drawn from a normal distribution with variance σ^2. Finally, an observed demand is generated for each individual, using her unique value of 1.

Five models are estimated using this information:

1) All observations are used. This complete census is an a "ideal" case, in the sense that the analyst has all available information.
2) Zonal aggregates are used. The total number of visits from each zone is calculated, and regressed on zonal averages of travel cost and income, using zonal population as a weight.
3) A sample of visitors. Ten percent of all visitors are sampled. This data set only contains non-zero observations. Furthermore, it will suffer from endogenous stratification, since frequent visitors are more likely to be sampled then infrequent visitors. Three models are computed using this sample of visitors:

   3a) A naive sample, that uses the standard Poisson without modification.

   3b) A model that recognizes the non-existence of zero-demanders, and corrects for truncation (see Grogger and Carson, 1988).

   3c) A model that recognizes both truncation and endogenous stratification (see Shaw, 1988).

For each sample, β coefficients and the expected value of consumer surplus are computed. Each sample is replicated a number of times, with each replication differing only in observed demand income, travel cost, and ϵ are the same, hence λ is the same. Thus, for each individual (in the entire population), in each replication, a new draw from a Poisson distribution is taken.

Using the β and E[CS], three measures of model quality are computed for each set of replications. These are: mean square error of the price coefficient (β_p), an average absolute deviation from true β_p measured in terms of predicted standard errors, and the deviation of predicted **E[CS]** (using predicted β) from the "true" E[CS] (using generated A), with E[CS] aggregated over the entire population (not just users).

The results of these measures are displayed in Tables **Ia** to **Ic,** and in Figure IV. Each of Tables **Ia** to Ic use a slightly different specification, with differences a function of the size of the σ_ϵ^2 ($E[\epsilon^2]$), sample size, and how the population is distributed around the site. Figure IV holds all factors constant, but systematically changes σ_ϵ^2.

Regardless of specification, the results are strikingly consistent. As expected, in all cases the sample based models that do not recognize endogenous stratification (3a and 3b) perform poorly. Surprisiiy, the zonal model performs quite well, often better than the "ideal" complete census. The endogenous stratification model has mediocre performance, better then simpler sample based models, but worse then complete census and zonal models.

Figure IV highlights the effects of model misspecification: the addition of an ϵ term to the λ function. Note that as σ_ϵ^2 increases, the relative performance of the zonal models also improves. These results can be explained as an outcome of the robustness of the Poisson estimator. Basically, as long as the expected value of demand is accurately modeled, then the Poisson will be consistent. For zonal models, the expected value of demand for a zone is

$$E[Y] = \sum_{n=1}^{N} \lambda_n \quad ; \textit{where } N \textit{ is the population}.$$

The zonal models use $E[Y] = N \exp(\bar{X}\beta)$, with $\bar{X}$ the zonal average of X. It appears that the error induced by this approximation is comparatively smaller than the

error arising from using sample based estimators that lack this robustness feature, especially as σ_ϵ^2 increases.

DISCUSSION

In the best of worlds, travel cost analysis would avoid truncation bias by operating on a large census of the potential user population, and would deal with censoring by using models that explicitly recognize the zero bound (e.g., the Poisson). Unfortunately, due to the prohibitive costs of conducting a population survey large enough to include a **significant** number of visitors, on-site surveys are often the only source of data available. Two extremes of on-site data are typical: a sample of user interviews, yielding detailed information on a fraction of the user population, or a complete set of permit information, yielding sparse data on all visitors. In the first case, one must account for truncation and endogenous stratification. In the second, one must account for censoring and aggregation bias.

The appeal of a model directly linked to individual behavior, and not appealing to some amorphous "zonal demand," is undeniable. Furthermore, with advances in the econometrics of demand analysis, it is straightforward to control for inadequacies in sample design, such as endogenous stratification and truncation. However, as implemented to date, these econometric techniques are heavily dependent on specific distributional assumptions. Should these fail to be true, bias will be introduced. Zonal models, while certainly suffering from an aggregation bias, do not have the same degree of dependence on specific distributional assumptions. In other words, aggregate (zonal) analysis is not necessarily dominated by **site**-based samples estimated with econometric techniques that recognize truncation and other problems of sample selection.

The effectiveness of aggregate analysis is demonstrated using simulated data. Both in terms of accuracy of estimated coefficients, and in terms of accuracy of consumer surplus estimates, models using aggregated data consistently outperformed more sophisticated models that used data on participants only. This superiority of zonal models increased as the extent of model misspecification, here involving inclusion of an error term, rose. While only a few cases were investigated, all using count models were investigated; these results suggest that zonal models can perform quite well.

In summary, when constructing a survey, or when using available data to estimate a model, survey design must be considered. Censoring, truncation, and endogenous stratification will bias results if not properly controlled for. Although continuous models that achieve this control are available, the use of count models is advocated here as a sensible alternative. Lastly, despite their unavoidable aggregation bias, zonal models do implicitly control for non-visitors without relying on a specific **probability** distribution, and are, therefore, not necessarily dominated by individual observation based models that econometrically adjust for data which is gathered only from participants (e.g., on-site survey data).

REFERENCES

Bockstael, Nancy; Strand, Ivar; McConnell, Kenneth; Arsanjani, Firuzeh. 1990. Sample selection bias in the estimation of recreation demand functions: An application to sportfishing. Land Economics. 66:40-49.

Brown, William; Sorhus, **Colin;** Yang, B.C.; Richards, Jack. 1983. Using individual observations to estimate recreation demand equations: A caution. American Journal of Agricultural Economics. **65:154-157.**

Cameron, Colin; Trivedi, Pravin. 1986. Econometric models based on count data: Comparisons and applications of some estimators and tests. Journal of Applied Econometrics. **1:29-53.**

Clawson, Marion; Knetsch, Jack. 1966. Economics of outdoor recreation. Baltimore, MD: John Hopkins Press for Resources for the Future.

Creel, Michael; Loomis, John. 1990. Theoretical and empirical advantages of truncated count data estimators for analysis of deer hunting in California. American Journal of Agricultural Economics. **72:434-445.**

Deaton, A.; Muelbauer, J. 1980. Economics and consumer behavior. New York: Cambridge University Press.

Freeman, **Myrick.** 1979. The benefits of environmental improvements. Baltimore, MD: John Hopkins University Press.

Gourieroux, C.; Monfort, A.; Trognon, A. 1984. Pseudo maximum likelihood methods: Applications. Econometrica. **52:701-720.**

Grogger, J.T.; Carson, R.T. 1988. Models for counts from choice based samples. Working paper, University of California Department of Economics.

Hall, **Bronwyn;** Hausman, Jerry; Griliches, Zvi. 1986. Patents and R & D: Is there a lag. International Economics Review. **27:265-282.**

Hellerstein, Daniel. 1991. Using count data models in travel cost analysis with aggregate data. American Journal of Agricultural Economics, in press.

Hueth, Darrell; Strong, Elizabeth. 1984. A critical review of the travel cost, hedonic travel cost, and household production models for measurement of quality changes in recreational experiences. Northeast Journal of Agricultural and Resource Economics. **13:187-198.**

Maddala, G.S. 1983. Limited-dependent and qualitative variables in econometrics. Cambridge: Cambridge University Press.

Mendelsohn, Robert. 1987. Modeling the demand for outdoor recreation. Water Resources Research. **23:961-967.**

Mendelsohn, Robert; Brown, Gardner. 1983. Revealed preference approaches to valuing outdoor recreation. Natural Resources Journal. **23:607-618.**

Mullahy, John. 1986. Specification and testing of some modified count data models. Journal of Econometrics. **33:341-365.**

Nelson, F.D. 1981. A test for misspecification in the censored-normal model. Econometrica. **49:1317-1329.**

Pudney, Stephen. 1989. Modeling individual choice: The econometrics of corners, kinks, and holes. Oxford: Basil Blackwell Ltd.

Shaw, Daigee. 1988. On-site samples' regression: Problems of non-negative integers, truncation, and endogenous stratification. Journal of Econometrics. **37:211-223.**

Smith, V. Kerry. 1988. Selection and recreation demand. American Journal of Agricultural Economics. **70:29-36.**

Stapleton, D.C.; Young, DJ. 1984. Censored normal regression with measurement error on the dependent variable. Econometrica. **52:737-760.**

Stynes, Daniel; Peterson, George; Rosenthal, Donald. 1986. Log transformation bias in estimating travel cost models. Land Economics. **62:94-103.**

NOTES:

Average $(\beta_p - b_p)^2$	The mean square error (MSE) of the price coefficient, with β_p the true coefficient, and b_p the predicted coefficient. **Small** values **signify** good fits.
Average $(\beta_p - b_p)/s_p$	The average distance between true and predicted price coefficient, normalized using the predicted standard error of the price coefficient (s_p). This is akin to a t-stat, except β is used instead of zero. **Small** values signify good fits.
Average **ABS($\Sigma E[CS_n]$ - $\Sigma E[cs_n]$)**	The average difference between the "true" and the "predicted" values of expected consumer surplus, aggregated over population, where the expected **value** of consumer surplus for individual i equals $-\lambda_n/\beta$. For **$E[CS_n]$**, $\lambda_n = \exp(X_n\beta + \epsilon_n)$; for $E[cs_n]$, $\lambda_n = \exp(X_n b)$. **Small** values signify good fits.

$\Sigma E[CS]$, the "true" expected **value** of aggregated consumer surplus, uses $\lambda_n = \exp(X_n\beta + \epsilon)$. Note that each observation is generated via a random draw from a Poisson distribution, with λ_n remaining the same across replications. In other words, **all** that changes across replications is observed demand, neither X_n nor ϵ_n changes across replications (although they do vary across each $n = 1,..,N$ individuals).

Value of β, for **all** simulations = $\{\beta_0 = 1.3, \beta_p = -0.04, \beta_I = 8e\text{-}06\}$.

FIGURE I: OLS PREDICTED VALUES UNDER CENSORING, ETC.

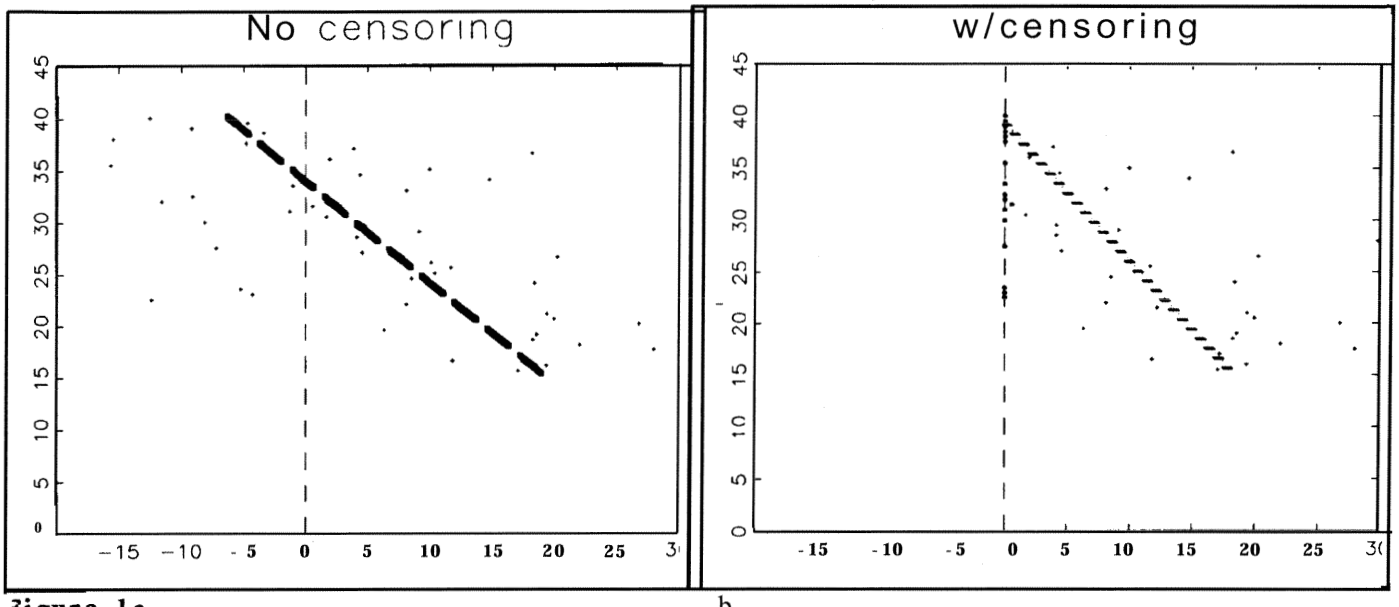


Figure 1a. b.

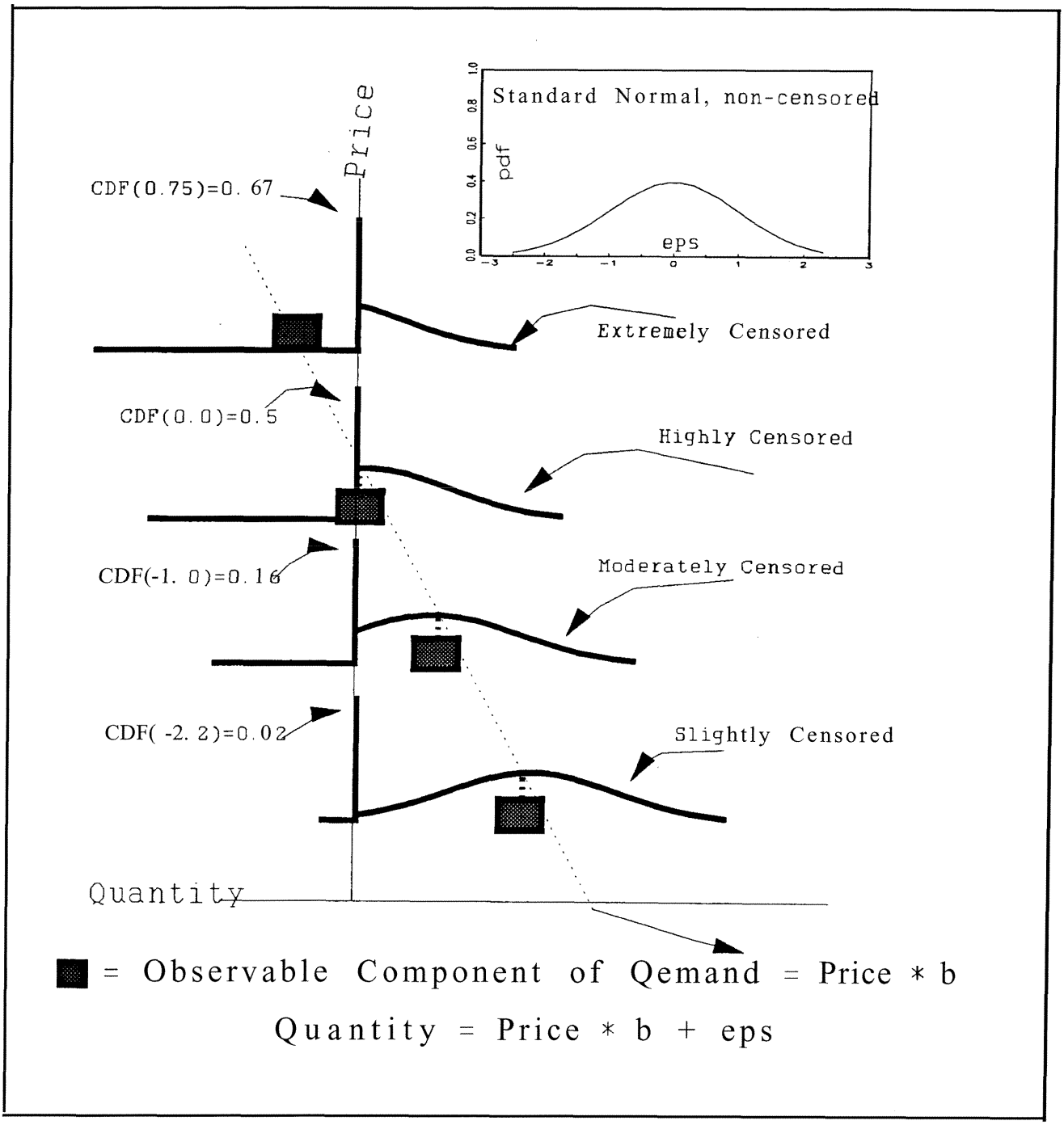
1c. 1d.

NOTES: $Q = \beta_0 + \beta_1 P + \epsilon$

	β_0	β_1
True	35	**-1.0**
OLS ESTIMATES		
Non-censored	35.7	**-1.**04
Censored	29.4	-0 73
Truncated	24.8	-0 49
Truncated **& endog.** stratification	27.5	-0 **48**

OLS estimates are used for all data sets; estimators that exp**licitly** control for truncation, etc., are **not** used.

FIGURE II: DEMAND WITH CENSORED NORMAL RANDOM TERM



Notes:

Cross-hatched boxes represent the observable component of demand. The curves depict censored normal probability density function for the random term associated with each observable component of demand. These distributions are correlated with the observable component of demand in such a way that Quantity (which equals the observable component plus the random component) is always greater than or equal to 0. Note that "highly" censored distributions have a large probability mass at a value **s.t.**

Q = **Observable_Component** + Random-Term = 0.

FIGURE III: POISSON PROBABILITIES

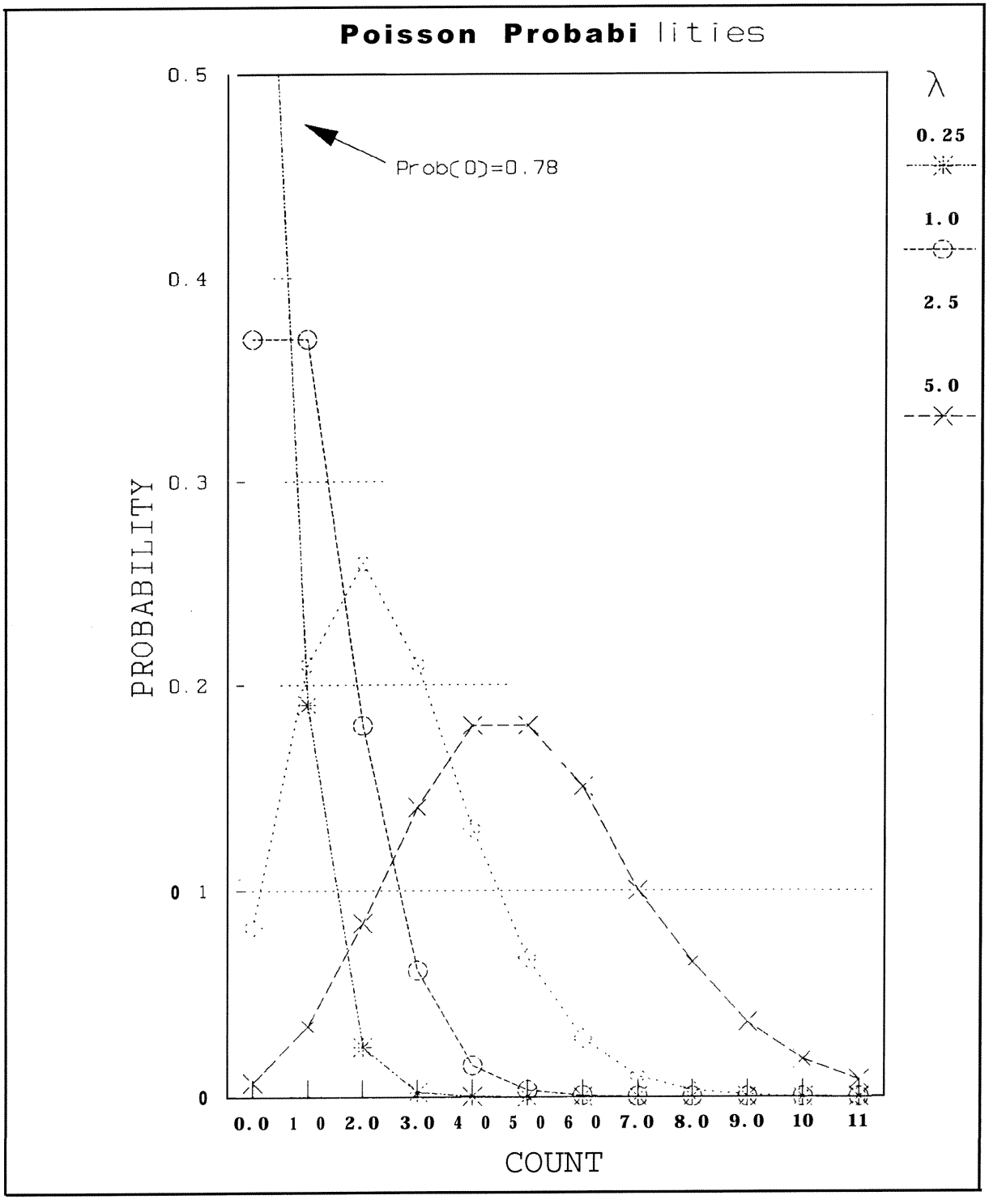
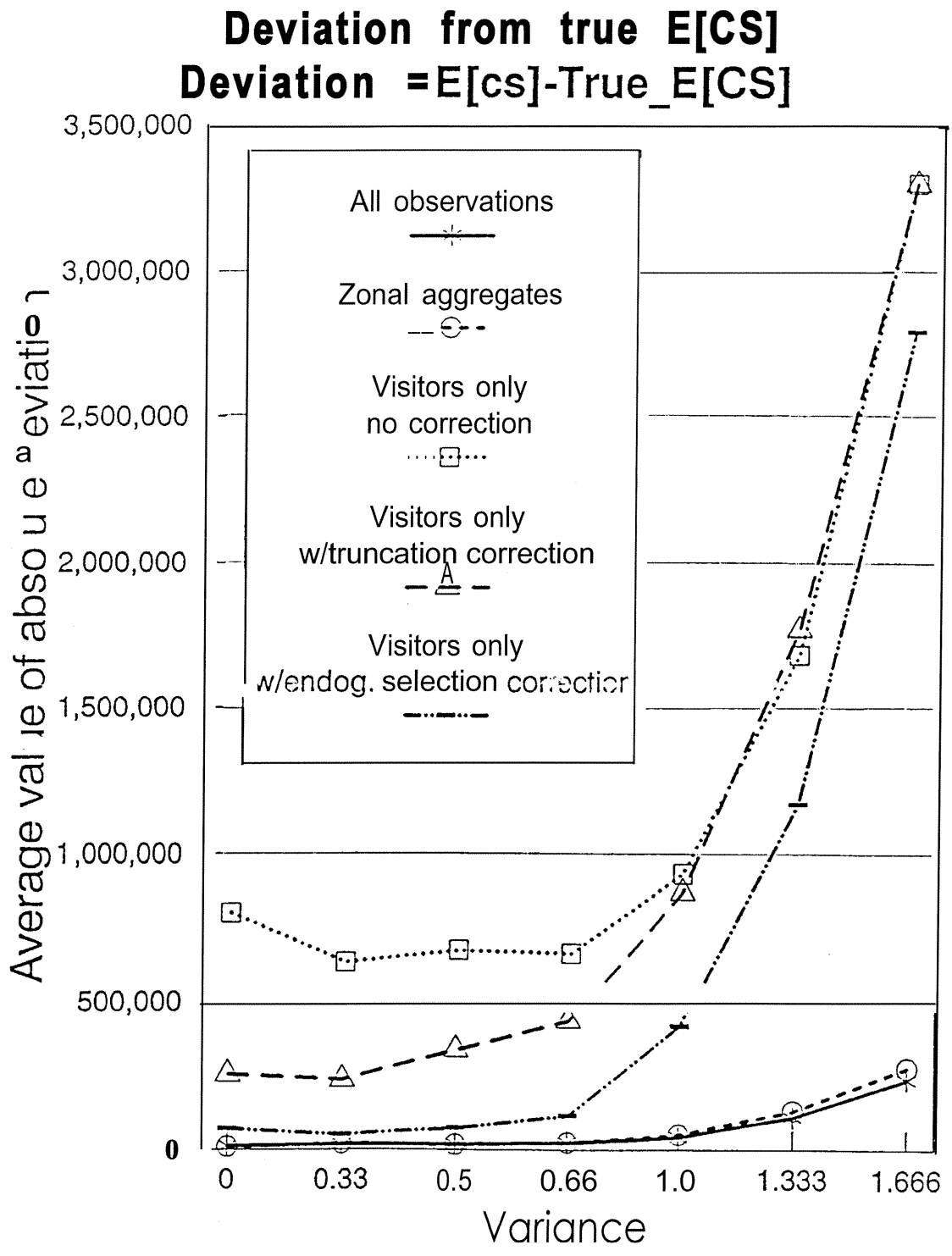


FIGURE IV. DEVIATION FROM TRUEE[CS]



E[cs] = exp(Xb)/-b (b=estimted ß)
True_E[CS] = exp(Xß + ϵ)/-ß

ENDNOTES

1. For surveys of the travel cost literature, see **Mendelsohn,** 1987; **Mendelsohn** and Brown, 1983; or Hueth and Strong, 1984.

2. In comparison, Ordinary Least Squares (when it's applicable) is consistent, regardless of the correctness of assumptions concerning the random term.

3. For an example, see Creel and Loomis, 1990. Note that unbiased prediction using any semi-log model requires correcting for the bias due to the asymmetric effect, on the assumed **lognormal** multiplicative error term, of taking logs (Stynes et. **al.,** 1986).

4. For both truncated estimators, the consistency under misspecification has not been thoroughly explored. See **Grogger** and Carson (1988) for a discussion of truncation in the Negative Binomial case.

5. In a sense, non-visitors are controlled for by using the population of the zone when constructing the dependent variable. In other words, when there are many non-visitors, per-capita visitation rates **will** be **small.**

6. Note that this is a standard formula for E[CS] from the semi-log model of demand. Alternatively, one **could** use observed demand, rather then the expected **value** of demand, as the numerator (see Bockstael et. **al.,** 1990). Here we focus on E[CS], partially for convenience, and partially in recognition of many cases in which E[CS] is the desired quantity (e.g., when behavior is best described within a random utility framework). See **Hellerstein** (1991) for further discussion of issues surrounding consumer surplus calculations in conjunction with count models.

Table 1a: Results from Simulation, using Poisson Count Models

Using equal size, randomly spaced zones. $\Sigma E[CS] = 123{,}00$

MODEL. # iterations:25 # obs: 10,000 # zones: 50 $E[\epsilon^2]$: 1.0 Average λ: 0.49 Average $e^{x\beta}$:0.29	Using All Observations	Using Zonal Aggregates	Using 10% Sample of Visitors	Using 10% Sample, with Truncation Correction	Using 10% Sample, with Endogenous Selection Correction
Average $(\beta_p - b_p)^2$	0.42	0.26	1.2	1.7	1.6
Average $(\beta_p - b_p)/s_p$	17	6.7	16	31	16
Average $ABS(\Sigma CS_n - \Sigma cs_n)$	4422	2552	673,600	379,400	172,200

Table lb: Results from Simulation, using Poisson Count Models

Using equal size, randomly spaced zones. $\Sigma E[CS] = 105{,}600$

MODEL. # iterations: 50 # obs: 2,500 # zones: 25 $E[\epsilon^2]$: 1.8 Average λ: 1.7 Average $e^{x\beta}$:0.35	Using All Observations	Using Zonal Aggregates	Using 10% Sample of Visitors	Using 10% Sample, with Truncation Correction	Using 10% Sample, with Endogenous Selection Correction
Average $(\beta_p - b_p)^2$	1.65	2.8	3.2	2.8	3.1
Average $(\beta_p - b_p)/s_p$	27	16	30	164	29
Average $ABS(\Sigma CS_n - \Sigma cs_n)$	2602	5923	918,300	1,278,000	727,900

Table lc: Results from Simulation, using Poisson Count Models

Using randomly dispersed population, zones of equal ring width.

$\Sigma E[CS] = 33{,}000$

MODEL. # iterations:50 # obs: 2,500 # zones: 25 $E[\epsilon^2]$: 0 Average λ: 0.53 Average $e^{x\beta}$:0.53	Using All Observations	Using Zonal Aggregates	Using 10% Sample of Visitors	Using 10% Sample, with Truncation Correction	Using 10% Sample, with Endogenous Selection Correction
Average $(\beta_p - b_p)^2$	0.003	0.017	0.012	0.075	0.043
Average $(\beta_p - b_p)/s_p$	0.71	0.86	0.58	1.0	0.77
Average $ABS(\Sigma CS_n - \Sigma cs_n)$	986	1293	155,400	25,960	6223

Part II. Economic Methods and Techniques

VALUATION OF EASTERN WILDERNESS: EXTRAMARKET MEASURES OF PUBLIC SUPPORT

A. Gilbert, R Glass, and T. More*

ABSTRACT

A dichotomous choice form of contingent valuation was used to quantify user and nonuser values of Eastern wilderness. Data were obtained from a random mail survey of 2,000 individuals living in two concentric zones around Lye Brook wilderness Area in southwestern Vermont. Separate survey instruments were used. The instrument used for the 0 to 25 mile zone requested value information on Lye Brook Wilderness Area. The instrument used in the 25 to 75 mile zone requested value information on Eastern wilderness. The discrete (yes-no) responses to randomly selected contributions to hypothetical trust funds to fund Lye Brook and Eastern wilderness were converted to maximum willingness-to-pay (MWTP) values using a Logit model. Respondents were also asked to list their MWTP into these trust funds. Tobit analysis was used on these data to estimate the parameters of the regression model because the dependent variable was normal but truncated to the left of zero.

Existence and use values were determined by asking respondents to allocate their MWTP among future use, option, preservation, bequest, and altruism values. Additional insight on wilderness values was obtained from respondent preferences for alternative funding schemes (Federal taxes, Federal lottery, user fees, etc.) for wilderness protection and management.

Results of the Logit analysis (dichotomous choice) showed very little difference in median willingness-to-pay to support Lye Brook and Eastern wilderness ($9.04 vs. $10.42, annually). Separate Logit regressions of past users and nonusers in each zone show that respondents from the 25 to 75 mile zone who visited an Eastern wilderness in the past were willing to pay 123 percent more than those who had never visited an Eastern wilderness area (median value of $14.28 vs. $6.40). Median willingness-to-pay values for Lye Brook (0-25 mile zone) for past visitors and non-visitors was $9.71 and $8.64, respectively.

The distribution of MWTP among existence and use values was very similar for the Lye Brook and Eastern wilderness zones and among user and nonuser groups within zones. Percentage distributions ranged from 30 percent allocated to bequest values to 13 percent for actual future use of the area(s).

These findings suggest that people living in the study area place a high annual value on Eastern wilderness ($9 to $21 per respondent) and attribute approximately 85 percent of the derived value to nonuse existence benefits.

INTRODUCTION

When people hear the word "wilderness," many envision vast, virgin forests, alpine meadows, and majestic snow-capped mountains. Wilderness enthusiasts might extend this vision with thoughts of past wilderness forays in remote Western wilderness areas with historically colorful names like the Bridger, the Bob Marshall, and the Teton. Few people, we suspect, envision relatively small, second growth forests with attractive, but only regionally significant, features (waterfalls, rock outcrops, etc.) and names like Lye Brook, Bristol Cliffs, and George D. Aiken. These latter areas typify Eastern wilderness areas.

Eastern wilderness areas have existed in a de facto sense for hundreds of years but the formal designation of Eastern wilderness is relatively new. Yet, because the concept of wilderness in the east, where human presence has been more obvious, differs from the larger, more remote, less impacted wilderness of the West, the criteria for wilderness designation **differs** between these regions. Western areas are judged by criteria set forth in the Wilderness Act of 1964 (unnoticeable human impact, at least 5,000 acres..., etc.). In contrast, the Eastern Wilderness Act allows for the inclusion of smaller tracts with obvious intrusions by people **(Hendee** et al. 1977). Although the criteria for designation is different, it is not clear if

* A. Gilbert is an Associate Professor of Resource Economics in the Department of Agricultural and Resource Economics, University of Vermont, Burlington. R. Glass and T. More are, respectively, Research Economist and Social Scientist, Northeastern Forest Experiment Station, USDA Forest Service, Burlington, Vermont.

the underlying value systems that manifest themselves in demand for wilderness differ significantly between these regions.

Do people value Eastern wilderness less because they are smaller, less spectacular, and less well known than Western wilderness areas? Conversely, do they value Eastern wilderness areas more because they are more accessible to more people and at a lower cost? Do Eastern wilderness areas generate nonuser values comparable to those reported in studies of Western wilderness? This study attempted to answer these questions by surveying a randomly selected population of people living within 75 miles of the Green Mountain National Forest (GMNF). This area included the southern two-thirds of Vermont, parts of east-central New York, northwest Massachusetts, and southwest New Hampshire. This area was selected for two principal reasons. First, a limited research budget necessitated maximizing the effectiveness of our research effort by selecting a population with a high probability of wilderness awareness. The existence of six wilderness areas within the study area enhanced wilderness awareness, which we felt was important to the valuation process. People with some knowledge of Eastern wilderness (know it exists, visited an area, etc.) should be more willing and able to respond to questions concerning user and nonuser values of wilderness.

Second, the rapid growth in population and development in the study area prior to the current recession greatly increased the demand for a variety of wildland uses. It also increased opportunity costs for the designation of resources into limited use categories. GMNF officials felt that information on the user and nonuser values of people living in the study area was vital to future wilderness planning on the Forest.

METHODS

This study used both dichotomous choice and open-ended forms of contingent valuation to quantify user and nonuser values of Eastern wilderness. The open-ended form was included for value comparison purposes. Both techniques measure maximum willingness-to-pay and require that the resource being valued, and the hypothetical market for trading the resource, be clearly described to the respondent.

The dichotomous choice technique - first used by Bishop and Heberlein (1979), and more recently by Boyle and Bishop (1988), Bowker and Stoll (1988), and McCollum, Gilbert and Peterson (1990) - closely simulates normal market procedure. The respondent is quoted a specific value or "price" for the resource and is then given the opportunity to "take it or leave it." The "yes" or "no" responses of respondents to one of a range of "prices" are recorded for subsequent statistical analysis (Loomis, 1988). This method is generally favored over other forms of contingent valuation because it does not require the respondent to precisely estimate his/her maximum willingness-to-pay for the resource. The respondent only needs to decide whether to accept or reject the stated offer. Boyle and Bishop (1988) discuss two related weaknesses. First, the analysis of qualitative, "yes-no" responses to valuation questions require more sophisticated statistical procedures than are required to analyze open-ended responses. Second, the qualitative responses provide less information on respondents' actual values than do open-ended questions because only the respondents' reaction to a specific price is known.

This latter weakness prompted us to supplement the dichotomous choice technique with the open-ended form of contingent valuation in which respondents list their maximum willingness-to-pay. Some of the strengths and weaknesses of this technique were indirectly addressed in the above discussion.

The data for this study were obtained from a 1990 mail survey to heads of households living in a 75-mile zone around Lye Brook Wilderness Area in southwest Vermont. The study area was divided into two concentric zones of zero to 25 and 26 to 75 miles. Zone-specific questionnaires were mailed to 1,000 individuals in each zone. A second questionnaire was mailed to nonrespondents two weeks after the initial mailing. The usable response from the near and distant zones was 35 percent and 27 percent, respectively. Financial limitations prevented us from validating differences between respondents and nonrespondents. The selected individuals in each zone were sent similar questionnaires containing a brief statement on the purpose of the study, a brief description of the two types of wilderness designations, and a series of questions on knowledge, use attitudes, perceptions, and values of Eastern wilderness. The two questionnaires were structurally identical except for the specific wilderness being valued. The inner zone questionnaire requested value information on Lye Brook Wilderness Area specifically, while the outer zone questionnaire focused on Eastern wilderness, i.e., all designated wilderness areas east of the Mississippi River. The "value" sections of the questionnaire consisted of: 1) a dichotomous choice question, 2) an open-ended contingent value question, 3) a checklist of reasons that a respondent could use to explain a zero willingness-to-pay response, and 4) a question that asked respondents to allocate their maximum

willingness-to-pay among five use and **nonuse** value categories.

The dichotomous choice and open-ended questions were prefaced by the following statement:

> **If Federal budget cuts eliminated all funding for (Lye Brook Wilderness Area/Eastern Wilderness Areas) and the only way to continue (its/their) protection and management would be to ask individuals to contribute to a special (Lye Brook Wilderness/Eastern Wilderness) trust fund ....**

The respondents were asked if they would pay a specified amount annually into this fund. The payments ranged from $2 to $500 in front-loaded unequal increments. This was followed by an **open-ended** contingent value question that asked the respondents to list the maximum amount they would pay into the fund annually. If the response was zero, they were asked to check (or write in) reasons for not being williig to pay into this fund. Respondents who were willing to pay into the fund were asked to allocate their maximum willingness-to-pay on a percentage basis among the following reasons:

1. So I can actually visit (Lye Brook/an Eastern wilderness area) this year or next year.
2. To retain the opportunity (option) to visit (Lye Brook/an Eastern wilderness area) in the future.
3. To protect (Lye Brook/an Eastern wilderness area) for future generations.
4. Just for the pleasure of knowing (Lye Brook/an Eastern wilderness area) exists, even though I have no plans to visit it personally.
5. To save (Lye Brook/an Eastern wilderness area) so that others can use it.

This allocation request was designed to produce estimates of respondents' willingness-to-pay into a wilderness fund to insure actual near-term use value of wilderness and several **nonuse** benefits commonly referred to as preservation values. These values were first discussed by Weisbrod (1964) and Krutilla **(1967),** and later applied to improved water quality (Walsh et al., **1978),** wildlife resources (Brook&ire, Eubanks, and Randall, **1983),** and wilderness (Walsh, Loomis, and **Gilman,** 1984). Preservation values include: 1) option value - willingness-to-pay for the "option" of possible future use of wilderness, 2) bequest value - **willingness-to-pay** for the satisfaction of providing a wilderness legacy for future generations, 3) existence value - willingness-to-pay just to know it exists even if I could not use it, and 4) altruistic value - willingness-to-pay so that others can use wilderness.

Statistical Analysis

The dichotomous choice responses were analyzed with a **Logit** model, which was used to derive the maximum willingness-to-pay estimates from the requested payments into the wilderness fund and the respondents' dichotomous (yes or no) responses to them. The model estimates the log odds (which is the log of P over 1-P where P is the **probability** of a positive response) as a function of the requested payment, allowing us to calculate the payment at which 50 percent of the respondents would respond positively. This payment is an estimate of the maximum amount at least half of the people would be willing to pay into the wilderness **fund** to achieve a positive change in utility (or accept as compensation for a negative change in utility). The conceptual and theoretical justification for using this technique is discussed by Hanemann (1984) and a simplified explanation and application of the technique is provided by Loomis (1988).

A regression model devised by **Tobin (1958), Tobit** analysis, was used to relate maximum **willingness-to-pay** of individuals who responded to the open-ended contingent value questions to their socioeconomic characteristics. This model was used because it is effective in dealing with censored data. Since there is no way for an individual to pay less than zero into the wilderness fund, the dependent variable has a number of its values clustered at zero. If a conventional linear regression model was used to estimate the coefficients, the predicted values could be negative for a few individuals, which is, obviously, not possible. **Tobit** analysis takes this censoring into account. It uses all of the observations, those at zero and those greater than zero, to estimate a regression line. An improved mathematical formulation of **Tobin's** model is provided by Amemiya (1973) and McDonald and **Moffitt** (1979).

An inherent limitation of **Tobit** analysis is the absence of an R-square value to provide information on the percent of variance. It is, therefore, difficult to quantify how well the model fits the data. McDonald and Moffitt (1979) suggest a way to extract more information from the coefficients. They show how **Tobit** can be used to determine changes in the probability of being above zero (receiving a positive response) and changes in the magnitude of the dependent variable if it is already above zero.

Preservation values were estimated by allocating the mean willingness-to-pay value from the **Tobit** analysis by the respondents' mean percentage distribution of this value among preservation categories (option, bequest, existence, and altruistic).

RESULTS

The estimated **Logit** models for six subgroups of respondents are presented in Table 1. Models were estimated using maximum likelihood procedures in SAS **Proc** Logistic. All the estimated coefficients are significantly different from zero and the offer variables have the expected sign. The &i-squared statistics show that the offer variables are highly significant in explaining the **variability** in the response variable. These data indicated that if we increase the log amount of the requested payment into the wilderness fund by $1, the expected log odd of responding positively will decrease by the amount of the appropriate offer variable.

The "proportion of correct predictors" variable is a measure of goodness of fit. It is derived by using the positive and negative responses to the original payment requests to estimate the probability of a positive response to increases in the requested payment. If the probability of paying is greater than 0.5, it is assumed the person will pay; and if it is less than 0.5, the person will not pay. The predicted and observed responses are observed and the proportion of correct predictors is calculated. Figure 1 is the plot of observed and predicted responses of the Lye Brook respondents who visited Eastern wilderness.

Table 2 lists the median values for the models presented in Table 1. These values represent the maximum amount members of the various subgroups would be willing to pay annually into a special Lye Brook/Eastern wilderness fund if Federal budget cuts eliminated all funding for Lye Brook/Eastern wilderness. The median value - the amount that 50 percent of the respondents would be willing to pay - was suggested as the appropriate measure by Hanemann (1984) to reduce the effects of outliers and extreme values.

The median values show that respondents who visited an Eastern wilderness area in the past were willing to pay more than those who had never visited an Eastern wilderness area. The difference is most pronounced for the 26 to 75 mile zone ($14.28 vs. **$6.40),** where respondents' contributions would be used to protect and manage all Eastern wilderness. This 123 percent difference in median willingness-to-pay suggests that a renewed effort to acquaint people with Eastern wilderness may increase the value of this resource.

The importance of past visits to Eastern wilderness to willingness-to-pay is also evident when the Lye Brook and Eastern wilderness zones are compared. Respondents from the 26 to 75 mile zone were willing to pay 46 percent more into the fund for Eastern wilderness ($14.28 vs. $9.71) than the 0 to 25 mile zone respondents were willing to pay into the Lye Brook wilderness fund. This result is expected since payment to all Eastern wilderness is being compared with payment to a single area. When the values of all respondents in each zone are compared, the difference is less pronounced. The difference in **willingness-to-pay** between the distant and near zones is only $1.38 ($10.42 vs. $9.04). This effect is likely caused by a greater respondent familiarity with Lye Brook Wilderness Area and the fact that they were not asked if they would also contribute to an Eastern wilderness fund.

Tobit Analysis

Tobit analysis produced mean willingness-to-pay values from responses to the open-ended, contingent value question that requested maximum willingness-to-pay into the wilderness fund. Tables 3 and 4 present the maximum likelihood estimates for the Lye Brook (0 to 25 miles) and the Eastern wilderness (26 to 75 miles) zones. Models were estimated in LIMDEP (Greene, **1986)** by maximum likelihood using Newton's method.

The probability estimates (Prob $t \geq x$) show which coefficients had a significantly different-from-zero effect on the amount respondents would be willing to pay. Table 3 shows that respondents from the Lye Brook zone who 1) belonged to an environmental organization, 2) expected to visit one of the (other than Lye Brook) live Vermont wilderness areas, and 3) supported public donations to fund wilderness, were willing to pay more into the Lye Brook wilderness fund than respondents who did not have these characteristics. The significant variables for the Eastern wilderness zone (Table 4) were 1) belonging to an environmental organization, 2) person's sex, 3) person's age, 4) having one or more years of college, 5) expecting to visit one of the other live Vermont wilderness areas, 6) supporting user fees to fund wilderness, and **7)** supporting public donations to fund wilderness. The sex and college variables indicate that male and college educated respondents are willing to pay more into the fund, and the negative coefficient for age suggests that older respondents would pay less.

Since the estimates only show which variables are significantly different from zero, and not the actual probability of the event, the analysis was extended through the decomposition procedure described by McDonald and **Moffitt** (1979). This procedure, in essence, breaks the coefficients into two parts, one that affects the probability of paying into the wilderness fund and one that affects the magnitude of the amount paid by those who are already paying something.

Tables 5 and 6 show the decomposition effects: 1) the expected change in y for every change in x if y is already positive (dEy^*/dx_i); and 2) the expected change in the probability of a positive response in y for a change in x ($dF(z)/dx = f(z)Xbi/\sigma$. The normal coefficient is a normalized coefficient derived by dividing the beta coefficient by sigma. The beta coefficient is obtained from **Tobit.** It measures the change in the magnitude of the dependent variable for responses above zero.

The $dF(z)/dx = f(z)XBi/\sigma$ value is the increased probability of paying into the wilderness fund by respondents already contributing to the fund who exhibit the significant variable. For example, Table 5 shows that the **probability** of paying an additional amount in the Lye Brook wilderness fund is **.14** greater for a respondent who belongs to an environmental organization that it is for a respondent who does not belong to such an organization. The Lye Brook data also show that males, respondents who expect to visit other Eastern wilderness areas, and respondents who support public donations to fund wilderness, have a greater **probability** of paying than respondents who do not exhibit these characteristics. Respondents from the Eastern wilderness zone displayed three additional characteristics (Table 6). College-educated respondents had a greater probability of paying additional amounts into the Eastern wilderness fund **(.15);** older respondents and those who supported the use of user fees to fund wilderness had lower probabilities of paying additional amounts into the fund **(-.01** and **-.15,** respectively).

The dEy^*/dx_i value in Tables 5 and 6 are the log scale amounts that will be paid into the wilderness fund by respondents already contributing to the fund who exhibit the significant variable. For example, a respondent from the Lye Brook zone who belongs to an environmental organization is predicted to pay **.53** on the log scale more than a respondent who does not belong but was the same in every other respect (Table 5). The log scale values for the remaining significant Lye Brook and Eastern wilderness zone variables show that all were positive except age and support of user fees to fund wilderness (Tables 5 and 6). Older respondents and those supporting the use of user fees to fund wilderness were predicted to pay less on the log scale into the wilderness fund than respondents who did not exhibit those characteristics.

The mean willingness-to-pay values were derived from the decomposition of the **Tobit** coefficients evaluated at the mean or mode for the independent variables. These means for respondents from the Lye Brook and Eastern wilderness zones are presented, along with the median values from the **Logit** (dichotomous choice) analysis, in Table 7. The mean values estimated using **Tobit** were less than the median values from the **Logit** analysis. This result was unexpected because, **unlike** the median values, mean values include outliers and extreme values. The mean, therefore, should be larger than the median, assuming all other things were equal. This was clearly not the case since two distinct contingent value approaches were used to estimate the values.

Use **and Preservation** Values

Use and preservation values are presented in Table 8. They were estimated by allocating the mean willingness-to-pay value from the **Tobit** analysis by the respondents' mean percentage distribution of this value among the use and preservation categories. These results show that preservation values constitute 87 percent of the Lye Brook and 84 percent of the Eastern wilderness respondents' total maximum willingness-to-pay into a wilderness fund dedicated to the protection and management of Lye Brook/Eastern wilderness.

The preservation value with the highest mean willingness-to-pay for both zones was the bequest value.

SUMMARY AND CONCLUSION

Dichotomous choice and open-ended contingent valuation procedures were used to estimate the general public's maximum willingness-to-pay for the protection and management of Eastern wilderness and Lye Brook Wilderness Area in southwest Vermont. Respondents were also asked to allocate their maximum **willingness-**to-pay between use and preservation values. **Logit** and **Tobit** regression models were used to estimate median and mean annual economic values for Lye Brook and Eastern wilderness. These values were then distributed on a respondent-generated percentage basis among use value and the four preservation values.

The estimated values show: 1) **Tobit** mean values were approximately 29 percent lower than the **Logit** median values; 2) estimated values for Eastern wilderness were 6 **(Tobit)** to 15 **(Logit)** percent higher than the values for Lye Brook; 3) Preservation values accounted for over 87 percent of the value attributed to Lye Brook and 84 percent of the value of Eastern wilderness; 4) people who visited an Eastern wilderness area in the past were willing to pay more, for wilderness protection than those who did not visit; and 5) willingness-to-pay was positively correlated to membership in an environmental organization, college education, plans to visit an Eastern wilderness area, and support for public donations to fund wilderness. It

was negatively correlated to increasing age and support of user fees to fund wilderness.

Study results show that respondents from both the Lye Brook and Eastern wilderness zones place higher values on the preservation of wilderness than they do on actual future use. This was even observed among respondents who previously visited an Eastern wilderness area. This has important policy implications because it counters the often heard claim, by opponents of additional wilderness designation, that wilderness only benefits those who have the physical stamina to experience it (Nash, 1982). For example, the annual preservation and use values of Eastern wilderness for only those households within the 26 to 75 mile zone (using the median values from the Logit analyses) is $5,718,430 and $ 1,073,055, respectively. If these values were expanded to include the 19 million households in the Northeast (U.S. Dept. of Commerce, 1990), the preservation values alone would exceed $167,000,000.

Since this study was confined to a 17,672 square mile area, centered in southern Vermont, that contains six Federally designated wilderness areas, it would be presumptuous to suggest that the derived preservation and use values represent values held by the rest of the Eastern population. Nevertheless, the results were consistent with findings observed by Walsh et al. in a 1984 study of wilderness values in Colorado (preservation values were higher than use values, and among its components, bequest and existence values, respectively, were highest), suggesting that our results may have a more universal application.

Additional research, involving a broader segment of the population, is necessary to test these fmdings and produce additional estimates of the preservation and use values of Eastern wilderness. We may find that Eastern wilderness designation was the right decision.

REFERENCES

Bowker, J.M.; Stoll, John R. 1988. Use of dichotomous choice nonmarket methods to value the whooping crane resource. American Journal of Agricultural Economics. 70(4):372-381.

Boyle, Kevin J.; Bishop, Richard C. 1988. Welfare measurements using contingent valuation: A comparison of techniques. American Journal of Agricultural Economics. 70(1):20-28.

Brook&ire, D.S.; Eubanks, L.S.; Randall, A. 1983. Estimating option prices and existence values for wildlife resources. Land Economics. 59:1-15.

Greene, W.H. 1986. LIMDEP, Version 4.2. Wiiam H. Greene, 517 12th St., Brooklyn, N.Y. 11215.

Hanemann, W. Michael. 1984. Welfare evaluations in contingent valuation experiments with discrete responses. American Journal of Agricultural Economics. 66:332-341.

Hendee, John C.; Stankey, George H.; Lucas, Robert C. 1977. Wilderness management. Misc. Pub. No. 1365. USDA Forest Service.

Krutilla, John V. 1967. Conservation reconsidered. American Economic Review. 57(Sept.):777-786.

Loomis, John B. 1988. Contingent valuation using dichotomous choice models. Journal of Leisure Research. 20:46-56.

McCollum, Daniel W.; Gilbert, Alphonse H.; Peterson, George L. 1990. The net economic value of day use cross country skiing in Vermont: A dichotomous choice contingent valuation approach. Journal of Leisure Research. 22(4):341-352.

McDonald, John F.; Moffitt, Robert A. 1980. The uses of Tobit analysis. The Review of Economics and Statistics. LXII(2):318-321.

Nash, Roderick. 1982. Wilderness and the American mind. 3rd ed. Yale University Press.

Statistical Abstract of the United States. 1990. National Data Book. 110th ed. U.S. Dept. of Commerce. Bureau of the Census.

Tobin, James. 1958. Estimation of relationships for limited dependent variables. Econometrica. 26:24-36.

Walsh, Richard G.; Greenley, Douglas A,; Young, Robert A.; McKean, John R.; Prato, Anthony A. 1978. Option values, preservation values, and recreational benefits of improved water quality. Socioeconomic Environmental Studies Series. EPA-600/5-78-001.

Walsh, Richard G.; Loomis, John B.; Gillman, Richard S. 1984. Valuing option, existence, and bequest demands for wilderness. Land Economics. 60:14-29.

Weisbrod, Burton. 1964. Collective-consumption services of individual-consumption goods. Quarterly Journal of Economics. 78(Aug.):471-477.

Table 1. Logit models for subgroups of the Lye Brook and Eastern wilderness respondents.

Zone and Condition	Constant	Offer	Chi-Squared[1]	Correct[2] prediction	n
Lye Brook Data					
All respondents	2.4147	-1.0970	72.75	80.0	260
Visited Eastern wilderness	2.2138	-0.9739	34.96	73.3	150
Never visited Eastern wilderness	2.8654	-1.3290	36.92	84.0	100
Eastern Wilderness Data					
All respondents	2.2116	-0.9436	49.86	80.5	195
Visited Eastern wilderness	2.7326	-1.0276	32.39	80.6	108
Never visited Eastern wilderness	1.7430	-0.9388	16.47	82.1	78

1 Chi-squared is the statistic testing the hypothesis that all slope coefficents equal zero. It is defined as -2 times the difference in log likelihood in both cases.

2 Correct prediction is the proportion of correct predictions made by the estimated model, compared with the original data.

Table 2. Annual median **Logit** values for subgroups of Lye Brook and Eastern wilderness respondents.

Zone	Median Values		
	All respondents	Respondents who visited an Eastern wilderness area	Respondents who never visited an Eastern wilderness area
Lye Brook wilderness	**$** 9.04	$ 9.71	**$** 8.64
Eastern wilderness	$10.42	$14.28	**$** 6.40

Table 3. Tobit coefficients for Lye Brook.

Variable*	Coefficient	Standard Error	Prob|t|≥x
ONE	-5.13780	1.53463	.00081
ORGAN	1.08347	.500441	. 03038
SEX	.892282	.551242	. 10552
AGE	.217146E-01	.167475E-01	. 19477
COLLEGE	.263340	. 581998	. 65093
AWARE	.691416	. 882495	.43335
VISITLYE	- .974556E-01	.610927	.87326
VISITO	- .492488	. 605933	. 41635
VISITE	- .633647	. 577473	.27252
VISITW	.700146	.563155	.21377
EXPL	- .767372	.836096	. 35872
EXPO	1.92456	. 857599	. 02482
EXPE	.952017	.755521	. 20764
EXPW	- .909957E-01	.708372	.89779
FUND8A	- .456408	. 629259	.46826
FUND8B	- .445155	. 565049	.43080
FUND8C	.541784	. 532154	. 30863
FUND8D	. 317619	.530473	. 54934
FUND8E	2.49387	.654817	. 00014
FUND8G	. 273351	.522881	. 60113
LNMAXAMT	2.67950	.228774	.00000

* ORGAN = Member of an envirowntal organization; AUARE ▫ Aware that there are 6 wilderness areas in Vermont; VISITLYE = Visited Lye Brook; VISITO = Visited other Vermont wilderness areas; VISITE = Visited other Eastern wilderness areas; VISITW = Visited Western wilderness areas; EXPL = Expect to visit Lye Brook; EXPO = Expect to visit other Vermont wilderness areas; EXPE = Expect to visit Eastern wilderness areas; EXPU = Expect to visit Western wilderness areas; FUND8A = Support Federal taxes to fund wilderness; FUND8B = Support voluntary contributions to fund wilderness; FUND8C = Support Federal lottery to fund wilderness; FUND8D = Support user fees to support wilderness; FUND8E = Support public donations to support wilderness; FUND8G = Support special tax on hunting and fishing equipment to fund wilderness.

Table 4. Tobit coefficients for Eastern wilderness.

Variable*	Coefficient	Standard Error	Prob| t|≥x
ONE	-3.41032	1.61070	.03423
MEMBER	1.32668	.524958	.01150
SEX	1.17518	.588635	.04588
AGE	- .354187E-01	.188790E-01	.06064
COLLEGE	1.12355	.668591	.09286
AWARE	- .500501	1.41449	.72346
VISITLYE	- .350931	.968374	.71706
VISITO	- .698751	.716395	.32938
VISITE	- .575571	.568282	.31114
VISITW	.311703	.563252	.57999
EXPL	- .710521	.797738	.37311
EXPO	3.72439	.917839	.00005
EXPE	.123355	.805480	.87828
EXPW	- .513890	.713367	.47130
FUND8A	- .266172	.682556	.69656
FUND8B	- .627292	.637307	.32497
FUND8C	.185098	.540234	.73188
FUND8D	-1.13541	.604355	.06028
FUND8E	3.47684	.752965	.00000
FUND8F	- .452002	.562025	.42126
FUND8G	2.31245	.212291	.00000

* MEMBER = Member of an environmental organization; AWARE = Aware that there are 6 wilderness areas in Vermont; VISITLYE = Visited Lye Brook; VISITO = Visited other Vermont wilderness areas; VISITE = Visited other Eastern wilderness areas; VISITW = Visited Western wilderness areas; EXPL = Expect to visit Lye Brook; EXPO = Expect to visit other Vermont wilderness areas; EXPE = Expect to visit Eastern wilderness areas; EXPU = Expect to visit Uestern wilderness areas; FUND8A = Support Federal taxes to fund wilderness; FUND8B = Support voluntary contributions to fund wilderness; FUND8C = Support Federal lottery to fund wilderness; FUND8D = Support user fees to support wilderness; FUND8E = Support public donations to support wilderness; FUND8G = Support special tax on hunting and fishing equipment to fund wilderness.

Table 5. Decomposition of Tobit effects on maximumwillingness to pay into the Lye Brook Wilderness Fund.

Variable	Normal Coefficient	Beta Coefficient	dEy*/dxi	dF(z)/dx=f(z)XBi/o
Member of an environmental organization	.4043553	1.08347	.534	.141
Sex	.3330032	.892282	.438	.116
Expect to visit other Eastern wilderness	.7182534	1.92456	.945	.251
Support public donations to a wilderness fund to fund wilderness	.9307221	2.49387	1.224	.325

Beta coefficient measures the change in the magnitude of the dependent variable for those above zero.

dEy*/dxi is the expected change in Y for every change in X if Y is already positive. This is the "conditional effect."

dF(z)/dx=f(z)Xbi/o is the expected change in the probability of a positive response of Y for a change in X.

Table 6. Decomposition of **Tobit** effects on maximumwillingness to pay into the Eastern **Wilderness** Fund.

Variable	Normal Coefficient	Beta Coefficient	dEy^*/dx_i	$dF(z)/dx=f(z)Bi/o$
Member of an environmental organization	.5737119	1.32668	.721	.178
Sex	.5081970	1.17518	.639	.158
Age	- .0153465	- .0354187	- .019	- .005
Col lege	.48587	1.12355	.611	.151
Expect to visit other Eastern wilderness	1.610582	3.72439	2.025	.501
Support user fees to fund wilderness	- .4909987	-1.13541	- .617	- .153
Support public donations to a wilderness fund to fund wilderness	1.503531	3.47684	1.890	.468

Beta coefficient measures the change in the magnitude of the dependent variable for those above zero.

dEy^*/dx_i is the expected change in Y for every change in X if Y is already positive. This is the "conditional effect."

$dF(z)/dx=f(z)Xbi/o$ is the expected change in the probability of a positive response of Y for a change in X.

Table 7. **Tobit** mean and **Logit** median values for Lye Brook and Eastern wilderness.

Zones	**Tobit** Mean	**Logit** Median
Lye Brook (O-25 miles)	$6.70	$9.04
Eastern Wilderness (26-75 miles)	$7.10	$10.42

Table 8. Mean use and preservation values for Lye Brook and Eastern wilderness.

Variable	Lye Brook		Eastern Wilderness	
	Percent of maximum willingness to pay	Maximum willingness to pay	Percent of maximum willingness to pay	Maximum willingness to pay
So I can actually visit Lye Brook/ Eastern wilderness this year or next	13.1	$ .88	15.8	$1.12
To retain the opportunity to visit Lye Brook/ Eastern wilderness in the future	16.9	$1.13	16.9	$1.20
Just for the pleasure of knowing Lye Brook/ Eastern wilderness exists, even though I have no plans to use it personally	20.1	$1.35	21.2	$1.51
To protect Lye Brook/ Eastern wilderness for future generations	29.6	$1.98	29.0	$2.06
To save Lye Brook/ Eastern wilderness so that others can use it	20.3	$1.36	17.1	$1.21
TOTAL	100.0	$6.70	100.0	$7.10

AIR QUALITY, WILLINGNESS TO PAY, AND WILDERNESS: A REVIEW OF METHODS, APPLICATIONS, AND IMPLICATIONS FOR WILDERNESS MANAGEMENT IN THE PACIFIC NORTHWEST

Kathleen A. Williams*

ABSTRACT

Under the Clean Air Act, certain wilderness areas and National Parks were classified as Class I areas, where only small increments of pollution above baseline levels are allowed. Federal land managers are responsible for protecting Air Quality Related Valu(AQRVs), including visibility,from adverse impacts. Economic analysis can be helpful in determining the relatiuse- and preservation-related values people hold for visibility protection, as well as what factors contribute to those values. Management can thereby be better tailored to reflect those values.

"CAA" AND THE ECONOMICS OF VISIBILITY

Passage of the Clean Air Act (CAA) Amendments of 1977 (P.L.9595) included initiation of a program for the prevention of significant deterioration in air quality. Five purposes were listed for this section of the Amendments, one being:
"to preserve, protect, and enhance the air quality in National Parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value . . ." (sec. 160).

Congress set up criteria for "Class I" protection areas (including all existing National Parks and national wilderness areas larger than 5,000 acres), and stated the following national goal:
"prevent . . . any future, and remedy ... any existing impairment of visibility in mandatory Class I Federal areas in which impairment results from manmade air pollution" (sec. 169A(a)(1)).

"Impairment of visibility" was defined as "reduction in visual range and atmosphere discoloration" (sec. 169A(6)).

The Amendments charged the Federal land manager with:
"an affirmative responsibility to protect the air quality related values (including visibility) of any such lands within a Class I area and to consider ... whether a proposed major emitting facility will have an adverse impact on such values" (sec. 165(d)(2)(B).

This "affirmative responsibility" is exercised through the Prevention of Significant Deterioration (PSD) program. Under this program, the Federal land manager (FLM) provides input on new or expanded industrial emitters that could adversely affect air quality in Class I areas. The FLM reviews the projected effects of emissions on the air quality-related values (AQRVs) of the Class I area, determines whether that impact is "significant," recommends to the permitting authority (usually EPA or the State) whether the permit should be granted, and whether additional pollution controls or permit conditions should be mandated. The air regulatory authority considers the recommendations of the FLM and determines whether to issue a permit, and any additional requirements.

To effectively influence the permitting process, then, a FLM must have or generate the following information:

- The AQRVs for the Class I area ("Visibility" was the only AQRV specifically defined in the Act - others might include aquatic and vegetation resources).
- The baseline condition of each AQRV.
- Projected effects of the proposed new emissions on the AQRVs.
- The threshold level where effects would be considered "significant."
- How additional controls could protect or enhance AQRVs.

Several studies have focussed upon quantifying in economic terms the value persons place upon visibility. These results, if considered accurate, can assist in AQRV protection in several ways: (1) they provide a scale to measure potential effects of (positive or negative) changes in air quality; (2) both site users, as well as persons who may not visit the area, but derive some satisfaction from its existence in an unimpaired

* Recreation Planner on the Clackamas District of Oregon's Mt. Hood National Forest.

condition, can be surveyed; (3) different increments of change, and/or diierent baseline conditions, can be simulated and evaluated, which could assist in determining "significance," and in defining protection/enhancement priorities; (4) aggregate estimates of the benefits to society of pollution control can be balanced against the costs involved in implementing such controls, thereby yielding the "socially optimal" level of air quality protection; and (5) knowing the values placed upon visibility of the voting public could enhance the public focus and funds allocated to air quality protection.

EVALUATION METHODS

There are several methods which have been used to quantify the values people place upon different levels of a public good, **such as clean air. Hedonic pricing** employs regression analysis to separate out factors affecting the changing value of a market good (e.g., lakefront real estate) with changing levels of a public good (e.g., clean lake water). Though hedonic pricing has been used to value air quality in urban areas (Freeman, 1974; Smith and Deyak, **1975),** it is difficult to **define** "markets" for Class I areas, since Class I lands are not typically available for sale (Randall, 1979).

The Travel **Cost Method (TCM)** uses travel expenditures as proxies of market prices to determine visitors' willingness to pay (WTP) to enjoy a recreational resource. This method has been challenged as **"(in)sufficiently** precise to permit isolation of the economic value of visibility from among the multitude of variables affecting the desirability of alternative recreation sites" (Randall, **1979:127).** It is unable to quantify values held by non-visitors.

The **Contingent Valuation Method (CVM) is the** method most widely applied to visibility evaluation. It involves creating a "hypothetical market" to value proposed changes to an environmental good. Typically, respondents make "bids" of their willingness to pay for a varied level of an environmental good under a variety of conditions. Advantages of the method are that it allows for off-site evaluation of preservation values, and it enables valuation of a variety of simulated air quality conditions.

Critics of CVM argue that its hypothetical nature allows for multiple and significant biases. Intense research has been dedicated to reviewing and improving the application of **CVM** (see Mitchell and Carson, 1989). Despite its criticisms, **CVM** is widely used, and generally accepted for evaluation of resource damages. The U.S. Court of Appeals recently upheld use of the method, denying to overturn the Department of Interior's opinion that CVM "can be structured to eliminate undue upward biases" (Chestnut and Rowe, 1990).

Some studies employ **a Combined TCM/CVM approach, where values are elicited for changes in willingness to incur travel expenses relative to changes in the level of an environmental good.**

HISTORICAL BACKGROUND

Early CVM evaluations of the economic value of visibility **focussed** upon: visibility reductions from **coal-**fired facilities in the Four Corners area of the southwestern U.S. (Randall, et al, 1974); potential visibility reductions from a proposed power plant overlooking Glen Canyon Recreation Area (Brookshire et al., 1976); and values of general reductions in visual range in the Four Corners area (Rowe et al., 1979). All used a series of photographs (each depicting different levels of air quality impairment) to elicit responses of **WTP** for varied levels of visibility. This continues to be the survey method of preference.

The late 70s showed increased research focus upon improving iterative bidding techniques (Randall, 1979; Brookshire, **1979),** and use of WTP rather than Willingness to Accept (WTA) measures of value (Rowe et al., 1979; ibid).

Over the late 70s through **mid-80s,** researchers and policy-makers gathered at least three separate times to assess the current status and future direction of managing for visibility values (Fox, Loomis, and Green, 1979; Rowe and Chestnut, 1983; and Bhardwaja, 1986). Proceedings from these workshops show an increasingly intense focus upon economic quantification of visibility protection values.

Research in the 80s further investigated application of CVM, identifying and attempting to control for a multitude of potential biases (Schulze et al., 1981; Rae, 1983; McFarland et al., 1983). Where previous studies had focused upon the value of visibility to visitors of Class I areas (on-site use values), increased interest was placed upon the values people held for visibility, whether or not they visited Class I areas (preservation values) (see Schulze et al., 1981; Tolley et al., 1986; Rahmatian, 1986; and Rae, 1984). Preservation Values for Visibility Protection at the National Parks (Chestnut and Rowe, 1990) is the most extensive and rigorous such application of the CVM to date.

SELECTED FINDINGS

There is a moderate body of literature concerning WTP for visibility. A selection of those studies is described below.

On-Site Studies

Chestnut and Rowe (1990) prepared an extensive review of both on-site and preservation values studies. Their summary of on-site use values for visibility protection (pp. 2-19) has been used to calculate WTP for changes in air quality, by mile of visibility change, in Table 1, below.

Several observations might be made from the **WTP** per mile of visibility protection/enhancement. First, it appears visitors are willing to pay more to keep a certain level of visibility from getting worse, than they are to improve visibility. It also appears that people are willing to pay more for the same improvement in visibility (25 miles), when the baseline is a cleaner condition **(75-mile** initial visibility), rather than a more impaired condition **(50-mile** initial visibility). Also, in all of the studies, people are willing to pay more for initial improvements in visual range - i.e., they exhibit a declining marginal willingness to pay for visibility improvements.

Fine particles are one of the most common contributors to visibility impairment (National Park Service, 1988). A certain amount of particulates applied to relatively clean air reduces visibility a good deal more than the same amount of particulates entering relatively dirty air (see Figure 1). This would mean that if WTP were expressed in "increments of particulates avoided," the cleaner the baseline air quality, the higher the negative value of those particulates to visitors of recreation sites.

Factors Influencing WTP. Though these on-site studies did not involve extensive review of the factors influencing willingness to pay for visibility protection, it is well known that clean, clear air is of high importance to National Park visitors. In studies of five different National Parks, visitors ranked "clean, clear air" among the top four most important features of each park. Cluster analysis grouped this factor, along with "cleanliness of park" in a "naturalness" cluster, which was rated the most important set of features for each park (NPS, 1988).

Off-site Evaluations

"Preservation Values" are one way to describe the values people hold for protection of the quality of a resource, even though they might not visit the site in question. Two studies **(Schulze,** et al, 1981; Chestnut and Rowe, 1990) evaluated preservation values of visibility protection at National Parks (see Table 2). (The latter study involved an extremely rigorous effort to control for many of the biases attributed to CVM analyses, thus caution should be used in directly comparing results of the two studies.)

Similar to the results of on-site studies, it appears respondents were willing to pay more to avoid a decrement in visibility, than to achieve an equivalent improvement. If improvements are expressed in miles of visibility, it also appears respondents were willing to pay more for initial improvements, than for added increments of visibility. Clearly, the frequency (percentile) unit of measure yields more uniform WTP estimates across sites.

Factors Influencing WTP. Schulze et al., (1981) found no relationship between WTP and distance from the parks, and very little between WTP and expected future visitation. WTP was negatively correlated with age, and positively correlated with income.

Chestnut and Rowe (1990) found that WTP was significantly correlated to motives to visit National Parks for enjoyment of nature. WTP was also significantly correlated to desires of respondents to have parks protected for others to visit, to preserve undeveloped areas and national heritage, and to provide scientific research opportunities. Regression analysis revealed that WTP was significantly correlated to education, household income, residence in the state containing the park in the photos (familiarity), and probability of future visitation to the park. WTP is negatively correlated to age and percentage of male respondents.

Pope and Miner (1988) conducted a CVM study of WTP for improved air quality in Utah County, Utah. Respondents were willing to pay an average of $37 per household per month, to improve air quality to a level enjoyed by residents of nearby areas (Logan UT, Twin Falls ID). Persons who considered the County's air quality problem to be "serious" averaged a WTP of 19 percent above the sample mean. Those who felt the problem was "extremely serious" were willing to pay, on average, over 28 percent more than the mean WTP.

Apportioning WTP

The values in Table 1 are expressed in dollars per visitor party, per day. Even if visitors travelled to one of the parks several times, each time staying for several

days, total **annual** on-site WTP for visibiity improvements would likely be far less than preservation value estimates in Table 2. Economists attribute this to the fact that existing on-site use values' are not reflective of the complete and true values which members of the general population might hold for visibility protection.

Preservation values can be subdivided into several "motives" for preservation, such as: "option price" (related to the WTP for current and potential future use of a site under desired conditions); "existence value" (satisfaction of knowing a site exists in a specific condition); and "bequest value" (satisfaction of knowing such site conditions will be available to future generations).

Chestnut and Rowe (1990) apportioned WTP by "motive," resulting in "option price" accounting for 31 percent of total WTP, "bequest value" accounting for 37 percent, and "existence value" responsible for 32 percent of WTP. These results are not dissimilar to findings of Walsh, Loomis, and **Gillman** (1984) in valuing preservation values for wilderness in Colorado. These proportions are also similar to those determined by **Barrick** and Beazley **(1990),** concerning values of preserving the Washakie Wilderness in Wyoming.

IMPLICATIONS FOR WILDERNESS IN THE PACIFIC NORTHWEST

There are currently 158 Class I areas, most are wilderness areas. There are 19 Class I areas in the combined states of Oregon and Washington; 15 are under the jurisdiction of the U.S. Forest Service (Blankenship, 1990). Together, these Pacific Northwest (PNW) Class I wilderness areas received visitation in excess of 850,000 Recreation Visitor Days **(RVDs)** in **FY1990,** over **40** percent of total wilderness visitation in the PNW (U.S. Forest Service, 1991).

Similar to National Park visitors, scenery and a natural environment are critical attributes of visitors' wilderness experience (Lucas, 1985). In fact, wilderness users (in comparison to National Park visitors) might place an even higher value on an unimpaired environment. In a survey performed both in 1970 and in 1982, the top factors affecting visitor satisfaction at the Bob Marshall Wilderness were scenery and the natural environment (Lucas, 1985). Visitors of nine wilderness areas stated specific "wilderness" qualities ("primitive," "natural," "unmodified," etc.) as top motives for choosing to visit wilderness (Lucas, 1982).

Wilderness users in Colorado rated preservation of water quality, wildlife habitat, and air quality as the top three values for wilderness. Wilderness as a setting for recreation opportunities was rated sixth of the thirteen factors. More than 77 percent of respondents listed air quality as **"very"** or "extremely" important for protection **(Haas** et al., 1986).

Off-site respondents are also concerned about protection of biophysical factors in wilderness, rating protection of air quality as second in importance (protecting water quality was rated highest) (ibid). Walsh et al., (1984) found the following variables positively associated with preservation values for wilderness in Colorado: income, distance to substitute areas, education, family size, county population, probability of visiting, willingness to pay for recreation use, and the importance of scenic beauty, learning about nature, and spiritual inspiration through wilderness experiences - correlations not unlike those associated with preservation values for visibility in the National Parks, maybe with a more "naturalistic" emphasis.

In summary, then, it might be reasonable to surmise that on-site as well as preservation values for protecting visibility in Class I wilderness areas might be comparable to, if not higher than, WTP results summarized in Tables 1 and 2.

In the case of the Pacific Northwest, air in most Class I wilderness areas is still relatively clean (compared to average conditions in the East and southern California), though some urban areas (e.g., Seattle, WA) have reached non-attainment status (NPS, 1988; **Bachman,** 1991). The above studies illustrate that people are willing to pay more to maintain an increment of clean air, than they are to obtain an equal "cleaning" of polluted air. Also, people's willingness to pay for protection of air quality is likely highly correlated to respondents' perception of the air quality problem in their area of residence, as well as nationally. Almost half of southern Californians polled listed air pollution as their number one environmental issue, above global warming, toxins in drinking water, and others (Opinion Research Service, 1990).

Economic valuation of visibility as a Class I AQRV points to timely and aggressive efforts to preserve the existing visibility values in Pacific Northwest wilderness areas. In doing so, wilderness takes on another economic value: that of a limiter of air pollution throughout the PNW. By serving as the basis for limiting additional emissions, Class I areas, and the desire to preserve their visual and natural attributes, provide benefits to the entire region. Some might argue that a portion of the benefits associated with

avoiding the future negative effects of increased air pollution, then, could be attributed to the existence of wilderness. In our preserving wilderness, it is assisting in preserving us.

REFERENCES

Bachman, Robert. 1991. Air Resources Specialist, U.S. Forest Service, Regional Office, Portland OR. Personal communication.

Barrick, Kenneth A., and Ronald I. Beazley. 1990. Magnitude and distribution of option value for the Washakie Wilderness, Northwest Wyoming, USA. Environmental Management **14(3):367-380.**

Bhardwaja, Prem S., ed. 1986. Visibility protection: Research and policy aspects. Transactions from an APCA Specialty Conference. Pittsburgh, PA: APCA.

Blankenship, James 0. 1990. Wilderness air management. In: **Hendee,** John C.; **Stankey,** George H., Lucas, Robert C., eds. 1990. Wilderness Management. Boulder, CO: North American Press.

Brookshire, D.; Ives, B.C.; **Schulze,** W.D. 1976. The valuation of aesthetic preferences. Journal of Environmental Economics and Management 3:325-346.

Chestnut, Lauraine G.; Rowe, Robert D. February, 1990. Preservation values for visibility protection at the national parks. Draft Final Report. Boulder, CO: **RCG/Hagler,** Bailly, Inc.

Fox, Douglas; Loomis, Ross J.; Green, Thomas C. (tech. **coord.).** 1979. Proceedings of the workshop on visibility values - Fort Collins, Colorado. Gen. Tech. Rep. WO-18.

Freeman, A.M. 1974. On estimating air pollution control benefits from land value studies. Journal of Environmental Economics and Management **1:74-83.**

Haas, Glenn; **Hermann,** Eric; Walsh, Richard. 1986. Wilderness values. Natural Areas Journal **6(2):37-43.**

Lucas, Robert. 1980. Use patterns and visitor characteristics, attitudes and preferences in nine wilderness and other **roadless** areas. Research paper INT-253. Ogden, UT: U.S. Forest Service, Intermountain Station.

Lucas, Robert. 1985. Visitor characteristics, attitudes, and use patterns in the Bob Marshall Wilderness Complex, 1970-1982. Research paper INT-345. Ogden, UT: U.S. Forest Service, Intermountain Station.

MacFarland, Karen; Malm, William; Molenar, John. 1983. An examination of methodologies and social indicators for assessing the value of visibility. In: Rowe, Robert D.; Chestnut, Lauraine G., eds. 1983. Managing air quality and scenic resources at national parks and wilderness areas. Boulder, CO: **Westview** Press.

Mitchell, R.C.; Carson, R.T. 1989. Using surveys to value public goods: The contingent valuation method. Washington, D.C.: Resources for the Future.

National Park Service. 1988. Air quality in the national parks - A summary of findings from the National Park Service Air Quality Research and Monitoring Program. Denver, CO: NPS, Air Quality Division.

Opinion Research Service (ORS). 1990. American Public Opinion Index 1989. Boston, **MA:** ORS.

Pope, C. Arden III; Miner, F. Dean Jr. 1988. Valuation of improved air quality in Utah County, USA. Environmental Management. **12(3):381-389.**

Rae, DA. 1983. The value to visitors of improving visibility at Mesa Verde and Great Smoky National Parks. In: Rowe, Robert D.; Chestnut, Lauraine G., eds. 1983. Managing air quality and scenic resources at national parks and wilderness areas. Boulder, CO: **Westview** Press.

Randall, A. R.; Ives, B.; Eastman,C. 1974. Bidding games for valuation of aesthetic environmental improvements. Journal of Environmental Economics and Management. **1:132-149.**

Randall, Alan. 1979. The economic value of atmospheric visibility. In: Proceedings of the workshop in visibility values. Gen. Tech. Rep. **WO-18.** Ft. Collins, CO: U.S. Forest Service.

Rowe, Robert D.; **D'Arge,** Ralph; Brookshire, David S. 1979. An experiment on the economic value of visibility. Journal of Environmental Economics and Management. **7(1):1-19.**

Rowe, Robert D.; Chestnut, Lauraine G., eds. 1983. Managing air quality and scenic resources at national parks and wilderness areas. Boulder, CO: **Westview** Press.

Schulze, William D.; **D'Arge,** Ralph; Brook&ire, David S. 1981. Valuing environmental commodities: Some recent experiments. Land Economics. **57(2):151-172.**

Schulze, William D.; Brookshire, David S.; **Walther,** Eric G.; **MacFarland,** Karen Kelly; Thayer, Mark A.; Whitworth, Regan L.; Ben-David, Shaul; **Malm, Willaim;** Molenar, John. 1983. The Economic benefits of preserving visibility in the national parklands of the Southwest. Natural Resources Journal. **23:149-173.**

Smith, V.K.; Deyak, T.A. 1975. Measuring the impact of air pollution on property values. Journal of Regional Science. **15:277-288.**

Tolley, **B.A.;** Randall, A.; Blomquist, G.; Fabian, R.; Fishelson, G.; Frankel, A.; Hoehn, J.; Krum, R.; Mensah, E.; Smith, T. 1986. Establishing and **valuing** the effects of improved **visibility** in eastern United States. Washington, D.C.: U.S. EPA.

U.S. Forest Service. 1991. Wilderness use statistics (data files). Portland, OR: U.S. Forest Service.

Walsh, Richard G.; Loomis, John B.; **Gillman,** Richard A. **1984.** Valuing option, existence, and bequest demands for wilderness. Land Economics. 60(1):14-29.

Table 1. Summary of On-Site WTP for Visibility Protection

Author(s) (site)	Init. Vis. (miles)	New Vis. (miles)	Change (miles)	WTP (1988$) (/party/day)	WTP, per mile
Rowe, et al, 1980: (Navajo Reservoir, NM)					
	75	50	-25	6.98	0.279
	75	25	-50	11.14	0.223
	50	25	-25	5.19	0.208
Schulze, et al, 1981: (Grand Canyon National Park)					
	75	95	+20	2.47	0.124
	75	125	+50	4.06	0.081
	75	175	+100	5.73	0.057
	75	240	+165	7.57	0.046
McFarland, et al, 1983: (Grand Canyon National Park)					
	70	100	+30	1.40	0.047
	70	130	+60	2.34	0.039
	70	165	+95	3.07	0.032
	70	215	+145	4.03	0.028
(Mesa Verde National Park)					
	70	100	+30	1.24	0.041
	70	130	+60	1.68	0.028
	70	165	+95	2.56	0.027
	70	215	+145	3.73	0.026
Rae, 1983: (Mesa Verde National Park)					
	74-95	160	+65-86	4.42	0.068-0.051
	95	160	+65	11.88	0.183
(Great Smokies National Park)					
	6-12	60	+48-54	5.67	0.118-0.105
	12	60	+54	3.76	0.070
	12	60	+54	2.94	0.054

Source: adapted from Chestnut and Rowe (1990), Table 2.3-2, pp. 2-19.

Table 2. Summary of Mean Annual Preservation Value for Visibility Protection

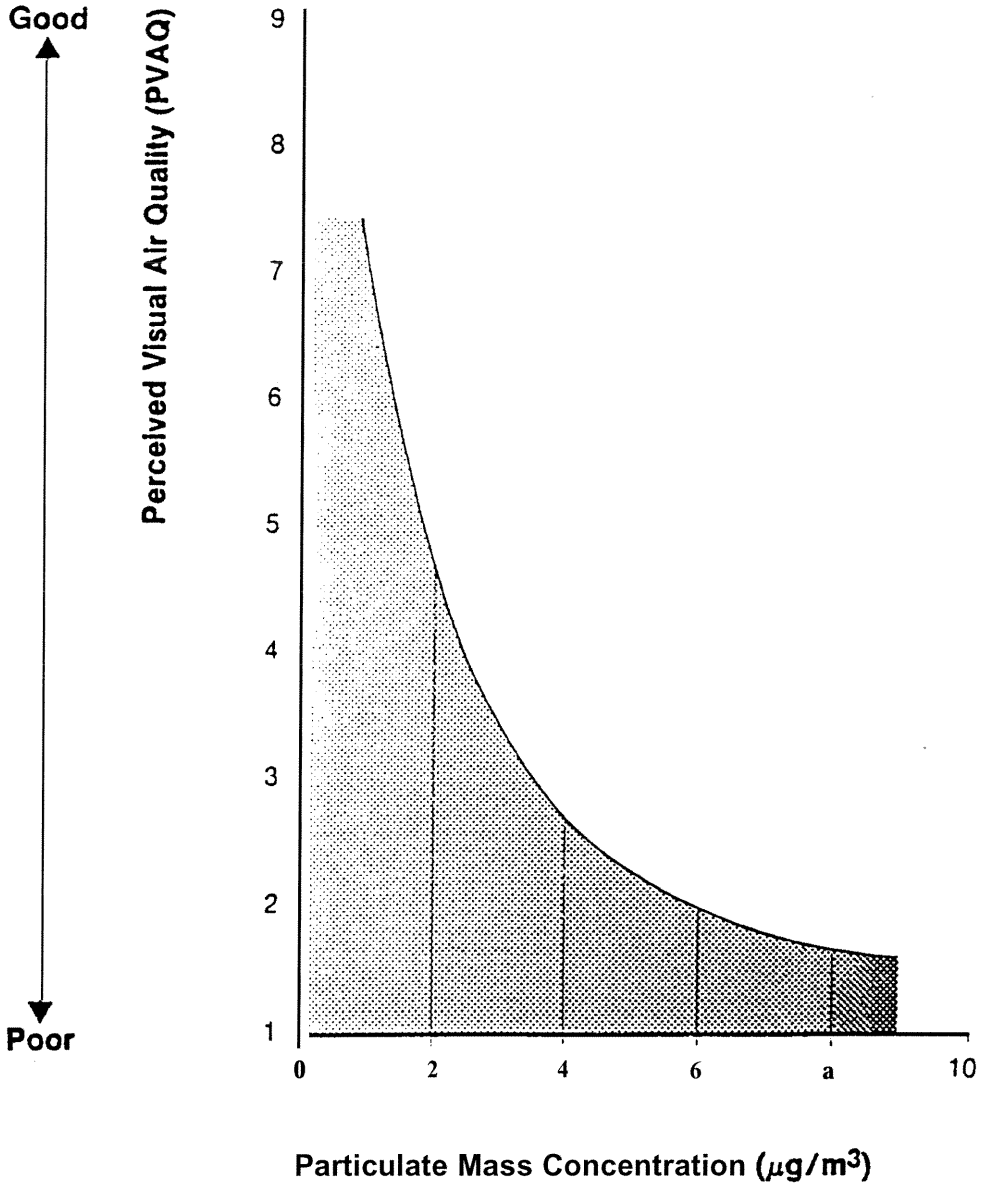
Author & Site (view[s])	Init. Vis. (miles)	New Vis. (miles)	Change (miles)	WTP/hshld. (1988$)	WTP ($/mi.)
Schulze, 1981*:					
Grand Canyon (Mt. Trumbull a.m. & p.m. and Desert View)					
	124	96	-30	$95.00	$3.167
Southwest Region (above, + Mesa Verde & Zion NPs)					
	124	96	-40	175.00	1.823
Chestnut and Rowe, 1990**:					
Yosemite (Half Dome)					
	56	78	12	$46.36	$3.863
	56	93	37	56.33	1.522
	56	30	-26	52.79	2.030
Grand Canyon (Mt. Trumbell)					
	96	124	30	$42.14	$1.405
	96	155	59	56.11	0.951
	96	71	-25	48.53	1.941
Shenendoah (Rocky Mt.)					
	16	31	15	$41.16	$2.744
	16	47	31	57.59	1.858
	16	6	-10	51.77	5.177

Sources: Schulze et al., 1983; Chestnut and Rowe, 1990.

* The initial visibility represents "average" visibility conditions (50th percentile); the new visibility represents "below average" conditions (25th percentile). Respondents were from the Los Angeles, Albuquerque, Denver, and Chicago metropolitan areas.

** For each park, the first line represents respondents' willingness to pay to improve visibility from 50th percentile visibility conditions to 70th percentile conditions. The second line is WTP to move from 50th percentile to 90th percentile. The third is WTP to maintain visibility at the 50th percentile conditions, rather than allowing degradation to 10th percentile conditions. Responses have been corrected for influences of income.

Figure 1. Effects of Fine Particle Concentration upon Perceived Visual Air Quality



Source: NPS, 1988.

FUTURE ECONOMIC VALUES OF WILDERNESS

John Loomis and Richard Walsh*

ABSTRACT

The *future increases in value of wilderness relate to increases in preservation value as well as recreation. In Colorado, the total value is expected to rise 77 percent in the next 30 years. About 22 percent is from increases in value perhousehold, driven by increases in income, e&cation, and retirement status. Population increases account for the other 55 percent of the increase in future value.*

INTRODUCTION

Decisions to develop pristine natural environments are often irreversible or involving many decades to reverse. Thus, resource allocation decisions need to account for the benefits of preservation of wilderness for several decades into the future.

To date, most empirical analyses of wilderness benefits have obtained **direct** estimates for only one year and then extrapolated these to future years (Walsh, Loomis, and **Gillman, 1984,** Pope, and Jones, 1990). As these were pioneering studies of wilderness preservation benefits, only minimal attention was given to factors underlying future extrapolation of benefits. The purpose of this paper is to more completely develop the economic foundation for generating estimates of future wilderness benefits. The second purpose is to illustrate the importance of including both recreation and public-good type preservation benefits when computing future wilderness benefits.

Finally, an empirical example will illustrate the future benefit stream of Colorado wilderness.

TYPE OF WILDERNESS BENEFITS

While the theory that wilderness preservation provides more than just on-site recreation benefits is over 25 years old (starting with Weisbrod in 1964, and Krutilla in **1967),** it bears repeating as the U.S. Forest Service continues to economically value only the recreation use. This practice exists despite empirical demonstration that recreation is less than 50 percent of the total economic value of wilderness nearly seven years ago.

What are the other benefits of wilderness preservation? There are two to three, depending on how **fine** a distinction one wants to make between the public's motivations for wilderness preservation. The first benefit wilderness preservation provides to noncurrent visitors is the option to visit the natural environment in the future. This option value is much like payment of an insurance premium to maintain the opportunity to visit the area in the future. Much refmement in the theoretical rigor of this concept has occurred since Weisbrod (1964) first put forward the idea. See Bishop (1982) and Smith (1987) for more up to date discussion of the concept.

The next benefit wilderness preservation provides to people is called existence value, defined as the knowledge that the natural environment, including its unique features and wildlife habitats, is protected. That is, some people derive enjoyment and satisfaction from simply knowing natural environments with their flora and fauna exist, even if they never plan to visit them. This economic rationale was put forward by Krutilla **(1967)** and refined by Randall and Stoll **(1983),** Brookshire, Eubanks, and Sorg **(1986),** and by Loomis (1988).

A **third** preservation benefit sometimes combined with existence value is bequest value. This is the satisfaction people derive today knowing that future generations will also have wilderness areas.

Taken together, option, existence, and bequest values reflect what some have referred to as preservation values, or **offsite** values of wilderness protection. When recreation value is further combined with preservation values, the result is called 'Total Economic Value' (Randall and Stoll, 1983). All of the components of Total Economic Value are measured

• John B. Loomis, Associate Professor, Division of Environmental Studies, University of California-Davis, Davis, **California** 95616. Richard Walsh, Professor, Agricultural and Natural Resources Economics, Colorado State University, Fort Collins, Colorado 80523.

either as willingness-to-pay (WTP) or accept compensation. This is the appropriate measure to use when comparing the benefits of wilderness to its opportunity costs.

THEORY OF TOTAL ECONOMIC VALUE

It is often useful to keep recreation value separate from preservation values. There are at least two reasons for this. First, **onsite** recreational use of wilderness is closer to a traditional private good in many cases than a pure public good. Especially when there is congestion and visitor use rationing, one person's consumption of a visitor day may preclude another person's consumption. In addition, the total wilderness area recreation demand curve is found by horizontally summing visits consumed by people at prices given by their location relative to the wilderness area. This is illustrated in the horizontal series of recreation demand curves at the top and left of Figure 1, where recreation demand is related to acres visited by an implicit production function relating number of recreation visits of constant quality to acres required. The more visits demanded, the more acres required to maintain an acceptable level of crowding.

By comparison, preservation values are pure public goods. Everyone can consume the existence of a particular wilderness area without generating congestion. As with other public goods, derivation of total public good demand requires vertical summation of the benefits all individuals receive at alternative quantities. This process is illustrated on the right-hand side of Figure 1.

The top right set of two demand curves reflects the total recreation demand (D_{trec}) and the total value demand curve (D_{tval}). The difference between the recreation and total value demand curves is the preservation values.

DETERMINING THE TREND IN WILDERNESS BENEFITS

By separating the recreation demand from preservation demand, we can evaluate the influence of socioeconomic factors on the future levels of these demands. The two demands have some similar determinants such as population levels, income, and tastes. However, recreation demand is more than likely negatively affected by age. Preservation values, much like recreation benefits, may be affected by relative distance from the natural environment (Sutherland and Walsh, **1985**) but need not be affected by age. Education levels may be positively related to preservation values. We will revisit these determinants in more detail in the empirical example later in this paper.

To illustrate future trends in wilderness benefits, we have to recognize that the value at the margin for adding another **roadless** area to the National Wilderness Preservation System is found by relating the total economic demand to supply. Total economic demand is driven by the determinants of recreation demand and preservation demand. The trends in many of these determinants are clear. Population is increasing in nearly all states and will tend to increase both recreation and preservation benefits. However, the average age is increasing, which may reduce number of wilderness recreation visits. The population distribution continues to shift westward, putting people locationally closer to wilderness. Income has generally been increasing, although slowly and unevenly. Education levels have been increasing as well. All taken together, with population being the dominant force, total economic demand is likely to be increasing over time.

Supply Side

Supply of pristine natural environments is kinked at each end. There is a legal minimum supply set at the current amount of land in the National Wilderness Preservation System. At the other end is the upper limit on the acreage in undesignated **roadless** areas, beyond which no additional wilderness can be forthcoming. That is, it becomes extremely costly to rapidly restore disturbed areas to make them mimic undisturbed natural environments. In between these two limits is an increasing cost of allocating additional **roadless** areas to wilderness preservation. Note that implicitly some of the undeveloped **roadless** areas supply wilderness services while in their undeveloped state. As the trend in supply curves illustrates, over time as **roadless** areas are either designated or developed, the supply curve becomes more and more price inelastic. In the limit the supply curve becomes vertical when all areas are either designated or developed.

A series of these supply functions is shown in Figure 2, illustrating a **leftward** shift in supply over time as **roadless** areas are allocated to development over time. This is combined with an increasing demand to illustrate the time path of marginal benefits of wilderness preservation. As can be seen from this figure, future marginal benefits of wilderness would be expected to increase rapidly over time due to combined demand increases coupled with supply decreases.

The exact rate of increase in total economic value over time is, of course, an empirical question. We now turn to a simple empirical example of how to analyze future values of wilderness.

EMPIRICAL ESTIMATES OF FUTURE WILDERNESS BENEFITS

Data Sources

Data on recreation and preservation benefits of wilderness were obtained from a mail survey of Colorado households in 1980. The survey obtained a response rate of 41 percent using the **Dillman** (1978) approach. Details of the survey can be found in Walsh, Loomis, and **Gillman** (1984).

The survey asked Contingent Valuation Method (CVM) questions to allow estimation of preservation benefits of Colorado households.

Table 1 presents the key economic variables in the CVM WTP equation for preservation value and those that will systematically influence future benefits. It should be noted that the **first** derivative of the CVM WTP equation with respect to quantity of wilderness yields a preservation demand curve similar to that shown in Figure 1. As can be seen in Table 1, preservation value per household is positively related to income, education, whether household is retired or not, and quantity of wilderness.

Future Trend of Key Demographic Variables

Since the time of the original survey, Colorado's per capita income has increased about 1 percent a year throughout the **80s,** with growth in 1988-89 being 3.4 percent (Gerold and Hussan, 1990). If the 1 percent growth in per capita income continues through 2010, we can calculate the increase in WTP for preservation over the 30 years since the survey. To do this we multiply the new level of income in 1990 and the forecast level of income for 2000 and 2010 by the WTP coefficient on income found in table 1. Household WTP due to increasing income would be expected to rise about 40 cents per decade.

Education levels also have been increasing since the survey in 1980. The percentage of population with some college and college degrees has been increasing, while the percentage for those with less than 12 years of schooling has fallen (Snyder, **1989:7).** Using these trends we updated education levels from 1980 to 1985 and 1990. Then we used the trends to forecast future education levels. These new levels were then multiplied by the coefficient on education in Table 1 to update WTP.

With regard to the dummy variable for retired, we used Census Bureau data on percentage of population age 65 and over. To go beyond 1990 we used Census Bureau projections of percentage of population age 65 and over (Wetrogan, 1988). This was multiplied by the coefficient on retired to obtain an updated estimate of WTP.

Table 2 presents the effect of future levels of income, education, and retired variables on increases in WTP obtained from multiplying them by the respective regression coefficients. Performing these calculations and **adding** the increases in WTP to the 1980 baseline **WTP** for 5 million acres results in the values shown as the first line in Table 3. Per household WTP rises from a baseline $25.30 to $30.76 over 30 years (in real terms - 1980 dollars). This represents a 21 percent increase in per household WTP over this time. When this is coupled with Census Bureau estimates of increases in the number of households in Colorado over this same period, total preservation value rises from $28 million to $49 million in 30 years. This represents a 77 percent increase over 1980 preservation values.

All of this increase in preservation value stems solely from increases on the demand side. We have not accounted for the effect of reductions in **roadless** acres on WTP.

CONCLUSIONS

A diagrammatic presentation illustrated the sources of future increase in recreation and preservation values of wilderness. From demand side changes, the total value of wilderness is expected to increase in recreation and preservation values of wilderness. From demand side changes, the total value of wilderness is expected to increase over time due to small increases in recreation demand (driven largely by population) and substantial increases in preservation values. The forecast increase in preservation value is 77 percent over the next 20 years. Of this 77 percent, about 22 percent is from an increase in value per household. In order of importance, this 22 percent increase is due to increases in income, education, and retirement status. The remaining 55 percent is due to increases in population in the state.

As developed in the paper, there are also increases in value from reductions in supply of defacto wilderness. While the future direction is clearly reductions, the rate

of decrease in roadless acreage, to be integrated with demand side increases, is left to future research.

REFERENCES

Bishop, Richard. 1982. Option value: An extension and exposition. Land Economics 58:1-15.

Brook&ire, David; Eubanks, Larry; Sorg, Cindy. 1986. Existence values and normative economics. Water Resources Research 22(11):1509-1518.

Dillman, Donald. 1978. Mail and telephone surveys: The total design method. New York: John Wiley and Sons.

Gerald, Debra; Hussar, William. 1990. Projections of education statistics to 2001: An update. National Center for Education Statistics, Washington D.C.

Krutilla, John. 1967. Conservation reconsidered. American Economic Review 57:777-786.

Loomis, John. 1988. Broadening the concept and measurement of existence value. Northeastern Journal of Agricultural and Resource Economics 17(1):23-29.

Pope, Arden; Jones, Jeffrey. 1990. Value of wilderness designation in Utah. Journal of Environmental Management 30:157-174.

Randall, Alan; Stoll, John. 1983. Existence value in a total valuation framework. In: Rowe, R.; Chestnut, L. eds. Managing Air Quality and Scenic Resources in National Parks and Wilderness Areas. Westview Press, Boulder, Co.

Smith, V. Kerry. 1987. Nonuse values in benefit-cost analysis. Southern Economic Journal 51:19-26.

Snyder, Thomas. 1989. Digest of educational statistics, 25th Edition. National Center for Education Statistics, Washington D.C.

Sutherland, Ronald; Walsh, Richard. 1985. Effect of distance of preservation value of water quality. Land Economics 61(3):281-291.

Walsh, Richard; Loomis, John, Gillman, Richard S. 1984. Valuing option, existence and bequest demands for wilderness. Land Economics 60(1):14-29.

Weisbrod, Burton. 1964. Collective consumption services of individual consumption goods. Quarterly Journal of Economics 78:471-477.

Wetrogan, Signe. 1988. Projections of the population of states by age, sex, and race: 1988 to 2010. Current Population Reports, Series P-25, No. 1017, Washington D.C.

Wetrogan, Signe. 1989. Projections of the population of states by age, sex, and race: 19892010. Current Population Reports, Series P-25, No. 1053, Washington D.C.

Table 1. Regression Coeffkients for Key Economic Variables Influencing Future Preservation Values of Colorado Wilderness.

Variables	Coeffkients (t statistics)
Distance	-.0684 (-6.58)
Income	.0001 (2.67)
Education	1.2353 (3.41)
Retired	9.805 (2.68)
Qty of Wilderness	4.1854 (2.76)
Qty Squared	-.1919 (-1.49)

Source: Walsh, Loomis, and **Gillman,** 1984.

Table 2. Effect of Future Values of Income, Education, and Retired Variables on WTP.

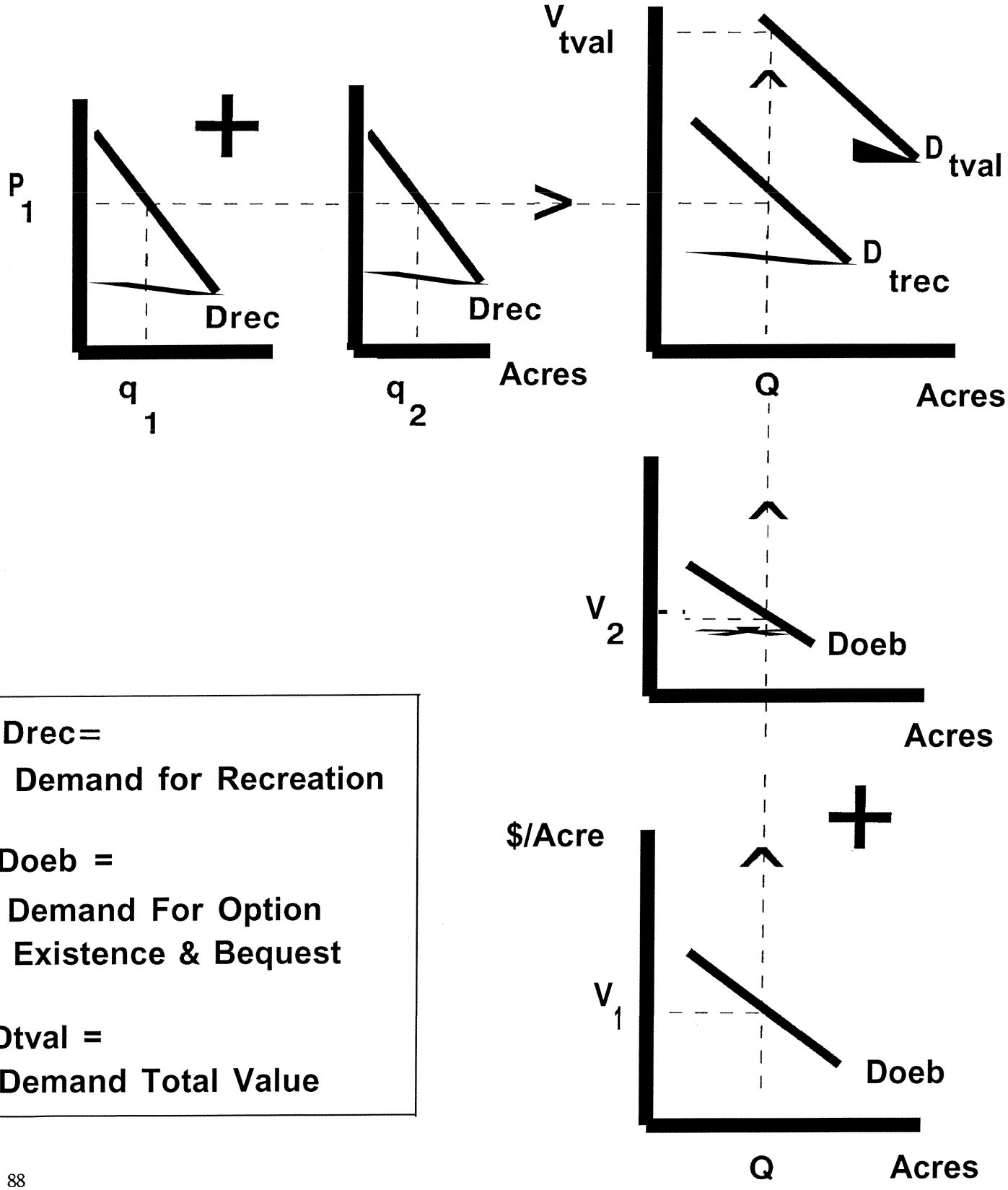
	1980	1985	1990	2000	2010
Household Income	$23,790	$35,989	$40,184	$44,389	$49,000
WTP	$2.38	$3.59	$4.02	$4.44	$4.90
WTP change		$1.21	$1.64	$2.06	$2.52
Education (years)	12.70	13.06	13.42	14.14	14.86
WTP	$15.68	$16.13	$16.58	$17.47	$18.35
WTP change		$.45	$.90	$1.79	$2.67
Retired(% of population)	.13	.13	.135	1.43	.157
WTP	$1.27	$1.27	$1.32	$1.40	$1.54
WTP change		0	$.05	$.13	$.27
Total WTP change		$1.66	$2.59	$3.98	$5.46

Table 3. ColoradoansAnnual Marginal PreservationValue Per Household and in Total.

	1980[a]	1985[b]	1990[b]	2000[b]	2010[b]
Annual Value Per Household	$25.30	$26.96	$27.89	$29.28	$30.76
% Change from 1980		6.5%	10.2%	15.7%	21.58%
Number of Households	1,098,000	1,212,167	1,244,867	1,468,000	1,598,000
Total Annual Value	$27,779,400	$32,680,000	$34,719,340	$42,983,000	$49,154,500
% Change from 1980		18%	25%	55%	77%

[a]Base value in year of survey, million acres (2.6 official, 2.4 roadless).
[b]Increase from base from Table 2.

Figure 1
Relationship of Recreation & Preservation Demands

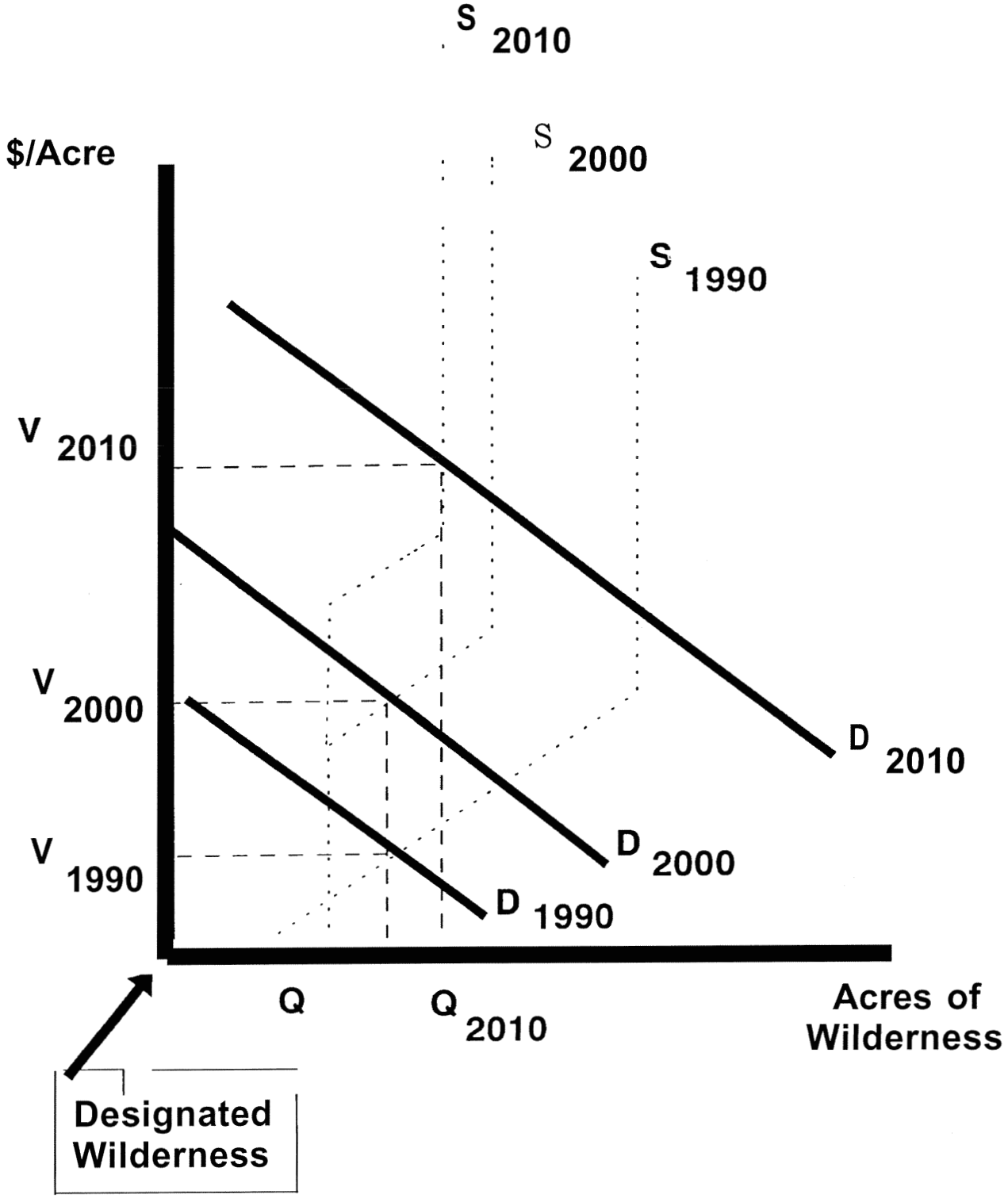


Drec=
Demand for Recreation

Doeb =
Demand For Option Existence & Bequest

Dtval =
Demand Total Value

Figure 2
Illustrative Example of Future
Wilderness Demand & Supply



ESTIMATING THE TOTAL VALUE OF FOREST QUALITY IN HIGH-ELEVATION SPRUCE-FIR FORESTS

Michelle Haefele, Randall A. Kramer, and Thomas Holmes*

ABSTRACT

The protection of forest resources is currently one of the most important policy issues in the U.S.This paper reports the results of a study to determine the nonmarket benefits of protecting forest quality in the southern Appalachian MountainsThe contingent valuation method is used to estimate the total value of forest quality. Two willingness to pay question formats (discrete choice and payment card) are compared; results indicate that there is a significant difference between them. Other results are: 1) there is substantial willingness to pay to protect forest quality; and 2) most forest protection benefits reflectonuse values.

INTRODUCTION

One of the most highly visible items on the natural resource policy agenda in the United States is the management and protection of forest resources. Much of the public debate concerns the management of old growth forests in Alaska and the Pacific Northwest, as well as the role of the U.S. in affecting the use of primary forests in the tropics. In addition to controversy about balancing the use of forests for timber and nontimber production, many are concerned about damages to forest resources. While the recent National Acidic Precipitation Assessment Program (NAPAP) report (Barnard et al., 1989) was inconclusive, many scientists are convinced that ozone, acid precipitation, and other pollutants are damaging forest resources in parts of the United States (de Steiguer et al. 1990). Furthermore, periodic outbreaks of pests, such as the gypsy moth in the Northeast, have significant impacts on the public's perception of forest quality.

One important forest ecosystem undergoing rapid change due to environmental conditions is the spruce-fir ecosystem in the Appalachian Mountains, which is located primarily on public lands. Preventing or reversing excessive forest mortality can be expected to have significant costs. Although spruce-fir forests in the Appalachians currently provide little in the way of commercial or market commodities, they provide significant nonmarket values including recreation, scenic beauty, and biodiversity protection. Therefore, economic analysis which takes into account both market and nonmarket values is required to facilitate informed investment decision-making about publicly owned forests (Kramer et al., 1990).

This study evaluates public preferences toward efforts to reduce further decline in forest quality in the southern half of the Appalachian Mountains. More specifically, the purposes of this study are: 1) to measure changes in recreational and nonuse values which may result from protecting forest quality from further deterioration; and 2) to assess the available evaluation methods and recommend refinements for improved measurement of forest quality benefits.

SPRUCE-FIR FORESTS

The spruce-fir forest type in the southern Appalachian Mountains occurs as a series of island-like stands, occupying the highest peaks (between 4,400 and 6,684 feet) in North Carolina, Tennessee, and Virginia. The major tree species in these forests are red spruce (Picea rubens) and Fraser fir (Abies fraseri). The spruce-fir ecosystem includes a number of endemic and rare plants and animals. A marked increase in mortality in the spruce-fir forests of the southern Appalachian Mountains has been observed in recent years. Twenty-five percent of the spruce-fir area is classified as having severe mortality (that is, greater than 70 percent of the standing trees dead) (Dull, et al., 1988).

. Michelle Haefele is a graduate student at Colorado State University, Fort Collins, CO; in May 1991 she was a graduate research assistant at Duke University, Durham, North Carolina. Randall Kramer is an Associate Professor, Center for Resource and Environmental Policy, Duke University, Durham, North Carolina. Thomas Holmes is a Research Forester, Southeastern Forest Experiment Station, Research Triangle Park, North Carolina.
The authors appreciate comments from Evan Mercer and Dixie Reeves on earlier drafts.

Although the spruce-fir forests were important tourist locations as early as the mid **1800s,** much of the high elevation forests remained virtually inaccessible until they began to be logged around the turn of the century (Pyle and Schafale, 1988). Timber harvesting continued until approximately 1925. Disturbance from logging and associated wildfires has reduced these forests to ten percent of their original area (Dull et al., 1988). The establishment of the Great Smoky Mountains National Park in 1934 ended the logging and fires and preserved a large part of the forest areas. The pattern of logging and burning is the **first** of three major human-induced disturbances which have altered the ecology of the spruce-fir forests (Richter et al., 1989).

The second wave of human-induced forest disturbance is associated with an infestation of the balsam woolly adelgid introduced accidently from Europe about 1900. Initially introduced in the Northeast, this pest was first detected in the southern Appalachians in 1957. The balsam woolly adelgid attacks only the mature Fraser **fir.** A survey of Fraser fir regeneration at Mt. Mitchell, North Carolina, conducted over the period 1966 to 1978 indicates that the species seems to be able to produce viable seeds before severe infestation; therefore, Fraser **fir** will probably remain in the southern Appalachians (Witter and Ragenovich, 1986). Red spruce are resistant to the insect, but can be indirectly affected by fir mortality as they are **shallow-**rooted and may need the buffering of the **fir** trees to prevent blowdown.

Air pollution is believed to be the cause of the third wave of anthropogenic forest disturbance. Air pollution injury is suspected of reducing the resistance of Fraser fir to the balsam woolly adelgid infestation (Garner et al., 1989). Acidic precipitation is also suspected of contributing to the decline of the spruce-**fir** forests, by altering the resistance of red spruce to winter injury (Barnard et al., 1989) and by reducing red spruce growth rates (Chappelka et al., 1985). All of the high elevation forests in the eastern United States are exposed to potentially harmful levels of ozone and cloud water acidity. The long-term effects of this exposure are as yet unknown (Barnard et al., 1989).

METHODS

This study uses the contingent valuation (CV) method to estimate both use and **nonuse** values of the spruce-**fir** forest ecosystem. The contingent valuation method uses simulated markets to determine willingness to pay for environmental amenities and other public goods. Although widely applied to the study of nonmarket goods, the contingent valuation method has received relatively little attention as a means of estimating damage to forests. Exceptions include two studies of air pollution damage to southern California forests by Peterson et al. (1987) and by **Crocker (1985),** and one study of pine beetle damage in the Colorado Rockies by Walsh et al. (1990).

To determine benefits from improvements in forest quality, a survey instrument was developed at the School of Forestry and Environmental Studies at Duke University. The instrument was refined through a series of focus groups comprised of **133** graduate students. Seven focus groups were used to test different question formats and alternative presentations of visual information.

The sampling frame for the survey consisted of all households living within a **500** mile radius of Asheville, North Carolina. Asheville was selected as the geographical center of the sampling frame because it is centrally located within the southern Appalachians and is a frequent destination of vacationers visiting the mountains. The Blue Ridge Parkway, for example, passes within a few miles of Asheville's city limits. A 500 mile radius around Asheville approximates one day's driving time, and includes most recreators and potential recreators. A socioeconomic survey of visitors to the Great Smoky Mountains National Park showed that 61 percent of visitors entering the park lived in Tennessee, North Carolina, or adjacent states (Peine and Renfro, 1988). The actual sampling frame was all households in telephone directories in zip codes contained wholly or partially within the 500 mile radius. Each zip code was sampled proportionally to its population. A sample of 1,300 was drawn, of which **100** were used for the pretest.

The pretest version of the survey instrument was mailed to 100 households in January, 1991. **Twenty-**one percent of the surveys were returned, with only one postcard follow-up mailing. Based on pretest results and comments from several survey experts, the final survey was revised and sent to 1,200 households in March, 1991. The format of the survey and the implementation procedures closely followed Dillman's (1978) recommendations.

A brief description of the southern Appalachian spruce-fir forests (and the recent decline) was included in the cover letter. This description was expanded upon in the introduction to the survey. A map of the area was included to show where these forests occur.

The first portion of the survey sought to establish the respondent's prior knowledge of the area and the decline of the spruce-fir forests. The second section elicited some travel cost data from those who had

visited the area and asked how familiar respondents are with the southern Appalachians. The third section of the questionnaire contained a description of the forest damage. Three levels of forest quality were illustrated using color photographs taken at Mt. Mitchell, North Carolina. The proportions of the remaining forests in each category were shown using a pie chart. The suspected causes of the damage and possible control measures were also described.

Several payment vehicles were tested in the focus groups and in a mail pretest. The mail pretest used a voluntary contribution to a special fund. This seemed to cause some confusion, and a common reason for zero bids was that "the government should pay." An increase in taxes was finally chosen as the payment method since it is familiar to most people and the use of tax revenues is a common way of providing public goods.

The contingent valuation questions were placed on a page facing the description of the public good (forest protection). Two questions were asked: 1) How much would you be willing to pay for protection programs along roads and trails (about one-third of the remaining forests); and 2) How much would you be willing to pay to protect all of the remaining forests. The exact wording of the contingent valuation questions is given in the appendix.

Previous studies have used several different answer formats for CV questions. For example: open ended responses, payment cards, and "take-it-or-leave-it" formats (Mitchell and Carson, 1989). Although the "take-it-or-leave-it" format, also known as discrete choice, is increasingly popular among researchers, few studies have compared this elicitation method with the payment card format in an experimental context. Therefore, in order to test for differences across formats, we presented the payment card to half of our sample and discrete choice to the other half.

The payment levels for the discrete choice questions were developed after responses to the mail pretest (which used a payment card only) were received. Pretest bids ranged from zero to $500. We selected ten payment levels within this range, which included most of the bids given by the pretest respondents. **Sixty** respondents were assigned to each level. The same payment level was used in both questions.

We also included a question in which we asked respondents to partition their bids among three types of values: 1) use values; 2) bequest or vicarious consumption values; and 3) existence or intrinsic values. One question explored reasons for zero bids. The **final** section of the survey asked about respondents' participation in outdoor recreation, their involvement in "environmental behavior," and the usual socioeconomic characteristics.

RESULTS

A total of four mailings were sent to the potential respondents. The first mailing was the initial contact with the respondents. The second mailing was a follow-up postcard which reminded the respondents to return the survey. The next two mailings contained letters which tried to reinforce the importance of each respondent's answers and the social importance of the entire study. The last two mailings also contained a replacement questionnaire.

The mean willingness to pay for the two different levels of protection are shown in Table 1. The responses are broken out for two groups corresponding to the two different question formats (payment card versus discrete choice). As can be seen, respondents are willing to pay about $18 to 59 to protect the remaining undamaged forests along roads and trails (about one third of the higher quality forests), and about $20 to 99 to protect **all** of the remaining high quality forests.

The question format does not appear to affect response rates; 51 percent of the respondents returned completed discrete choice surveys, while 53 percent of the payment card surveys were returned.

The respondents were asked to partition their bids according to use value, bequest value, and existence value. We recognize that there is debate in the literature about the cognitive abiity of individuals to disaggregate total value in this way, but we thought it would be useful to explore the relative contributions of each of these categories to total value. The results are shown in Table 2. As can be seen, existence value makes up about half of the total bid for both versions. The second largest category is bequest value. Use value makes up only about 9 to 13 percent of the total willingness to pay for forest protection.

CONCLUSIONS

This study has explored the benefits associated with protecting remnant spruce-fir forests in the southern Appalachians. Results indicate that the contingent valuation method coupled with visual information is an effective way of measuring preferences for forest quality. This assessment is based on response rates and the apparent ability of respondents to distinguish between protection levels. Further analysis of the data set is needed to determine the effect of the two

different CV question formats used in the survey and to compare value estimates from the CV and travel cost methods.

It is clear that there is a substantial willingness to pay for protecting forest quality. Most of these benefits are related to **nonuse** values. From a policy perspective, this suggests that it would not be appropriate to finance forest quality protection programs entirely from user fees, since many of the benefits are realized by nonusers. However, we recognize that the method used in this study to partition values is somewhat simplistic and does not attempt to control for other public goods in each individual's basket of goods and services. Separability in environmental valuation is an issue needing further scrutiny. In addition, further analysis will explore differences in willingness to pay between forest users and nonusers, as well as the differences between the two different levels of protection.

REFERENCES

Barnard, J.E.; **Lucier,** AA.; Johnson, A.H.; Brooks, R.T.; Karnosky, D.F.; DUM, P.H. 1989. Changes in forest health and productivity in the United States of America: State-of-Science/Technology Report 16. Washington, DC: National Acid Precipitation Assessment Program.

Chappelka, A.H.; Chevone B.I.; Seiler, J.R. 1985. Growth response of red spruce seedlings to acidic precipitation and ozone: preliminary results. In: Proceedings of the southwide forest disease workshop. Raleigh, NC: Department of Plant Pathology, North Carolina State University.

Crocker, T.D. 1985. On the value of the condition of a forest stock. Land Economics **61(3):244-254.**

de Steiguer, J.E.; Pye J.M.; Love, C.S. 1990. Air pollution damage to U.S. forests: A survey of perceptions and estimates by scientists. Journal of Forestry **88(8):17-22.**

Dillman, DA. 1978. Mail and telephone surveys: The total design method. New York, **NY:** John Wiley and Sons, Inc.

Dull, C.W.; Ward, J.D.; Brown, H.D.; Ryan, G.W.; Clerke, W.H.; Walker, R.J. 1988. Evaluation of spruce and **fir** mortality in the southern Appalachian Mountains. USDA Forest Service Protection Report **R8-PR** 13.

Garner, J.H.B.; Pagano, T.; Cowling, E.B. 1989. An evaluation of the role of ozone, acid deposition, and other airborne pollutants in the forests of eastern North America. USDA Forest Service Gen. Tech. Rep. SE-59.

Kramer, Randall A.; Healy, Robert; Mendelsohn, Robert. 1990. Forest valuation. Paper prepared for World Bank forest policy study. Washington, DC.

Mitchell, Robert C.; Carson, R.T. 1989. Using surveys to value public goods: The contingent valuation method. Washington, DC: Resources for the Future.

Peine, J.D.; Renfro, J.R. 1988. Visitor use patterns at Great Smoky Mountains National Park. U.S. Department of the Interior, National Park Service, Research/Resources Management Report SER-90. Southeast Regional Office, Atlanta, GA.

Peterson, D.C.; Rowe, R.D.; **Schulze,** W.D.; Russell, G.W.; Boyce, R.R.; Elliot, S.R.; Hurd, B. 1987. Valuation of visual forest damages from ozone. Draft: **USEPA** Cooperative Agreement **#CR812054-**02.

Pyle, C.; Schafale, M.P. 1988. Land use history of three spruce-fir forest sites in southern Appalachia. J. Forest History **32:4-21.**

Richter, D.D.; Ring, **K.S.;** Witter, JA.. 1989. Moisture and nutrient status of extremely acid umbrepts in the Black Mountains of North Carolina. Soil Sci. **Soc.** Am. J. **53:1222-1228.**

Walsh, R.G.; Bjonback, R.D.; **Aiken,** RA.; Rosenthal, D.H. 1990. Estimating the public benefits of protecting forest quality. Journal of Environmental Management **30:175-189.**

Witter, JA.; Ragenovich, I.R. 1986. Regeneration of Fraser **fir** at Mt. Mitchell, North Carolina, after depredations by the balsam woolly adelgid. Forest Science **32(3):585-594.**

APPENDIX

Contingent Valuation Questions Used in Survey

Suppose the only way to provide for these tree protection programs is to start a special conservation fund financed by increased taxes. Although most of the southern Appalachian spruce-fir forests are like those shown in photo A, without these programs most of the forests will eventually decline to the level seen in photo C. The whole forested area is at **risk** from the insect and pollution damage.

Version 1: **Payment** Card Format

13. What is the most money you would pay each year to provide protection programs for spruce-fir forests along roads and trails in the southern Appalachian Mountains (which is about one-third of the remaining forest areas)? (Circle one amount.)

$0	$2	**$4**	$6	$8	$10	$15	$20
$25	$30	$40	$50	$75	$100	$125	$150
$175	$200	$250	$300	$350	$400	$450	$500

other $_____

14. What is the most money you would pay each year to provide protection programs for all of the remaining spruce-fir forests in the southern Appalachian Mountains? (Circle one amount.)

$0	$2	$4	$6	$8	$10	$15	$20
$25	$30	$40	$50	$75	$100	$125	$150
$175	$200	$250	$300	$350	$400	$450	$500

other $_____

Version 2: Discrete Choice Format

13. Would you pay _____ each year to provide protection programs for spruce-fir forests along roads and trails in the southern Appalachian Mountains (about one-third of the remaining forest areas)?

☐ **NO**
☐ **YES**

14. Would you pay _____ each year to provide protection programs for all of the remaining spruce-fir forests in the southern Appalachian Mountains?

☐ **NO**
☐ YES

Table 1. **Annual** Willingness to Pay Per Household for Protection of Forest Quality.

	Payment Card Version	Discrete Choice Version
Forests along roads and trails	$18.08	$59.22
All of the remaining forests	$20.86	$99.57

Table 2. Value Components of Total Willingness to Pay

	Payment Card Version	Discrete Choice Version
Type of Value		
Use	8.2%	12.8%
Bequest	29.6%	29.8%
Existence	58.5%	55.9%

TOTAL VALUATION OF WILDLIFE AND FISHERY RESOURCES: APPLICATIONS IN THE NORTHERN ROCKIES

John W. Duffield*

ABSTRACT

This paper provides an overview of methods for measuring the total valuation of wildlife and fishery resources. The total valuation framework and the dichotomous choice contingent valuation model are described. Five case studies using these approaches are summarized. The studies are set in the Northern Rockies and include analysis of instream flows, endangered fisheries, elk winter range, and wilderness recovery.

INTRODUCTION

This paper provides a summary of recent total valuation studies of wildlife and fishery resources in the Northern Rockies. This overview was developed for presentation at the Society of American Foresters' symposium on the "Economic Value of Wilderness" held in Jackson Hole in May 1991. The focus is on the problem of placing values on services of natural environments that are not traditionally exchanged in markets. This area of research, often referred to as nonmarket valuation, has been rapidly expanding in recent years. The unique element of the work described here is that the values described are not limited to traditional direct recreational uses of natural environments, uses such as hunting and fishing, but also include existence or **nonuse** values. The latter are values associated with the idea that a given wildlife or fishery resource is in a healthy condition or that a given natural environment is preserved.

After this introduction, the discussion is organized into two major sections: 1) theory and methods, and 2) case studies. The primary method described is contingent valuation. Applications of this method in live case studies are summarized. There are a number of elements common to all of these studies. They are cast in an applied welfare economics (benefit-cost) framework and are generally motivated by specific resource policy issues. The theoretical framework is total valuation - in the sense that **nonuse** or existence values are included. The primary method is dichotomous choice contingent valuation, which has been typically implemented through a household sample frame.

Given the theme of this symposium, it is useful to briefly summarize this economist's view of what is meant by the "economic value of wilderness". Essentially, the wilderness valuation issue is a special case of the larger general problem of valuing the services of natural environments. For example, valuing the recreational and aesthetic uses of a city park is theoretically no different than valuing the services derived from a wilderness. The "wilderness problem" admittedly has a special legislative and administrative history in the United States. This context serves to define the problem in terms of what are permitted uses and what services might be expected to arise from a given wilderness designation. However, the essential problem of estimating wilderness values is no different in principle than estimating the economic value of a wildlife refuge or of maintaining adequate flows on rivers or, in fact, valuing any point on the **preservation-development** continuum for a given natural environment. The problem is one of identifying what uses or human services will be associated with a given state of the resource and then placing a value on those service flows.

In the past, economic evaluation of natural resource policy or specific developmental projects has sometimes been more of a justification for market uses rather than a comprehensive and valid economic comparison of alternatives. This has been in part because of the difficulty of placing a value on the service flows that are not traded in a market. For example, if one proposes to dam a river, there are associated marketed uses such as hydro-electric power or irrigation (that will benefit marketed agricultural commodities). While not always a simple task, these types of benefits can be valued in dollar terms by using market information. A more difficult problem is in placing a value on

*Professor of Economics, Department of Economics, University of Montana, Missoula, Montana 59812.

potentially foregone uses such as white water recreation or **fishery** services that are unique to the free flowing river. Additionally, there may be aesthetic values or values associated with the idea that a given resource is in a wild and undeveloped state. For example, if it were proposed that we ought to dam the Grand Canyon, a number of individuals might feel a sense of loss. This loss may be independent of the possibility that they may ever see the canyon themselves. To conclude on this point, the work described below is focused on valuing specific resource services. These services could possibly be components of the service bundle derived from a given wilderness site.

The concept of **nonuse** or existence value merits some additional introductory discussion. The seminal statement of the idea of **nonuse** or existence values was presented by John Krutilla in a well known paper published in **1967** in the American Economic Review. In this paper Krutilla argued that important motives for protecting natural environments could include what he called option, existence, and bequest motives. Individuals may value wilderness in order to protect the option of their future use of an area, or they may simply value the idea that wilderness is protected, or they may wish to protect an area for future enjoyment by their children or other members of future generations. Examples are provided by current wilderness resources that are at issue. These include preservation versus development conflicts in the Arctic National Wildlife Refuge (ANWR), the Badger Two Medicine area on the Rocky Mountain front, and the issue of the preservation of salmon stocks in the Columbia River basin. With regard to ANWR, the direct recreational use of that area is very limited - on the order of 2,000 visits per year. Nonetheless, the wilderness values associated with this area may be very substantial.

What have we learned in the approximately 25 years since Krutilla first articulated the notion of existence value? In this period we have seen the development of a theoretical basis for measuring both direct use and existence values in a consistent framework. A good statement of the total valuation model is found in Randall and Stoll (1983). The other focus just prior to and during this period has been on the development of tools to measure both direct and **nonuse** values. This began in the late 50s with the development of the travel cost model (Wood and **Trice,** 1958; **Clawson,** 1959). The travel cost method uses the observed decline of visitation in response to increased travel costs to infer a demand curve for a given site. In **1963, in** a study of the recreational use of the Maine woods, Robert Davis provided an application of another important method - contingent valuation. In contingent valuation, individuals are directly surveyed as to their willingness to pay for use or existence of a given resource service contingent on their acceptance of a hypothetical market situation. Detailed discussions of these models are available elsewhere (Ward and **Duffield,** 1992). Revealed preference methods such as the travel cost model (based on observed behavior) cannot be used for measuring **nonuse** or existence values. Accordingly, total valuation studies necessarily utilize the contingent valuation method.

In recent years there has been increasing application of both the travel cost and contingent valuation models to valuing recreational and wildlife resources. A good index is provided by reviews commissioned by the U.S. Forest Service as part of its Resource Planning Act responsibilities in 1978, 1982, and 1988 (Table 1 and references cited there). While the 1978 review identified only 15 such studies, the 1988 review found **120.**

Almost all of these studies (about 95 percent - Table 2) have focused on traditional hunting and fishing uses. Whiie **40** percent of these research efforts have been on hunting use, only 9 percent of the United States participates in this activity. Participation in nonconsumptive wildlife uses such as **wildlife** viewing is much higher than participation in hunting and fishing in both the U.S. and in states like Montana (Table 2). Nonetheless, only a comparatively few studies have examined either nonconsumptive or existence uses. Summary results for a number of previous studies of the latter uses are listed in Table 3, including studies of whooping cranes (Bowker and Stoll, **1988),** bald eagles and striped shiners (Boyle and Bishop, **1987),** desert bighorn (King, Flynn, and Shaw, 1988) and deer (Loomis, Creel, and Cooper, 1989).

Part of the motivation for the case studies described is to add to the limited literature on existence and nonconsumptive uses. The work described below includes several studies of **instream** flows and associated fishery resources on Montana rivers. Another **fishery** study focuses on the existence value of several threatened species in Montana, Arctic grayling in the Big Hole drainage, and Yellowstone cutthroat in tributaries of the Yellowstone River. The other two studies examine expansion of elk winter range for the Northern Yellowstone herd and the values associated with wolf recovery in Yellowstone National Park.

THEORY AND METHODS

The purpose of this section is to briefly summarize the methodological basis for undertaking total valuation of a given environmental resource. There are basically two components to this framework. The first is

consumptive theory, which provides a model of individual behavior relating to economic choices among competing goods and services. This model allows us to **define** the value or measure of welfare associated with a given level of resource service. In common practice, the measure used is the individual's maximum willingness to pay in order to avoid the loss of use of the given resource. This measure is also commonly referred to as consumer surplus. One can also define the welfare measure in terms of the amount of compensation demanded (or willingness to accept') to do without the resource. For a discussion of these issues see Just, Hueth, and **Schmitz** (1982).

The second element of the analytical framework is the definition of the methods to be used to measure this willingness to pay. As previously noted, willingness to pay is measured in these applications with contingent valuation.

Total Valuation Model

A compact way of describing the satisfaction that individuals **derivc** from consumption of goods and services is a utility function. The level of well-being that individuals might derive from a given wildlife or wilderness resource is a function of their level of direct recreational use, such as hunting (H), nonconsumptive viewing or hearing uses (Nw), the level of a viable **wildlife** or fishery population (W) which provides them with existence value, other services derived from the wilderness or wildlife resource (S), and a vector of all other goods and services ($\tilde{Z}$) not associated with the resource in question. An individual's utility function, assumed to have the properties required by consumption theory, is then given by:

$$(1)\quad U(N_w, W, S, H, \tilde{Z})$$

The individual is assumed to maximize her level of well-being subject to her budget constraint (income) and prices corresponding to the set of goods and services modeled (Pw,Ps,Ph,Pz) where Pz is a vector and the existence service (being a pure public good) is unpriced. The solution to the consumer's constrained maximization problem results in optimal levels of goods and services. This optimal solution can be equivalently expressed in terms of an indirect utility function, V(.), where the arguments are prices and income, Y. For example, consider a current situation where the absence of a key wildlife resource (Nw, W = 0) affects only the nonconsumptive and existence services of the site. Then the maximum attainable level of well-being for an individual is given by:

$$(2)\quad U(0,0,S^*,H^*,Z^*) = \bar{U} = V(P_w^m, 0, P_s^0, P_h^0, P_z^0, Y)$$

Where $\bar{U}$ is the reference or current level of utility.

Note that the price of the key resource, P_w^m, is a price sufficiently high to make nonconsumptive services zero (or, equivalently, the price is infinite). This model provides a compact way of describing the value associated with changes in the current situation. If the key resource were present at some viable level $\bar{W}$, and nonconsumptive use was possible at a finite price, then there is some amount, WTP', which would make an individual ambivalent between the current experience and one with the resource present:

$$(3)\quad V(P_w^1, \bar{W}, P_s^1, P_h^1, P_z^0, Y - WTP^1) = V(P_w^m, 0, P_s^0, P_h^0, P_z^0, Y)$$

Because WTP' is willingness to pay for an improvement, this is a compensating variation welfare measure (Hicks, 1943). This measure provides a net total valuation estimate for the resource service of interest, since it includes both nonconsumptive (viewing and hearing) as well as existence value. WTP' can be estimated using dichotomous choice contingent valuation. From the perspective of a threshold motivation for these types of models, $\mathbf{WTP^1}$ corresponds to the individuals true WTP in the model of equation 4, below. Details of a contingent valuation model that can be used to implement this welfare measure are provided in the following section.

Dichotomous Choice Contingent Valuation

In dichotomous choice, individuals respond "yes" or "no" as to their willingness to pay a specific cash amount for a specified commodity or service. The advantages of this approach, as compared to **open**-ended or bidding game questions formats, have been discussed elsewhere (Boyle and Bishop, 1988; Bowker and Stoll, 1988). The disadvantage of this approach is that analysis and interpretation are relatively complex, since WTP is inferred rather than observed.

Hanemann (1984) has investigated the theoretical motivation for dichotomous choice models. He provides both a utility difference approach and an alternative derivation based on the relationship of the individual's unobserved true valuation compared to the offered threshold sum (see also Cameron **[1988]**). In the latter, it is assumed that if each individual has a

true willingness-to-pay (WTP), then the individual will respond positively to a given bid only if her WTP is greater than the bid. For example, suppose that an individual is confronted with an offered price (t) for access to a given resource or recreational site. The probability of accepting this offer $\pi(t)$, given the individual's true (unobserved) valuation WTP, is then:

$$(4)\quad n(t) = Pr(WTP>t) = 1-F(t)$$

where F is a cumulative distribution function of the WTP values in the population. In the **logit** model F(.) is the c.d.f. of a logistic variate, and in the **probit** model F(.) is the c.d.f. of a normal variate. The specification of this model can be briefly illustrated for the case where the WTP values are assumed to have a logistic distribution in the population of interest conditional on the value of covariates. A statistical model is developed that relates the probability of a "yes" response to explanatory variables such as the bid amount, preferences, income, and other standard demand shifter type variables. The specific model is:

$$(5)\quad \pi(t;\tilde{x}) = [1 + \exp(-\alpha t - \tilde{\gamma}'\tilde{x})]^{-1}$$

where $\pi(t;\tilde{X})$ is the probability that an individual with covariate vector $\tilde{X}$ is willing to pay the bid amount t. The parameters to be estimated are α and $\tilde{\gamma}'$ (the constant term is included in $\tilde{X}$). The equation to be estimated can be derived as:

$$(6)\quad L = \ln[p/(1-p)] = \alpha t + \tilde{\gamma}'\tilde{x}$$

where L is the "**logit**" or log of the odds of a "yes" and p are observed response proportions. In application, the **logit** and **probit** models are so similar that it is difficult to justify one over the other on the basis of goodness of fit. We generally choose to work with the logistic specification because the **probit** model does not lead to closed-form derivatives. Maximum likelihood estimates of the parameters in equation 6 can be obtained with a conventional logistic regression program.

Because we estimate the distribution of WTP values with dichotomous choice contingent valuation, the question remains as to which parameter of the distribution to use. A variety of welfare measures for dichotomous choice models have been proposed in the literature, including a truncated mean (Bishop and Heberlein, **1979),** the overall mean, and percentiles of the distribution, including the median **(Hanemann,** 1984, 1989). In all cases the distribution of F is assumed to be continuous and nonnegative. We generally utilize the truncated mean and several different percentiles. For a mathematical definition of these measures, see Duflield and Patterson (1991).

Methods have recently been developed to identify the precision of dichotomous choice-based welfare estimates. Several different procedures can be **utilized,** including bootstrapping (Efron, **1982),** simulation using repeated sampling from the estimated asymptotic distribution of the **logit** model parameters (Krinsky and Robb, **1986),** and analytical estimates using the delta method (Serfling, 1980). Details of the procedures for applying these methods to logistic models are described elsewhere (Park and others, 1989; Duflield and Patterson, 1991).

Summary Example of an Dichotomous Choice CVM Application

Because the preceding description of dichotomous choice CVM is necessarily somewhat abstract, the following provides a summary example that is very fairly generic for the other applications described below. The case chosen for this simple example is the proposed purchase of elk winter range north of Yellowstone National Park by a coalition of the Rocky Mountain Elk Foundation, the State of Montana, and the U.S. Forest Service. This proposed purchase of additional winter range was motivated by the large **die-**off the northern Yellowstone elk herd experienced in the severe winter of 1988-89. In this application, as in the others described below, a trust fund payment vehicle was used. This is a plausible, neutral, and possibly somewhat conservative payment vehicle that provides one approach for including not only direct recreational use but also existence motives. By contrast, a payment vehicle such as an entrance fee to a given recreational site would not necessarily capture existence values. A trust fund payment vehicle has been used successfully in a number of other studies related to **wildlife** valuation (Boyle and Bishop, 1987; Bowker and Stoll, 1988).

In this application visitors to Yellowstone National Park were provided with a handout-mailback survey booklet. In the survey, the proposed elk winter range purchase, its location, and the significance of this resource for the Yellowstone elk herd were described. The survey participant was asked to assume that a trust fund existed for acquiring elk winter range. Participants were further asked to assume that if they contributed to this trust fund, then this specific parcel of winter range could be purchased and the Northern Yellowstone herd would benefit. Respondents were then asked "would you be willing to donate X amount

to such a trust fund for the purchase of this elk winter range." The bid amounts were varied from $1 to $500.

Summary responses are provided in Table 4. At low donation amounts, for example, $1, over 88 percent of the individuals were willing to pay that amount. As the bid amount increases the probability of an individual being willing to contribute declines - just as one would expect. For example, at $25 the **probability** of a yes declines to 43 percent, at $50 to 23 percent and at **$300-$500** the probability of a yes response is well below 10 percent. This table also provides a comparison of the fitted probabilities based on an estimated logistic regression equation like that specified in equation 6. As one can note from the table, the model appears to fit the data quite well.

Given this model of the distribution of willingness to pay for this particular improvement in environmental services, one can derive specific welfare measures. For example, the median or typical willingness to pay can be interpolated from Table 4 to correspond to a dollar amount of about $18. Another welfare measure, the truncated mean, is about $78 in this case. It may be noted that these results are rather typical of most dichotomous choice applications, in that the distribution are heavily skewed to the right, as indicated by the measures of the mean being much larger than the median. This indicates that the average willingness to pay maybe heavily influenced by the willingness of a small part of the population to pay relatively high amounts.

Another standard component of most of these types of applications is an estimate of a multivariate relationship between willingness to pay and other explanatory variables. For example, in Table 5 an estimate for this data set is provided that includes the bid amount, income, the number of trips taken thus far to Yellowstone, a dummy variable for whether or not the individual is a big game hunter, a measure of how important seeing elk is to a particular park visitor, and a measure of environmental attitudes. The estimated parameters are all highly significant; the signs are consistent with what one would expect from economic theory. For example, the willingness to pay declines as the bid amount (which can be thought of as a price here) increases. On the other hand, the coefficient on income is positive, indicating that, other things being equal, the more income the individual has the, more likely she is willing to pay a given bid amount. This is also consistent with economic theory. The estimated willingness to pay relationship indicates that the responses are not just random but are consistent with economic theory and the characteristics of the individual respondents.

The table also provides in the fourth column a measure of elasticity of willingness to pay with respect to the given variable (excluding the effect of the trust bid amount). It is interesting to note that the measure of preference is the dominant explanatory variable. It may be noted that the interpretation of this relationship of willingness to pay and covariates that underlies this table is based on work originated by Cameron (1988) and extended by Patterson and **Duffield** (1991). The technical details of these types of models are provided in these references.

CASE STUDIES

This section provides a summary description of live total valuation studies of **fish** and wildlife resources that utilize the analytic framework described in the previous section. The studies (listed in Table 6) include three applications concerning Montana fishery resources: two **instream** flow studies and also a study of habitat improvement through **instream** flows for several threatened fishery species in Montana, Arctic grayling, and Yellowstone cutthroat. There are also two wildlife resource applications: the previously sketched analysis of the elk winter range purchase and also a study of proposed wolf recovery in Yellowstone National Park. These studies all **fit** well within the total valuation framework described in the preceding section. All these resources potentially have significant existence values components - that is to say, uses that are independent of direct recreational use. For example, the possibility that any given individual would directly benefit from improving the Arctic grayling or Yellowstone cutthroat populations in several small tributary streams is rather remote. Additionally, the likelihood that any given Yellowstone Park visitor would actually see or even hear wolves is also remote. The same might be generally said for the elk winter range purchase. It appeared from our study that people were primarily motivated by a concern for the existence or well-being of the elk rather than the expectation of the individual directly experiencing benefits from the purchase (such as an increased odds of shooting an elk).

All but one of these studies used dichotomous choice contingent valuation. In the endangered fishery study, a simple payment card approach was used. In this question format, individuals are given an opportunity to check a list of payment amounts, rather than respond yes or no to a single payment amount as in dichotomous choice.

Dates of the surveys and other specific summary details of the applications are provided in Table 6. Summary descriptions of the estimated willingness to pay for

each of these resources are provided in Table 7. This table also provides a description of the population and sample size. Table 8 provides aggregate or total benefit estimates associated with each of the described changes in environmental services. This table also shows estimated shares due to existence motives by method, as described in the footnotes. Table 8 can be compared with Table 3, previously described. An obvious finding is that the estimated aggregate value varies considerably across resources, from on the order of $150 million for wolf recovery to as low as $2 million for improved **instream** flows on different sets of Montana rivers.

It is beyond the scope of this paper to provide a full description of each of these case studies. Rather than proceeding in detail through the tables (which are more or less self contained and available for the reader's reference), we will tersely summarize the implications of these studies for several of the methodological questions in this area of research. We will examine in turn each of the following issues: 1) survey design (bid distribution and range); 2) theoretical consistency; 3) utilizing preference measures in willingness to pay models; 4) share due to existence motives in total valuation, and; 5) validation of estimates. This listing is not intended to be comprehensive, but is rather an outline to the methodological focus of the case applications being discussed here. The remainder of this section is organized along the line of these issues or problem areas. The results of various combinations of the studies will be summarized as appropriate.

Survey Design

One focus of the research listed in Table 6 has been on survey design. An important survey design choice is the distribution of the sample among bid levels and also the selection of the bid amount ranges. Unlike open-ended contingent valuation, dichotomous choice is more demanding at the survey design stage: an appropriate bid range has to be selected and the researcher has to decide how to allocate the sample among these bids. In the past, and perhaps to a large extent in the present, the resolution of these issues has been rather ad hoc. Several of the papers presented in this symposium utilized dichotomous choice contingent valuation. The application presented by Gilbert [Editors' Note: See Gilbert, Glass, and More in Section II of this publication] placed most of the sample at the low bid amounts. By contrast, Haefele [Editors' Note: See Haefele, Kramer, and Holmes in Section II of this publication] allocated the sample equally among bids. It appears that in both of these applications, the bid allocation was intuitive.

One approach to selecting a bid distribution is statistical efficiency, in other words, bids should be distributed among the bid points in a way that provides the most precise estimate of a given welfare measure, The analytical basis for distributing a sample among bid points for a truncated mean is provided in **Duffield** and Patterson (1991). It is beyond the scope of this paper to describe this procedure in detail, but it will be noted that for typical types of willingness to pay distributions encountered in the literature, the most efficient sampling procedure is not at the low end or equally, but rather with the sample skewed toward the higher bid amounts. The use of statistically efficient procedures has lagged somewhat behind the increasing application of this tool in part because until very recently, estimated standard errors for commonly used welfare measures were not even available. The reader interested in a more comprehensive description of this bid design procedure should examine the study for Montana Department of Natural Resources and Conservation by **Duffield** and others **(1990).**

Theoretical Consistency

An important issue in the evaluation of dichotomous choice contingent valuation is the extent to which the responses are consistent with economic theory from at least two standpoints. The first is that the responses should be consistent with the model of individual choice derived from microeconomic theory. A brief discussion of this issue for the elk winter range study was previously provided. All of the studies listed in Table 6 provide multivariate relationships between willingness to pay and covariates. These results, as for the elk winter range, support the position that respondents appear to be answering honestly and their responses can be explained in part by their socioeconomic characteristics.

A second type of theoretical consistency (that is, a concern with contingent valuation in general) is the consistency of responses with respect to the individual's total budget constraint. One issue is whether the responses are more or less arbitrary depending on the set of other environmental resources mentioned in the hypothetical setting. For example, if you ask an individual to contribute to an elk winter range trust fund, do you get a very different response if you remind the individual that, by the way, there are problems with wilderness, global and environment degradation, tropical rain forests, disappearances of pandas and condors, and all the host of other valid competing demands on his budget? This is an important and broad area for research. A narrow aspect of this issue that we have examined is the

consistency of responses to changing magnitudes of the same resource service.

The study listed first in Table 6 (Duflield, Brown, and Allen, 1992) examined **instream** flows for a set of five Montana rivers. This included the Bitterroot, the Bighorn, the Gallatin, the Clark Fork, and the Smith. In a household mail survey of residents of five Montana cities and residents of the city of Spokane, Washington, survey participants were asked their willingness to pay to a hypothetical trust fund for improving summertime **instream** flows on these rivers. One subsample of respondents was asked to contribute to a trust fund for one river. Either the Big Hole or the Bitterroot was listed. Another subsample was faced only with the question of the willingness to pay for a trust fund for all live of the rivers. A multivariate logistic regression equation was estimated on this data that included a continuous dependent variable that took the level of 1 for the one river subsample and a level of 5 for the other rivers. This model also included a weighted average distance of the given respondent's residence from the river or rivers at issue. The estimated relationship (with the dependent variable as defined in equation 6) is given by equation 7.

Point estimates from this continuous relationship are provided in Table 7 for this study. For example, the value of maintaining **instream** flows on one river, other things being equal, is **$6.38,** while the value of five rivers $15.45. Similarly, the relationship of mean willingness to pay to distance and the difference between river users and nonusers is also provided in this table. Our general finding is that in this aggregate sense, responses are also consistent with microeconomic theory.

Utilizing **Preference Measures In Willingness To Pay**

In much of applied microeconomics, there is a curious dichotomy between theory and applications. Theory suggests that individual preferences and attitudes are very important in explaining economic demand choice between competing bundles of services. On the other hand, few applications actually provide measures of these preferences. Most of the studies being described here and listed in Table 6 are collaborative projects that have included a social psychologist, Dr. Stewart Allen. These studies have utilized a series of survey questions that include Lickert-scaled response categories (from strongly agree to strongly disagree) as one way to measure preferences. For example,

(7)

$$L = -10.91 \underset{(-.19)}{-1.3293 \ln BIDT} + \underset{(3.26)}{1.0421 \ln QUANT} + \underset{(2.16)}{.6004 \ln INC}$$

$$\underset{(-3.09)}{-.7843 \ln DIST} + \underset{(2.48)}{.5589 \ln ACTDAY} + \underset{(2.12)}{2.6787 \ln NONUSE} \quad (7)$$

Where BIDT is the bid amount, QUANT is the number of rivers, INC is household income, DIST is mileage, **ACTDAY** is days of recreational activity on rivers per year, **NONUSE** is a measure of an altruism motive and t-statistics are in parenthesis.

The finding is that both quantity and distance, among other variables, are significantly related to willingness to pay. It can be shown that the elasticity of willingness to pay (for a percentile welfare measure) to quantity (as crudely approximated here by number of rivers) is positive and less than one. (This holds for a number of different specifications as shown in Duflield, Brown, and Allen [1992]). For the specification shown, this indicates that average individual willingness to pay is an increasing function of rivers protected, but that marginal valuation is a decreasing function. This is as one would expect from basic consumption theory and the general diminishing marginal utility of any given service.

questions that were utilized in the elk winter range study were designed to measure various components of environmental attitudes relating to existence motives. These ranged from measures of concern, to guilt, to altruistic motives, to perceptions of the ecological role of predators.

As evidenced by the results in Table 5 for the elk winter range study, these preference measures are a very important explanatory component. It may be noted that there have been other applications of these preference measures in our work, including the use of preferences or motives to define market segments. An example is **Duffield** and Allen **(1988),** which provided a market segmentation analysis of angler types **based on** motives for participating in fishing recreation. For the reader interested in these methods, there is an extensive discussion provided in the final report for the Rocky Mountain Experiment Station study (Duffield, Brown and Allen, 1992). This work suggests that it is

possible and important to measure attitudes. The work of Richard Bishop and Thomas Heberlein at the University of Wisconsin provides a good example of this kind of successful collaboration.

Share of Total Valuation Due to Existence Motives

One issue that these studies have explored with regard to utilizing preference measures is the interpretation of the relative share of total valuation due to existence as opposed to use motives. One of the standard procedures is to use a follow up question where the individual is asked to apportion his total willingness to pay among different motives (Walsh, Loomis, and **Gillman, 1984).** This approach was used in a paper presented at this symposium by Haefele [Editors' Note: See Haefele, Kramer, and Holmes in section II of this publication]. Another approach is to ask a valuation question, both with and without use, and the difference of course, reflects the direct use component. This was done by Boyle and Bishop in their study of bald eagles and striped shiners (Table 3). An alternative method is to estimate the share to existence from the relative magnitude of the **coefficients** on the covariates in a model specified like that in Table 5. (See Duflield, Brown, and Allen **[1992]** for details.) The comparison of these different measures of existence share is provided in Table 8. As may be noted, there is remarkable consistency with the direct regression estimate of the share to existence as compared to a share based on the other two approaches described. This is an interesting result and provides a possible focus for future research. A disadvantage of asking a second CVM question or a follow-up question is that it adds to survey costs and may distort results due to respondent fatigue.

Validation of Contingent Valuation Estimates

There are a number of ways to examine the extent to which contingent valuation responses are valid. One approach is to compare estimates for the same resource using different methods. For example, Duffield and Allen (1988) provide a contingent valuation estimate of the values associated with fishing experience on a set of 19 blue ribbon Montana trout streams. These results can be compared with the estimates from **Duffield,** Loomis, and Brooks (1987) that used a travel cost estimate for the same set of rivers. These are very different methods, yet the resulting willingness to pay estimates showed a very similar ranking across rivers in terms of which is most valuable. Both **Spearman** and Pearson correlation **coefficients** were significant and in the range of 0.7 to 0.8.

Another approach to validation is to compare consumer surplus estimates from travel cost or contingent valuation to market prices for similar resources. One such investigation was undertaken for validation of estimated values associated with elk hunting in Montana. Duffield (1988) estimated a travel cost model estimate of the value of elk hunting in Montana across different hunting districts, while Loomis, Cooper, and Allen (1989) utilized contingent valuation for the same resource. A third model was developed from the market demand for nonresident hunting permits in Montana **(Duffield,** 1988). These are combination permits that will allow the hunter to take elk, deer and other big game, but the primary motivation generally is elk hunting. Since the price for these permits has increased from $150 in the early 70s to about $450 at present, it is possible to estimate the relationship between price and the number of permits sold. The estimated consumer surplus from the permit-based model was quite similar to the estimates derived from both travel cost and contingent valuation. The comparison is not exact for the travel cost model because it was not possible to separate out just the nonresident demand component. Nonetheless, the findings were generally supportive.

Another market example that relates to the findings reported here is that the State of Montana auctions off several bighorn sheep permits every year to benefit a sheep conservation group. These actual auction prices for a single permit have averaged from $80,000 to over $100,000. This provides some support for the proposition that there are some very high willingness to pay amounts in the population and provides some justification for the typical finding that these distributions are generally quite skewed.

A related issue is reliability. A standard scientific criteria is whether the results can be replicated. A number of these replication experiments have been completed including Loomis's (1989) test/retest analysis of contingent valuation responses concerning Mono Lake. Duflield **(1989b),** in a study of the value of the Rock Creek fishery in Montana, was also able to compare contingent valuation results for the same resource from samples taken in separate years. The finding was that the responses in the two samples were not significantly different. These results tend to confirm the view that contingent valuation estimates are meaningful and not just the result of random responses.

Still another approach to validation is by doing side by side comparison of a standard hypothetical contingent valuation measure with a separate sample, where individuals are in a so-called simulated market setting (where actual cash transactions are utilized). One of

the first such studies was reported by Bishop and Heberlein (1979) in an innovative comparison of willingness to pay and willingness to accept of goose hunters for the right to hunt on a wildlife refuge in Wisconsin. Their finding was that the derived welfare measures were fairly similar, with cash and hypothetical willingness to accept differing by about 40 percent. Bishop and Heberlein (1986) have conducted similar studies for access to deer hunting opportunities on the Sandhill area in Wisconsin. Again, the finding is that the cash and hypothetical valuations are similar. This previous research along these lines has tended to be limited to direct recreational use. An important question is whether the same type of validity can be established for measuring total valuation or existence values. This is perhaps a more complicated area in that often these are public goods, and one faces the problem of free riders. By definition, exclusion of individuals from the existence service is not possible.

The last study listed in Table 6, which was supported by the U.S. Environmental Protection Agency, was designed to field test contingent valuation as a way to measure existence values. The resource being valued was habitat improvement through augmented instream flows on several small tributary streams; the streams provide important spawning habitat for several threatened fisheries. The fisheries examined included Swamp Creek in the Big Hole drainage of Montana for Arctic grayling (the only fluvial grayling population in the lower 48 states) and the threatened Yellowstone cutthroat population on Big Creek in the Paradise Valley area of Montana. Montana has recently instituted a demonstration water leasing program. This program authorizes the Montana Department of Fish, Wildlife, and Parks to lease irrigation or other consumptive water rights for purposes of improving instream flow for important fishery resources. This program provided an institutional setting for testing existence values.

In the case at hand, an agreement was developed between Montana Department of Fish, Wildlife and Parks, the University of Montana, and the Montana Nature Conservancy. The latter is a private nonprofit conservation organization that is experienced in developing trust funds and generally implements its conservation objectives through direct purchases in the market, either of land or water rights. In this setting, three different survey instruments were developed. One was a actual cash solicitation instrument through the Nature Conservancy for contributions to a Montana Water Leasing Trust Fund. The other two instruments were hypothetical in the sense that only hypothetical (contingent valuation) responses were solicited - not actual cash donations. One hypothetical survey instrument also went out under Nature Conservancy letterhead, and the third instrument was a typical contingent valuation survey sent under University of Montana letterhead. In the latter, individuals were asked to assume that a trust fund existed and were asked if they would be willing to contribute if they knew that it would benefit these fisheries. The Nature Conservancy hypothetical instrument was intermediate in that it included the same brochure describing the real water leasing trust fund, but did not solicit cash donations at this time. In other words, a set of instruments were designed of an increasingly hypothetical nature, the last being typical of academic research instruments in this field.

At this point in time, only preliminary results are available (Duffield and Patterson, 1992). However, these are summarized at the end of Table 7. The basic finding is that, just as for the cash transaction experiments for direct recreational use services, it appears that there is a consistency between the cash and hypothetical responses. This is for a resource where clearly the existence motive would have to be dominant. For the cash transactions with a sample of about 500 respondents, the mean donation is $8.44 (Table 7). The hypothetical responses are quite similar, ranging from an average of $8 to $12. When the responses are disaggregated by residence status (Montanans versus nonresidents), the contingent valuation estimates track the substantial difference in the average cash donation across these two subsamples. These findings seem to support the proposition that contingent valuation measures of existence and total values provide meaningful measures. However, another finding of the study is that survey response rates are substantially lower for the cash transaction. The implication of this is that one would be cautious about aggregating contingent valuation responses to the broader population. These findings suggest the need to examine nonrespondents.

These findings also raise issues about the choice and interpretation of the payment vehicle. In the EPA study application, the payment vehicle used is a trust fund. In other related research where a trust fund vehicle was also used (Duffield, Brown, and Allen, 1992), the respondents were asked who they thought should be responsible for taking care of instream flows. Almost 70 percent of respondents thought the federal government was the appropriate party, about 40 percent felt it was state government and only 22 percent felt that private trust funds were an appropriate way to fund instream flow transactions. Given these moral considerations about who is responsible, it appears that trust funds, while a valid and useful type of a payment vehicle, may be providing conservative estimates of total resource values. Alternatively, this information should be taken into

account in evaluating participation rates for purposes of aggregation.

To conclude, the emerging body of literature that evaluates the validity of contingent valuation seems to be generally supportive of the proposition that these techniques can provide meaningful measures of willingness to pay for environmental services. The specific preliminary findings outlined here for our cash transactions experiment seem to indicate that these results may also hold when existence motives are a significant component of total valuation.

REFERENCES

Bishop, R.; Heberlein, T. 1979. Measuring values of extra-market goods: Are indirect measures biased? American Journal of Agricultural Economics. **61:926-30.**

Bishop, R.; Heberlein, T. 1986. Does contingent valuation work. In: Cummings, R.; Brookshire, D.; **Schulze,** W., eds. Valuing environmental goods. Totowa, NJ: **Rowman** and Allanheld Publishers: 123-147.

Bowker, J.; Stoll, J. 1988. Use of dichotomous choice methods to value the Whooping Crane resource. American Journal of Agricultural Economics. **70:372-81.**

Boyle, K.; Bishop, R. 1987. Valuing wildlife in benefit-cost analysis: A case study involving endangered species. Water Resources Research. **23(5):943-950.**

Boyle, K.; Bishop, R. 1988. Welfare measurements using contingent valuation: A comparison of techniques. American Journal of Agricultural Economics. **70:21-27.**

Butkay, S.; Duffield, J. 1990. **Wildlife** and **fish** in the Northern Region: Literature review of economic studies of hunting, **fishing,** and wildlife viewing. Missoula, MT: U.S. Forest Service and Montana Department of Fish, Wildlife, and Parks.

Cameron, T. 1988. A new paradigm for valuing **non-**market goods using referendum data: Maximum likelihood estimation by censored logistic regression. Journal of Environmental Economics and Management. **15:355-79.**

Clawson, M. 1959. Methods of measuring the demand for and value of outdoor recreation. Reprint no. 10. Washington, DC: Resources for the Future, Inc.

Davis, R. **1963.** The value of outdoor recreation: An economic study of the Maine woods. Cambridge, MA: Harvard University. Dissertation.

Duffield, J. 1988. The net economic value of elk hunting in Montana. Helena, MT: Montana Department of Fish, Wildlife, and Parks.

Duftield, J. 1989a. Nelson property acquisition: Social and economic impact assessment. Helena, MT: Montana Department of Fish, Wildlife and Parks.

Duffield, J. 1989b. Economic analysis of fishery management policy on Rock Creek. Helena, MT: Montana Department of Fish, Wildlife, and Parks.

Duffield, J. 1991. Existence and nonconsumptive values for wildlife: Application to wolf recovery in Yellowstone National Park. In: Kling, C.L., ed. Benefits and costs in natural resources planning. Davis, CA: Department of Agricultural Economics, University of California, Davis.

Duffield, J.; Allen, S. 1988. Angler preference study **final** economics report: Contingent valuation of Montana trout fishing by river and angler subgroup. Helena, MT: Montana Department of Fish, Wildlife, and Parks.

Duffield, J.; Brown, T.; Allen, S. 1992. Economic valuation of recreation and preservation benefits of **instream** flow. (Technical bulletin in prep.). Fort Collins, CO: USDA Rocky Mountain Forest and Range Experiment Station.

Duffield, J.; Loomis, J.; Brooks, R. 1987. The net economic value of fishing in Montana. Helena, MT: Montana Department of Fish, Wildlife, and Parks.

Duffield, J.; Neher, C.; Patterson, D.; Allen, S. 1990. **Instream** flows in the Missouri River **Basin:** A recreation survey and economic study. Helena, MT: Montana Department of Natural Resources and Conservation.

Duffield, J.; Patterson, D. 1991. Inference and optimal design for a welfare measure in dichotomous choice contingent valuation. Land Economics. **67(2):225-39.**

Duffield, J.; Patterson, D. 1992. Field testing existence values: An **instream** flow trust fund for Montana rivers. Paper presented at the Association of Environmental and Resource Economics annual meeting; 1992 January; New Orleans, LA.

Dwyer, J. 1978. Estimating recreational values for the 1980 RPA program. Paper presented at the RPA workshop on resources value; Washington, DC.

Efron, B. 1982. The jackknife, the bootstrap, and other resampling plans. Philadelphia: Society for Industrial and Applied Mathematics.

Hicks, J. 1943. The four consumers' surpluses. Review of Economic Studies. **11:31-41.**

Hanemann, W. 1984. Welfare evaluations in contingent valuation experiments with discrete responses. American Journal of Agricultural Economics. **66:332-41.**

Hanemann, W. 1989. Welfare evaluations in contingent valuation experiments with discrete responses: Reply. American Journal of Agricultural Economics. **71:1057-61.**

Just, R.; Hueth, D.; **Schmitz,** A. 1982. Applied Welfare Economics and Public Policy. Englewood Cliffs: Prentice-Hall.

King, D.; Flynn, D.; Shaw, W. 1988. Total and existence values of a herd of desert bighorn sheep. Western Regional Research publication W-133. Benefits and costs in natural resources planning: 243-264.

Krinsky, I.; Robb, A. 1986. On approximating the statistical properties of elasticities. The Review of Economics and Statistics. **68:715-19.**

Krutilla, J. **1967.** Conservation reconsidered. American Economic Review. **57(4):77-86.**

Loomis, J. 1989. Test re-test reliability of the contingent valuation method: A comparison of general population and visitor responses. American Journal of Agricultural Economics. **71(1).**

Loomis, J.; Creel, M.; Cooper, J. 1989. Economic benefits of deer in California: Hunting and viewing values. Institute of Ecology report **#32.** Davis, CA: University of California.

Loomis, J.; Cooper, J.; Allen, S. 1988. The Montana elk hunting experience: A contingent valuation assessment of economic benefits to hunters. Helena, MT: Montana Department of Fish, Wildlife, and Parks.

Loomis, J.; Sorg, C. 1982. A critical summary of empirical estimates of the values of wildlife, wilderness, and general recreation related to national forest regions. Fort Collins, CO: Report for the Rocky Mountain Range and Experiment Station.

Park, T.; Loomis, J.; Creel, M. 1989. Confidence intervals for evaluating benefits' estimates from dichotomous choice contingent valuation surveys. Nebraska: Department of Agricultural Economics, University of Nebraska.

Randall, A.; Stoll, J. 1983. Existence value in a total valuation framework. In: Rowe, R.; Chestnut, L., eds. Managing air quality and scenic resources at national parks and wilderness areas. Boulder, CO: **Westview** Press.

Serfling, R. 1980. Approximation theorems of mathematical statistics. New York: John Wiley and Sons.

Walsh, R.; Johnson, D.; **McKean,** J. 1988. Review of outdoor recreation economic demand studies with nonmarket benefit estimates, 1968-1988. Fort Collins, CO: Report for USDA Rocky Mountain Forest and Range Experiment Station.

Walsh, R.; Loomis, J.; **Gillman,** R. 1984. Valuing option, existence and bequest demands for wilderness. Land Economics. **60(1):14-29.**

Ward, K.; Duflield, J. 1992. Natural resource damages: Law and economics. New York: John Wiley and Sons.

Wood, S.; **Trice,** A. 1958. Measurement of recreation benefits. Land Economics. x195-207.

Table 1. Recreation and wildlife related economic valuation studies available for Forest Service RPA review by year.

Year	Total studies	Number of specific estimates		
		Total	Big Game	Trout fishing
1978	15	34	7	5
1982	36	95	15	15
1988	120	287	56	40

Source: Derived from Dwyer (1978), Loomis and Sorg (1982), and Walsh, Johnson, and McKean (1988).

Table 2. Allocation of research effort to wildlife economic valuation versus recreation participation rates for United States and Montana as of 1988.

Category	Wildlife valuation studies		Percent participation	
	Number	Percent	U.S.	Montana
Hunting	42	40.4	9.2	25.2
Fishing	57	54.8	25.6	37.1
Noncons.	5	4.8	74.0	90.0
Existence	(3)	(2.9)	?	?
Total	104	100.0		

Source: Derived from Butkay and Duffield (1990) and Walsh, Johnson, and McKean (1988).

Table 3. Previous total valuation studies of wildlife resources.

Resource	Total value (million 1989 $)	Percent valuation for: hunting	viewing	existence
A. Total valuation including existence				
whooping crane - US	5127.2			
bald eagle - Wisconsin	28.1		.03	.97
striped shiner - WI	12.0			1.00
desert big horn - AZ	3.9		.37	.63
B. Consumptive and nonconsumptive				
deer - California	279.1	.82	.18	

Source: Butkay and Duffield (1990).

Table 4. Response to dichotomous choice contingent valuation question for expanding elk winter range for the Northern Yellowstone herd.

Donation ($)	Sample	Yes resp.	Probability	Fitted prob.
1	675	597	.884	.918
5	41	30	.732	.743
10	41	30	.732	.618
25	70	30	.429	.428
50	103	24	.233	.295
100	149	24	.161	.189
200	111	20	.180	.116
300	110	7	.064	.085
500	60	5	.083	.055

Source: Duffield (1989a). Fitted probability based on bivariate logistic regression estimate.

Table 5. **Multivariate** logistic regression estimate for dichotomous choice contingent valuation response to trust fund donation for **elk** winter range, Northern **Yellowstone** herd.

Variable	Parameter	Mean	**Elasticity**	Motive share
constant (t-statistic)	**-24.0499** (-3.74)			
lnTRUST	**-.98448** **(-9.96)**			
lnINCOME	**.48398** (3.03)	44,775	**.492**	
lnTRIPSF	**.22486** (1.42)	2.198	**.228**	**.028**
HUNT	**.54382** (2.23)	**.281**	**.153**	**.019**
lnELKVW	**.81036** (1.54)	3.352	**.823**	**.101**
lnPRESER	6.8025 **(6.38)**	20.56	6.910	**.852**

Source: Duffield (1989a). Variable definition: TRUST = **dollar** donation amount; INCOME = household income; TRIPSF = trips taken to park this year; HUNT = dummy variable with **value** of "1" if respondent hunts big game; ELKVW = response to "importance of viewing elk" on visit to **Yellowstone;** PRESER = sum of responses to **Lickert scaled** questions measuring existence and preservation attitudes toward **wildlife.**

Table 6. Summary description of recent total valuation studies of fish and wildlife resources in the Northern Rockies.

Sponsor/method	Date of survey/population	Resource
1. USDA Rocky Mountain Experiment Station / dichotomous choice	Winter 1988-89 / Residents of five Montana cities	Increase **instream** flows on Bitterroot, Big Hole, and three other Montana streams
2. Montana Dept. of Natural Resources and Conservation / dichotomous choice	Fall 1989 / Montana residents and nonresident licensed anglers	Maintain **instream** flows in Upper Missouri River Basin (19 specific river segments)
3. Montana Department of Fish, Wildlife, and Parks / dichotomous choice	October 1989/ Yellowstone National Park visitors	Expand winter range for Northern Yellowstone elk herd by 10,000 acres
4. National Park Service / dichotomous choice	August-September 1990 / Yellowstone National Park visitors	Wolf recovery for Yellowstone (10 to 12 wolf packs)
5. U.S. Environmental Protection Agency / payment card	Winter 1990-91 / Montana resident and nonresident licensed anglers	Increase **instream** flow on Swamp Creek (Arctic grayling) and Big Creek (Yellowstone cutthroat)

Table 7. **Willingness** to pay per respondent for **total** valuation of resource services for five case studies in the Northern Rockies.

Study/resource	Population	Sample	Median	Mean
1. USDA / **instream** flow	river users	269		14.04
	nonusers	254		4.07
	value one river	368		6.38
	value five rivers	186		15.45
	10 miles away	554		35.94
	500 miles away	554		8.98
2. DNRC / **instream** flow	Upper **subbasin** res.	615	6.38	27.44
	(standard errors)		**(1.28)**	(2.41)
	Out of basin res.	608	3.79	14.92
			(.91)	(1.76)
	Nonresident anglers	431	5.08	33.07
			(1.44)	(5.31)
3. DFWP / **elk** range	Yellowstone National Park visitors	685	17.72	78.09
4. **NPS / wolf** recovery	All YNP visitors	586	18.68	69.97
	(standard errors)		(3.32)	(4.84)
	MT, WY, ID res.	172	15.38	59.04
			(5.30)	(8.77)
	Out of region res.	412	20.27	74.51
			(4.59)	(6.85)
5. EPA / MT **instream** flow	Cash - The Nature Conservancy	511	0.00	8.44
	Hypothetical - The Nature Conservancy	481	**0.00**	12.26
	Hypothetical - Univ. of Montana	795	**0.00**	8.14

Source: Duftield, Brown, and Allen (1992); Duffield, Neher, Patterson, and Allen (1990); Duffield (1989); Duffield (1991); Duffield and Patterson (1992).

Table 8. Total valuation of environmental services, aggregate estimates for four case studies in the Northern Rockies.

Study / resource	Population	Present value (million dollars)	Share due to existence (method 1	2	3)
1. USDA rivers	Montana residents	2.4	.65		.77
2. DNRC rivers	Montana residents	5.39			
	Nonresident anglers	1.92			
3. DFWP elk	Yellowstone visitors	35.9			.83
4. NPS wolves	MT, WY, ID residents	4.9		.43	.46
	Out of region res.	152.7		.70	.74
	All YNP visitors	157.6		.62	.67

Source: Duffield, Brown and Allen (1992); Duffield, Neher, Allen and Patterson (1990); Duffield (1989); Duffield (1991).

Notes: Aggregate value based on assumption of zero value to nonrespondent portion of population. Present values are in current year dollars for 1988, 1989, 1989, and 1990, respectively. Share to existence value methods are: 1) follow-up apportionment question; 2) comparison of response to contingent valuation question for with and without direct recreational use of the resource; 3) share based on regression coefficients in a model of willingness to pay, including measures of motives and preferences as independent variables.

VALUING THE BACKCOUNTRY RESOURCE: A TRAVEL COST ANALYSIS OF AN APPALACHIAN TRAIL TENT SITE IN THE WHITE MOUNTAIN NATIONAL FOREST

Christopher E. DeForest and Kenneth J. Andrasko'

ABSTRACT

A travel cost analysis of visits the Nauman tent site in the White Mountain National Forest was conducted, using visitor cards from 1975, 1980, and 1985. The authors calculated how far hikers had driven to the trailhead in order to drive the value of the tent site, estimate consumer surplus, and estimate changes over the period in consumer surplus on a per-person a per-party basis. A regional census data base for the 2,064 New England cities and towns within 300 miles of the tent site was constructed to look for correlations between hikers' hometown characteristics and visitation to the Nauman site. Distance from the site and per capita income were the only two correlations that proved significant. Similar analyses of the value of ecotourism in a tropical rain-forest reserve help illustrate the uses-- and limitations-of the travel cost method.

INTRODUCTION

The travel cost method has been developed as a technique to infer the value of a recreation site (Brown and Mendelsohn, 1984; **Clawson,** 1959). Information about how far people travel to a site (and back home again) suggests the value of the site. Constructing a regression between visitation and distance allows figuring the consumer surplus. Regressing visitation against variables other than distance may reveal information about what kind of people visit a given site--whether they tend to be from wealthy towns, ethnically diverse or heterogeneous towns, elderly towns, and so on. Further, a longitudinal data set over a decade allows recreation managers to look at trends in characteristics of visitors using their facilities, and to allocate resources accordingly.

SITE DESCRIPTION

The Nauman tent site is on the Appalachian Trail near Crawford Notch in the White Mountain National Forest of north-central New Hampshire. It has five 8 x 8'wooden tent platforms, a rocked-in spring, and a solar-composting outhouse. An Appalachian Mountain Club caretaker occupies one platform, maintains the area, and collects the visitor cards and fees. Overnight fees were **$1/person** in 1975, $2 in 1980, and $3 in 1985. Mizpah Hut is a full-service rustic hut 5 minutes' walk away, and at about **$20/night,** it caters to hikers less keen on "roughing it." Nauman is a 2.5 mile hike along Crawford Path up from Route 302, and requires a steep (1800 foot gain) climb through old spruce-fir stands to the tent site at 3800 feet amid subalpine vegetation. The Appalachian Trail passes by the Nauman tent site and the Mizpah Hut, and high alpine meadows and the Presidential Range peaks are within a day's **hike.**

DATA

Visitor Data Base

Appalachian Mountain Club (AMC) workers have been collecting visitor cards (and fees) on the White Mountain huts, shelters, and tent sites from June through August since the 70s. Each card has the visitor's hometown and state, the date of the visit, number in the party, and the fee paid. Cards tallied for overnight stays at the Nauman tent site for this project are shown in Figure 1. Several percent of the cards were illegible. Cards for visitors from beyond the **300-mile** study area were not entered because the sample would have included people making extended trips and visiting multiple sites in the area. The regression equations later proved this to be a reasonable cutoff point.

• **DeForest** is Research Coordinator, Center for Forest Business Management, D.B. **Warnell** School of Forest Resources, University of Georgia, Athens, GA, 30602. Andrasko is Senior Forestry Analyst, Climate Change Division, Office of Policy Analysis, U.S. Environmental Protection Agency, Washington, D.C. The authors wish to thank Professor Robert Mendelsohn, Yale School of Forestry and Environmental Studies, for his guidance and encouragement; and to acknowledge the assistance of Daniel Hellerstein, USDA Economic Research Service, and John Perez-Garcia, Center for International Trade in Forest Products (CINTRAFOR).

Regional Census Data Base

We compiled a regional census data base, using information from the 1980 Census. We entered variables for all 2,064 cities and towns (over 2,500 population) in Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, Connecticut, New York, New Jersey and Pennsylvania **within** 300 miles of the White Mountain National Forest (Figure 2). Census documents provided the socioeconomic information. Maps identified distance from each city to the center of the White Mountain National Forest. The total population represented in the study was almost thirty million residents.

Regional Data Base Variables

For each city or town, the data base had columns containing the name of county, name of town or city, "town" or "city" designation, total population, number of males, people age 65 or older, number of whites, distance (miles) from the WMNF center, percent foreign-born, percent completed college, percent of families with children under age six, median family income, percent in poverty, population density, and 1970 population.

METHOD

Travel Cost Method

The travel cost method estimates the value visitors place on a site, based on their travel behavior. More precisely, it measures the demand function for visits to a site, which says that visits are a function of price and perhaps other variables that might shift the demand function, such as income and age. It describes how many times people purchase trips depending on the price of the trip. As a proxy for price, the travel cost method relies on the cost of travel to the site. Travel is expressed as the round-trip distance from the site, in miles, which is later converted to dollars using a cost per mile factor.

The relationships between visitation rate, distance, and socioeconomic variables for 1975, 1980, and 1985 were computed by using a multiple regression. Gauss was used to estimate the coefficients of the equations best describing the travel cost curves for each of the three years, specifying the relationship between visitation rate per million capita and distance (miles) from the Nauman site. Following **Tobias** and Mendelsohn, another Gauss routine was used to calculate the consumer surplus for the Nauman site for each study year. Regressions were also run to test whether hometown socioeconomic characteristics had any bearing on visitation rates.

RESULTS

Regressing visitation against distance and the other nine variables describing hometowns in the study area resulted in statistically significant coefficients (T test > |2|) for distance, but for no other variables. The coefficients for distance were negative, as expected: visitation rates fell with hometown distance from the site. There were positive correlations between visitation rate and the "per capita income" and "population density" variables, but not at significant levels. All the other independent variables had changed from weakly positive to weakly negative or vice versa over the 1975-1980-1985 span, and none were significant.

Regressing visitation against distance and distance-squared produced the following coefficients used in this analysis and presented here in equation form for each year:

	Constant	Distance	Distance^2	R^2	F
1975 Visitation =	22.3618 +	**-0.1752D** +	**$0.0004D^2$**	.004	3.66
T Values:	(3.76)	(-1.95)	**(1.46)**		
1980 Visitation =	12.0891 +	**-0.0844D** +	**$0.0002D^2$**	.002	52.5
	(2.28)	(-1.05)	(0.58)		
1985 Visitation =	30.8222 +	-0.29241) +	**$0.0007D^2$**	.008	69.7
	(4.38)	(-2.76)	(2.03)		

Visitation is expressed in number of trips to the Nauman tent site per million capita, and distance is measured in miles.

Consumer Surplus

The **annual** consumer surplus for the Nauman site declined by over 50 percent from 1975 to 1985 (Figure 3). This resulted from fewer visits and fewer people traveling from distant hometowns. Per-party and per-person consumer surpluses rose from 1975 to 1980, then sagged from 1980 to 1985 (Figure 4). Since there were roughly the same number of visitors and parties in 1985 as in 1980, the visitors in 1980 had apparently driven from farther away than had their successors. Mendelsohn (1987) analyzed overnight summer camping at Nauman and two other Appalachian Mountain Club sites, Liberty and Garfield, for each of the years from 1974 to 1985 except 1976 and 1977. His figures show a decline in total and per visitor-day values for the three sites over the period, as illustrated in Figures 5 and 6.

COMMENTS ON THE TRAVEL COST MODEL

There are advantages to the travel cost method and its use in estimating backcountry recreation values. In its favor are its relative simplicity and its basis in revealed preferences ("Let's go hike to Nauman this weekend") rather than the "What if..." approach of contingent valuation methods. Detractors note that other methods--advanced travel cost, multi-site method, hedonic travel cost--offer more potential for analytic richness. These methods (and others discussed at this conference) may better explain what characteristics, in total and on the margin, make sites more visited and hence more valuable.

DISCUSSION

Not surprisingly, the analysis confirmed the hypothesis that visitation declines with distance from the site. More interesting are the changes in the value of Nauman and the other two sites, and the inability to attribute use of the Nauman site to any of the socioeconomic variables other than income. The positive, significant coefficients for income suggest that higher-income users are more likely to travel to the site, and that they are probably willing to pay more for the site than are lower-income people living at the same distance.

That hometown population density was positively correlated with visitation is also fairly intuitive--that people from densely populated areas were more likely to "head for the hills" than people from more rural areas. However, the correlations for population density were not statistically significant. It is unfortunate that none of the other variables were consistently negative or positive--let alone at significant levels-because significant correlations would have given more clues about the kind of people who use sites such as Nauman, and thus how backcountry recreation sites should be managed and marketed.

As noted above, consumer surplus changed markedly during the period, which is consistent with Mendelsohn's fmdings. Several factors probably influenced the decline in the value of the Nauman tent site. The backpacking fad may have ebbed, as **Baby-**Boomers and students grew older, had families, and may be opting for easier hikes and campgrounds that are more accessible and offer more creature comforts. Gas prices rose sharply over the period, as well. And the overnight fee tripled, although $3 seems minor after driving for hours and hiking up a mountain.

A recent Ambio article (**Tobias** and Mendelsohn, 1991) measured the value of ecotourism at a tropical **rain-**forest reserve in Costa Rica, using the travel cost method. The authors found that the recreation value of the Monteverde Cloud Forest Biological Reserve was high enough to suggest that "expansion of protected areas near the reserve is a well-justified investment, both from an economic and social perspective." The data from Nauman and the other White Mountain National Forest sites could support the same conclusion. In both instances, the travel cost method helps establish on-site recreation values, which may be weighed against the values of commodity outputs (e.g., timber or shifting agriculture) from alternative management strategies.

Yet the travel cost method, like most other methods of valuing wilderness or natural areas, provides only a partial valuation of the site. It imputes recreation value from travel distances, but it does not include other on-site and off-site values. One weakness in the Nauman valuation is that no visitor cards were collected for day-use of the site. The total value of the forest, as **Tobias** and Mendelsohn note, includes benefits from watershed protection, from renewable harvests of many commodities, and the little-quantified values of biological diversity and ecological services, on a local, regional, and global scale. Theories about the role of natural areas in global carbon sequestering and buffering climate change add urgency to the wilderness valuation endeavor. Better management decisions are predicated on having better information about the economic value of wildlands, be they atop the Appalachian Trail in New Hampshire or straddling the Continental Divide in Costa Rica's rainforests.

REFERENCES

Brown, W.; Mendelsohn, R. 1984. The hedonic travel cost method. Review of Economics and Statistics, No. 66.

Clawson, M. 1959. Methods of measuring the demand for and value of outdoor recreation. Resources for the Future, Washington, D.C.

DeForest, C.; Andrasko, K. 1986. Gimme shelter--but what's it worth? Valuation of Nauman tent site, White Mountain National Forest. Unpub. manuscript, Yale School of Forestry and Environmental Studies.

Mendelsohn, R. 1987. Measuring the value of recreation in the White Mountains. Appalachia **46(3):72-84.**

Tobias, D.; Mendelsohn, R. 1991. Valuing ecotourism in a tropical rain-forest reserve. Ambio **20(2):91-93.**

USFS, White Mountain National Forest. 1985. Forest Facts: White Mountain National Forest.

Part III. International Case Studies

INTERNATIONAL WILDERNESS - ISSUES, PROGRESS, AND CONCERNS

Vance G. Martin'

ABSTRACT

The wilderness concept, as a specific land-use classification, has made slow but steady progress outside the United States. Five other countriesSouth Africa, Australia, New Zealand Canada, and Zimbabwenow have someform of formal protection, although the United States is still the only country with a national act concerned specifically with wilderness designation and protection. This paper discusses some of the challenges encountered in the process of international adoption of the wilderness concept, and gives a progress report for the five countries (other than the United States) in which wilderness has formal protectionIn addition, it will briefly review the new Categories For Protected Areas of the World Conservation Union (IUCN) as it pertains to enhanced recognition and protection of wilderness areas internationally. While the internationalization of the wilderness concept is a positive development in global environmental conservation, several issues concerning the connections between wilderness, management, and sustainable development need close scrutiny as this process continues.

INTRODUCTION

The first wilderness area, the **Gila** Wilderness Reserve, was administratively designated in 1924 through the efforts of **Aldo** Leopold and others in the U.S. Forest Service. After **40** years of social growth, conceptual development, and political lobbying, the Wilderness Act was enacted in 1964, and has since empowered the designation of almost 100 million acres of public land in the U.S.

The adoption of the wilderness concept by countries other than the United States has evolved in a similar, albeit less dramatic and successful, manner. The progress toward adoption of the wilderness concept usually begins with administrative use of the term (i.e., zoning within an area already protected under another, established classification), and proceeds over time and with much debate to the adoption of some form of legal protection.

In contrast to the rapid international adoption of the national park concept in the late 19th and early 20th centuries, adoption of the wilderness concept has been a much more deliberate and debated process. In part, this can be attributed to the fact that many national parks were established in the colonial era, while wilderness per se has been largely a post-colonial phenomenon and therefore subjected to a different type of scrutiny. This is especially relevant to the issue of indigenous peoples. Equally important, however, is that the wilderness concept has subjective meaning - both individual and cultural - which poses specific challenges to its adoption.

SOME CHALLENGES TO ADOPTION OF THE WILDERNESS CONCEPT

1. Language - The evolution of language is highly subjective and often location-specific, and, therefore, many words have cultural definition. Wilderness is a good example. As is often cited, wilderness has its roots deep in Old English - "wild-deor-ness" literally meant place of the untamed beast (Nash, 1982). The wilderness concept is laden with cultural and subjective connotations, i.e., what is wild to a resident of Tokyo would usually appear controlled and manicured to a campesino or aborigine; and what is engaging and desirable in a wilderness area to one American can be feared and rejected by another.

The word wilderness has few equivalent terms in other languages. "Area silvestre" in Latin America literally means "forested area," but refers to a wilderness-type area; **"sauvage"** in French literally means savage and refers to an untamed or uncontrolled condition; "dikaya mestnost" in Russian refers to a specific, usually small, wild area, while "zapovedniki" is actually the official term used for a protected wilderness and literally means "forbidden area." It is not unusual, therefore, that all of the countries which now have formal protection of wilderness have English as the most common language of business and education, all of them being former British colonies.

The grammar of wilderness also bears consideration. When people use the word wilderness, it is often as an

*President of the National Leadership Foundation (WILD), 211 W. Magnolia, Fort Collins, CO SO521

adjective ("a wilderness experience," "a wilderness feeling") rather than as a noun. Even when used as a noun, referring to a specific place, it more often reflects the speaker's understanding of the condition of the place rather than naming the place itself ("this is a real wilderness"), suggesting a subjective, individualized concept.

2. Definition - A word with such varied meaning is obviously difficult to define as a land-use category. Through the four meetings of the World Wilderness Congress (WWC), an attempt has been made to synthesize the different definitions which have evolved. The main aspects covered in the WWC definition include:

- An enduring natural resource providing opportunities to experience pristine elements which comprise both the spiritual and physical wilderness experience;
- An ecological preserve of natural, diverse processes and genetic resources, primarily affected by nature with human impacts substantially unnoticed, and without mechanical transport or installations;
- Must enjoy the highest legislative protection; be of sufficient size to realize its essential nature; and be managed to retain its wilderness qualities.

The Resolutions Committee of the 4th WWC asked the IUCN's Committee on National Parks and Protected Areas to further revise the definition. The following definition has been adopted (Eidsvik 1990):

> Wilderness is an enduring natural area, protected by legislation and of sufficient size to protect the pristine natural environment which serves physical and spiritual well-being. It is an area where little or no persistent evidence of contemporary human occupation is permitted, so that natural processes will take place largely unaffected by human interaction.
>
> Wilderness areas stress non-mechanized access. As pristine natural areas, they should be established to ensure that future generations will have an opportunity to seek understanding in largely undisturbed areas.

Despite this significant accomplishment, difficulty in defining wilderness persists, especially concerning its size, relationship to other designated areas, and (especially) its appropriate management.

3. Elitism - This is the most difficult challenge to quantify. It has often been expressed by resource extraction industries and by many leaders of developing countries faced with pressing needs to raise the standard of living of their rapidly growing and poor populations. By referring to wilderness as a "rich persons' playground," it suggests little or no relationship to the needs of people in developing countries and to cash-starved economies.
However, the recognition of the economic impact of wilderness areas, especially through tourism and its potential for sustainable generation of financial resources, has begun to override the elitism argument. The fact that wilderness tourism generates immediate financial benefit is a decisive, short-term tool for use in wilderness preservation. The economic benefit of wilderness is much easier to communicate than some of the equally important, but more arcane, preservation arguments of biodiversity, global climate moderation, new products, and sustainable development.

The real challenge is not whether wilderness yields economic benefits, but rather how to create appropriate financial policy and mechanisms to assure that wilderness-generated economic benefits go directly to the local people themselves, and not only to tour operators and government officials.

4. Indigenous People - As the U.S. Wilderness Act was being formulated and debated, the issue of Native American rights was, at best, a minor matter. When the Alaskan wilderness debate intensified in the late 60s and early 70s, claims by Native Alaskans were clearly part of the agenda. This was accommodated originally by the Alaska Native Claims Settlement Act (ANCSA) of 1971, and further settled through the Alaska National Interest Lands Conservation Act (ANILCA) in 1980. Special provisions were made for hunting and gathering by Native Alaskans in wilderness areas, recognizing the special relationship between rural Alaskans and the wilderness resources upon which they depend. However, it is important to note that some 40 million acres of wilderness were designated in the lower 48 states without considering native issues.

As the wilderness concept is adopted outside of the United States, the issues of native inhabitation within wilderness and indigenous use of resources is perhaps the greatest single concern. This new emphasis is a significant development, and the difference between this and the original wilderness movement in the

United States is clearly seen when one considers that the U.S. Wilderness Act states that "man is a visitor who does not remain," and a common American wilderness slogan is to "take only photographs, leave only footprints." The rights of indigenous people to use ancestral wilderness for sustainable resource use and/or spiritual rituals is now an integral part of the international movement to conserve wilderness values.

PROGRESS REPORT

Australia

The political structure of Australia is such that the states, rather than the national government, are the key actors in natural resource management. Three of the five states - New South Wales, West Australia, and Victoria - plus the Northern Territory and the Australian Capital Territory (analogous to Washington, D.C.) have statutory recognition of wilderness. States have designated 15 areas ranging from 6,000 acres (2,400 ha) to 283,700 acres (113,500 ha), with other areas proposed (Land Conservation Council, **1990).**

Wilderness designation in Australia imposes only the wilderness name and not necessarily the requisite management. Actual management plans are usually limited to areas already within established reserves, such as National Parks. However, the need for management is widely recognized. A working group convened in 1983 by the Council of Nature Conservation Ministers and prepared guidelines for management of established wilderness throughout the country.

Citizen activism is a consistent force for wilderness designation in Australia. The Tasmanian Wilderness Society was the first non-governmental organization (NGO) to mount a major and successful wilderness campaign. The Wilderness Society of New South Wales is also active, especially in lobbying for a national wilderness act similar to that of the United States. An important new development is that the Australian Federal Government has agreed to fund a national wilderness inventory, to be completed by 1993, which will undoubtedly pave the way for further wilderness designation.

New Zealand

New **Zealand** has the distinction of being the first country outside of the United States to declare a wilderness area. However, though the first wilderness was administratively designated in 1955 (the 29,640 acre **[12,000** hectare] Otahake Wilderness), the wilderness responsibilities were dispersed between different national agencies with no single, coherent plan for designation and management. A unified movement began to emerge in 1985 when a **final** Wilderness Policy was issued by the Wilderness Advisory Group, a joint working committee composed of governmental and NGO parties. The three main criteria for an area to be declared wilderness are:

1. Large enough to require two days foot travel to traverse;
2. Clearly defined topographic boundaries and adequately buffered from human influences;
3. No developments, such as huts, trails, bridges, signs, or mechanized access.

By the end of 1989, six areas had been gazetted (designated) as wilderness, totaling 740,000 acres (300,000 ha), with another five areas zoned as wilderness management plans, totaling 394,000 acres (164,000 ha) (Barr, 1990).

While no formal national wilderness preservation system has been enacted in legislation, the formation of a Department of Conservation, incorporating the disparate, wilderness-related activities of the three former agencies, will hopefully prompt more rapid and cohesive progress towards wilderness designation.

A prime mover in this wilderness debate has been the Federated Mountain Clubs (FMC) of New Zealand, the principal conservation NGO in the country. The FMC has consistently kept wilderness on the agenda.

Canada

The 1988 revision of the National Parks Act required that the boundaries of wilderness zones in National Parks be designated through legislation. This process is just now getting underway, under the auspices of the Canadian Park Service. The potential is vast - 34 national parks cover 70,252 square miles (182,000 sq. km), of which 90 percent is wilderness quality.

At the provincial (analogous to state) level in Canada, only two of the nation's 10 provinces have legislation explicitly designed to protect wilderness - Alberta and Newfoundland. However, British Columbia and Ontario both have wilderness zones in other protected areas.

The hotbed of wilderness activism and designation has been in western Canada, in part because of the unusual concentration of mountain, river, and coastal wilderness, and the threat to these wilderness areas by resource industries. The wilderness movement there is

also inextricably tied to indigenous people's issues. For example, after a long struggle, agreement was finally reached in 1987 to establish, in cooperation with the **Haida** people, a wilderness national park in the Queen Charlotte Islands, with full participation by the indigenous people themselves in policy development and management.

Also in British Columbia, wilderness activists have begun to rely heavily on the potential economic impact of tourism as a major plank in their platform. For example, a unique land zonation system for tourism has been proposed for all of British Columbia for the specific purpose of wilderness protection. Wilderness is designated as a special back-country zone with appropriate management and access (Careless, 1990).

Finally, the British Columbia Forest Service issued its Wilderness Management Policy in 1989. It provides for the establishment of wilderness areas within Forest Service territory, with a minimum size of 2,500 acres (1,000 ha). Clearly, the push for adequate wilderness protection in Canada is gaining strength and sophistication, and much progress will be made in the **90s.**

South Africa

The first wilderness area in Africa was zoned administratively in the Umfolozi Game Reserve, South Africa, in 1958. By 1971 the nation-wide Forest Act had been amended to legislatively recognize wilderness in National Forests. In addition, there are still wilderness zones administratively declared both in National Parks and Provincial Game Reserves.

Currently 12 areas are legally declared under the Forest Act, protecting **844,800** acres (340,900 ha) as designated wilderness, which have good management plans in operation or in development. Numerous wilderness zones exist in National Parks and Game Reserves (most, but not all, actually managed as wilderness), totaling at least 1.75 million acres (715,000 ha). Three additional areas are proposed as National Forest wilderness, totaling 214,000 acres (85,000 ha) (Bainbridge, 1990).

South Africans are intensely proud of their natural heritage of wildlife and wilderness, and wilderness "trails" (or treks) are very popular, usually being booked far in advance. Significant accomplishments in wilderness designation have been achieved in South Africa. There is even a group of conservation professionals and private citizens, the Wilderness Action Group, who are lobbying for passage of a national wilderness act.

Now that apartheid legislation is being effectively dismantled, and a new constitution and political structure are being created, the critical issue of future land-use designation is yet to be determined. The pressing needs presented by a population growth rate of 2.7 percent, which is even higher among poor, rural blacks (Huntley and others, 1989) pose critical questions for South Africa and its wilderness movement.

Zimbabwe

Zimbabwe **was** the first truly developing nation to adopt the wilderness concept. The Mavuradonna Wilderness Area was officially designated in 1989, and is unique in that it was designated by a tribal authority on communal land. Though not a precise analogy, the legal status is that of a state law in the federal system.

The Mavuradonna Wilderness Area is approximately 192 square miles (500 sq. km) in the escarpment area of the Zambezi Valley (Department of National Parks and Wild Life Management, 1989). While originally conceived to include both wildlife cropping and sport hunting as well as wilderness hiking and game viewing, further study narrowed the management plan specifically to non-consumptive uses. Thii was both unexpected and unusual for Africa, where great emphasis is placed on the economic benefits of consumptive wildlife use. The local Tribal Council has as yet received no real income from the area, but apparently sees the wilderness as protection for its natural heritage [Editor's note: See Monro in section III of this publication.]

The Zimbabwean example has several other unique aspects, most notably that the designation of the wilderness area was not preceded by an adversarial struggle between government, activists and development advocates. With a minimal amount of debate, local people accepted quickly the concept of a wilderness area and agreed on a management plan to facilitate it.

This wilderness movement is part of an innovative effort called Communal Areas Management Plan for Indigenous Resources (CAMPFIRE), one of the new programs in post-colonial Africa which integrates the needs of local people with the objectives of natural resource conservation. CAMPFIRE is under the authority of the government's Department of National Parks and Wildlife Management but is managed jointly with the Zimbabwe Trust, a conservation NGO. CAMPFIRE now includes numerous other proposed wilderness areas, and the Mavuradonna example will be monitored closely as a prototype.

WILDERNESS PROGRESS IN OTHER AREAS

While formal protection of wilderness is **limited** to the five countries reviewed above, plus the United States, protection of wilderness values does exist elsewhere. Wilderness designation is often not adopted because of difficulties in adapting the concept (as discussed above), and because wilderness values are sometimes thought to be protected under existing forms of designation, such as national parks, scientific reserves, game reserves, etc. However, in some countries where wilderness legislation does not exist, the wilderness concept does occur, for example, in the southern Africa country of Namibia.

In some areas, especially Latin America, the term wildlands is more culturally acceptable than wilderness. Because of geo-cultural ties between the United States and Latin America, there has been a significant amount of north-south cooperation on **wildland** issues in research, management, and institution building.

The Antarctica issue has given the wilderness concept a boost on the international scene. The concept of an "International Wilderness Park" for the entire continent was proposed by New Zealand and France. Though not widely accepted, the idea persists, and ultimately there may be some sort of wilderness designation involved in the legislative approaches and protocols to the management of Antarctica.

The adoption of the wilderness concept is not limited solely to terrestrial areas. The 2nd World Wilderness Congress **(WWC),** in Australia in 1983, discussed the proposal for a wilderness zone in the Great Barrier Reef Marine Park. At the 4th WWC in the United States in 1987, the concept of oceanic and marine wilderness was launched by the National Oceanic and Atmospheric Administration.

Many other examples exist which show the term 'wilderness" beginning to be used in places where English is not the primary language. An unusual example is Italy, where the Wilderness Associazione works on behalf of wilderness recognition and protection. The Scandinavian countries are also notable in this regard and, while there is not yet any form of statutory protection of wilderness, the term appears often in the conservation literature of Norway, Sweden, and Finland. In fact, the Arctic Center at the University of **Lapland** in Finland initiated a new project in 1991 entitled "Wilderness - The Biological and Sociological Meaning in the Northern Areas." With the 5th World Wilderness Congress (WWC) convening in Norway in 1993, the wilderness concept could advance in Scandinavia.

WILDERNESS RECOGNITION, BY THE WORLD CONSERVATION UNION(IUCN)

The IUCN'S Committee on National Parks and Protected Areas (CNPPA) has just adopted a new Framework for the Classification of Terrestrial and Marine Protected Areas (Eidsvik, 1990). This latest version includes a wilderness category for the first time since 1973, when wilderness was downgraded from a category to a zone. The new categories are:

I. Scientific Reserves and Wilderness Areas
II. National Parks and Equivalent Reserves
III. Natural Monuments
IV. Habitat and Wildlife Management Areas
V. Protected Land/Sea **Scapes,** plus: Areas Recognized/Designated Under International Instruments (World Heritage; Ramsar; Biosphere Reserves); and Unprotected Areas.

This is a significant accomplishment, following years of intensive debate within the IUCN and gradual progress toward this end through the WWC. While this does not imply any form of statutory protection, by acknowledging wilderness as a legitimate land-use category, it creates and lends considerable strength to efforts by local/national agencies and activists towards greater wilderness protection.

WILDERNESS, MANAGEMENT, AND SUSTAINABLE USE- AN INTERNATIONAL CHALLENGE

The wilderness concept is making slow but steady international progress. As each country goes through the process of debate, adoption, and designation, a process of change occurs as the concept adapts to a new country and society. This should be expected of a concept with such a strong cultural basis. As this occurs, however, we need to closely consider several matters.

First, there must be a clear distinction between that which is designated wilderness and that which should be a national park or wildlife management area. At face value, this may sound obvious. However, it is not unusual for areas to be referred to as wilderness that simply are not wilderness, even in a general sense. While adoption of the wilderness concept will definitely be encouraged by widespread and general use of the term, there are dangers that wilderness could become the Kleenex or Xerox of land-use protection, i.e., a generic term which doesn't distinguish quality or value.

Second, as discussed, there are indications that the wilderness concept is gradually being accepted in

developing countries. As this trend continues, we must beware of creating the wilderness equivalent of the "paper parks" that exist in many countries around the world. Management is needed. If management is not applied, then wilderness values will rapidly disappear, largely because of the massive population pressures in most developing countries.

Third, the management style needs to be light-handed, but consistent, and one which differentiates and protects the values relevant to a wilderness philosophy in the host country. While some sophistication is needed, in the end such a management policy simply needs to keep the "wild in wilderness.

Finally, the current buzzword in international conservation is "sustainable development." The wilderness movement needs to simultaneously integrate with, and tread lightly around, this concept. It is true that people have always used wilderness resources. At times, native people have lived in some degree of harmony with nature. But as much as this harmony may have sprung from a mystical appreciation of the earth, it was also maintained by a sheer preponderance of wilderness when compared to the number and concentration(s) of humans.

This has all changed. Even in Africa, Latin America, and Asia, wilderness areas are no longer blank spaces on the map surrounding human settlements. A few large bits are left, but wilderness areas are now a series of increasingly smaller, unconnected islands, surrounded by too many people. The current call for sustainable use of all natural areas is the result of a correctly perceived lack of adequate land, and the obvious lack of equitable, global financial relationships, to support a human population grown out of proportion to its natural environment.

As human numbers continue to increase, sustainable development will inevitably clash with wilderness. As currently conceived, the whole concept of sustainability comes from a completely anthropocentric perspective. Wilderness, by definition, demands a degree of biocentrism if it is to remain at all wild.

REFERENCES

Bainbridge, W.R. 1990. Private correspondence to Vance Martin.

Barr, Hugh. 1990. Federated Mountain Clubs of New Zealand. Private correspondence to Vance Martin.

Careless, Ric. 1990. Tourism resource **planning** as applied to Western Canada. Gibsons, BC, Canada: Ethos Consulting.

Department of National Parks and Wild Life Management, Zimbabwe. 1989. The status of projects involving wildlife in rural development in Zimbabwe, 1989 Report. **Harare,** Zimbabwe: Department of National Parks and Wild **Life** Management.

Eidsvik, Harold. 1990. A framework for the classification of terrestrial and marine protected areas. Gland, Switzerland: IUCN - The World Conservation Union.

Hendee, John C.; **Stankey,** George H.; Lucas, Robert C. 1990. Wilderness Management, chapter 3. Golden, CO: North American Press of Fulcrum, Inc.

Huntley, Brian; Seigfreid, Roy; Sunter, Clem. 1989. South African environments into the 21st century. Capetown, South Africa: Human **&** Rousseau Ltd.

Land Conservation Council. 1990. Wilderness special investigation descriptive report. Melbourne: Victorian Government Printing Office.

Nash, Roderick. 1982. Wilderness and the **american** mind, third edition. New Haven, CT: Yale University Press.

WILDERNESS IN SOUTH AFRICA

Roland Goetz*

INTRODUCTION

Through my experiences, first working with the Durban Museum on a variety of aspects concerning Later **Stoneage** Man and second with the Natal Parks Board in the field of environmental education, especially the rural Zulu communities, I became fascinated with humans' impact on the natural world. In tracing back to the earliest days of human development to the present day, a clear pattern emerges. To understand this pattern opens a whole new dimension in the field of environmental protection and wilderness management. The future of the wildlands of South Africa are at a crossroads. An opportunity exists to do it right or lose it all.

HISTORY OF THE CONSERVATION MOVEMENT IN SOUTH AFRICA

The African conservation movement began with the first inhabitants, the Australopithicafranus, who harvested natural resources and lived in harmony with the natural world. In the **1200s,** the Umguni moved into South Africa along the East Coast, bringing their herds of cattle with them. During the Stone Age, the San lived in harmony with the land, and it was about that same time (1652) that white people moved into the Cape region. Then came development by the Portuguese, followed by the Dutch, French, and English. These people brought with them the idea of setting land aside for conservation and controls in the use of natural resources. In fact, some of the first laws passed in South Africa were in connection with the cutting down of the yellowwood trees in the Knysna Forest.

Around the turn of the century, there was tremendous industrial growth. The mineral wealth of the region became apparent with the discovery of gold, diamonds, and other precious minerals. With this came the development of cities that encroached on the surrounding natural habitats.

On 27 April 1897, the Umfolozi, Hluhluwe, and St. Lucia reserves were proclaimed. These reserves were initially proclaimed in order to preserve certain endangered species, such as the White Rhinoceros. The protection and preservation of individual species is what commenced the conservation movement in South Africa.

After the reserves were proclaimed, wildliie managers began to realize that animals did not live in isolation from one another or from their environments; they were part of a whole system that needed protection. This triggered a new found understanding of the ecological processes that govern wild areas. In 1957, Dr. Ian Player determined the need for wilderness management. He set aside the first wilderness management area in Africa. In the early **1960s,** human beings were beginning to be recognized as an integral and vital part of wilderness ecosystems. Up until this time, humans were viewed as enemies to wilderness preservation and protection. Dr. Player saw **things** differently. He saw the value in bringing young potential decision-makers into the wilderness to encourage their environmental awareness and appreciation. Thus, the Wilderness Leadership School was born.

In 1971, Danie Ackerman, Chief Director of Forestry, helped change conservation legislation, through an act of Parliament, to include wilderness designation in Forestry Act 122. Currently, the State President's Council is considering a proposal that wilderness conservation be included in a national environmental management system. Other proponents of the proposal include wilderness consolidation for improved management and that areas presently managed as administrative areas get statutory protection.

In looking outside the reserves, population is increasing at an alarming rate. Consequently, people are beginning to question whether the reserves are a valid issue when people are starving. Unfortunately, the people don't understand that they are an integral part of the ecosystem. People are starving because they are degrading and depleting the natural resources rather than actively managing and using the resources for sustainable development.

People are leaving the outlying lands and moving into the urban areas by the thousands every day. Durban is

*International Wilderness Leadership School, Natal, South Africa.

one of the fastest growing cities in the world. The outlying lands have been so degraded that areas in **Zululand** are no longer able to support the people. And there are no jobs for people who move to the cities. They are dying of disease, pollution, and starvation.

Conservation education and management in South Africa is proving necessary to human survival. People need to see themselves as part of an integral and vital system instead of outsiders to a system that cannot sustain itself.

REFERENCES

Hendee, John C.; **Stankey,** George H.; Lucas, Robert S. 1990. Wilderness management, 2nd ed. Golden, CO: Fulcrum.

Maggs, T. M. O'C.; Ntshekane, Michael M. 1979. Early Iron Age site on the Tugela Basin. Natal: Natal Museum.

Natal Parks Board. **1899?.** Field guide to the Hluhluwe-Umfolozi complex. Natal: Natal Parks Board.

Odendaal, A. W. 1985. Cultural perceptions of conservation behavior education, with specific reference to **KwaZulu.** A research report. Pretoria: University of Pretoria.

THE CAMPFIRE PROGRAM IN ZIMBABWE: THE ECONOMIC BENEFIT OF WILDERNESS AREAS TO RURAL PEOPLE

Rob Monro*

INTRODUCTION

CAMPFIRE stands for the Communal Areas Management Program for Indigenous Resources. Communal areas were the previously designated areas of tribal trustlands. What CAMPFIRE is seeking to do is to devolve the decision-making control and management of natural resources, so that local communities not only manage these resources, but they also benefit from those resources directly. There is a direct link between the conservation and the economic benefits that they receive.

Zimbabwe consists of 350,000 square kilometers, with over ten million people residing. Although 13 percent of total land area has been officially given over to wildlands, approximately one-third of the country of Zimbabwe is being used for wildlife-based activities.

Zimbabwe has five agri-ecological regions. Regions Four and Five are semi-arid regions, where rainfall is no more than 650 mm. per annum. As in most of southern and south central Africa, the only land-use option for these areas is for either domestic or wild animals The communal areas are coterminous with Regions Four and Five, which suggests that the only ecologically and economically viable land use is management of wildlife or domestic livestock. Outside the protected areas, 74 percent of these semi-arid and arid regions lie within the communal areas, which severely restricts the livelihood options and provides the basis for implementation of the CAMPFIRE program.

THE ORIGINS AND PROGRESSION OF CAMPFIRE

It is the belief in Zimbabwe that unless economic value is appropriated and realized by those people who live adjacent to the wilderness areas, there will be no wilderness left. In Zimbabwe, as in most other African countries, poverty is the major problem, and wilderness and wildlife must pay their way in order to survive. The wildlife represents significant potential for enhanced food security for rural people. At the moment in many areas, rural people get costs from wildlands rather than benefits. They have been asked to set aside the newly protected areas without benefits for themselves in return; they only attain the costs of animals coming over and causing crop damage and human deaths. If people get no benefit from these protected wildlands, they would prefer that those wildlands were given over to other alternative use, even if it is marginal subsistence farming. Therefore, CAMPFIRE is trying to reintegrate the values of those wildlands with the needs of rural people.

HISTORY OF ZIMBABWEAN LAND USE

Environmental degradation and the problems that we have today are inherent in the policies and practice of land use and land tenure in the colonial and post-colonial regimes. Traditionally, in pre-colonial days, there was a symbiotic relationship between people and their resources. They depended for survival upon good husbandry of those natural resources and wildlife; there was nothing else. This provided a strong collective and internal incentive for rural people to maintain good husbandry of those resources. With colonialism, suddenly land was alienated from the people. The protected areas were established, people were moved into tribal trustlands and, at the same time, wildlife and wilderness were alienated from local people. There was generally a great deal of hostility toward those protected areas and wildlife; therefore, poaching and other threats to wildlife-inhabited ecosystems occurred.

The premises on which CAMPFIRE rests is that unless those who live in or adjacent to wilderness wildlife areas, and, therefore, are expected to conserve them and bear the immediate costs, are given the right to manage and benefit from these resources, then the future of these resources is bleak. Furthermore, the consumptive and non-consumptive utilization of wildlife and wildlands represents the most ecologically and economically viable form of land use in most of the communal areas, and thus has the greatest potential for the alleviation of poverty. CAMPFIRE's purpose is to embody or enjoin environmental or ecological values with developmental economic objectives or imperatives.

*General Secretary, Zimbabwe Trust, Bulawayo, Zimbabwe, Africa.

The right to use the environmental resources for the relief of poverty and to meet basic livelihood needs, therefore, provides an economic incentive to the local people for the conservation of those resources. CAMPFIRE is a synthesis of economic and environmental objectives, which, therefore, constitutes a model of sustainable development.

FACTORS WHICH PROMOTED CAMPFIRE AS A SUSTAINABLE LAND USE OPTION

Political Factors

The independence of Zimbabwe in **1980 meant there was a government in power which had to be much more responsive to local people and to their needs.**

Institutional Factors

Before independence, there were no government structures below the district level (there are 55 districts in Zimbabwe). Therefore, lower-level representative structures, from village level to ward level, were established.

Legal Factors

In 1975, the Parks and Wildlife Act allowed private landholders to manage and utilize wildlife on their lands for their own benefit, while still not having actual ownership. After independence in 1982, an amendment to the act allowed appropriate authority status to be provided to local communities if they showed the intent and capacity to manage their resources on a sustainable basis. That opened the door to allow the management and utilization of wildlife to go into the tribal trustlands and into the communal areas.

Economic Factors

After the 1975 Parks and Wildlife Act, there was a feeling that if one gave the private sector the right to manage and utilize the wildlife, they would simply get rid of all the wildlife on their land and put domestic livestock on their land, such as beef cattle. However, the opposite happened; there are now at least live hundred private commercial farmers who are farming wildlife. Some of them have multi-species animal production systems, where they are running wildlife along with cattle. Over the last few years, there has been a 34 percent annual growth rate in the wildlife industry in Zimbabwe. Recently, economic analyses have shown that there is at least a three-to-one return from wildlife utilization over cattle, primely because there are multiple uses of wildlife management.

Ecological Degradation Factors

Another factor which came into play was the increasing rate of ecological degradation and wildlife habitat removal, particularly in the Zambezi Valley. The Zambezi Valley was the first key area for wildlife sales and became important to help implement CAMPFIRE. It is a very fragile ecosystem, and the European Economic Community was in the process of financing a tsetse fly eradication program. One of the things that has kept the Zambezi ecosystem intact has been tsetse fly, because it brings sleeping sickness to beef cattle. If the fly is present, farmers will not have cattle. Tsetse fly eradication opens the cattle option in that valley, which many Zimbabweans believe will severely degrade that environment and push the wildlife out completely. Cattle are not where our comparative economic advantage lies in international trade, nor our internal competitive land use. In addition, we have also found that several, multi-national agencies are actually continuing with conventional agricultural policies which we think could be very damaging.

Budgetary Factors

The government, through the Department of National Parks and Wildlife, does not have the budget to manage areas outside the protected areas. The budget of this department is only 30 million Zimbabwean dollars, which is about ten million United States dollars.

THE IMPLEMENTATION AND ACHIEVEMENTS OF CAMPFIRE

CAMPFIRE is a rural development agency. We are primarily responsible for supporting rural communities to develop their management and institutional capacities in these common property areas. CAMPFIRE's role is to provide not only the awareness, but also the implementation, management, training, and promotion in all these communal areas at village and ward level, in order to build up economic institutions for the management of the resource. We have a strong collaborative agreement and working arrangement not only with the Department of National Parks, but particularly with the Worldwide Fund for Nature and its Multi-Species Animal Production Systems Project (which provides ongoing ecological and resource management input). CAMPFIRE also has a working arrangement with the Supply and Social Sciences Department at the University of Zimbabwe, which provides socio-economic input in terms of socio-economic baseline studies, longitudinal studies over time, and case studies of particular areas which are operating under the CAMPFIRE program.

What really sparked the program was in 1989 when the first two districts in the Zambezi Valley - the Nyami-Nyami and the Gazaland District - were given the superlative authority to manage their wildlife. Early last year, another nine districts were given superlative authority, including four districts in the southwestern part of the country, with strong financial support from **USAID.** Also developed in the past two years is a National CAMPFIRE Association of Rural Communities, which is directly representative of 17 districts. It is an economic lobbying body to promote district interests in the maintenance of wildlands and in wildlife utilization. CAMPFIRE feels that it is not our place to speak or represent those people; therefore, we welcome that development because it now is a strong lobbying group on this issue, as well as other environmental issues.

In the couple of years that CAMPFIRE has been in formal progress, the total economic benefit directly to local communities, such as availability of meat, hides, and ivory, amounted to 3.5 million Zimbabwe dollars (one million U.S. dollars). To a large extent, a lot of the economic benefits from these wildlands have rested on international safari hunting because, firstly, there is a quick return and there is very little economic damage resulting from this activity; and, secondly, the international safari client at the moment places a higher value on that resource, and, therefore, provides more money for the local people than does any other activity.

The people of Nyami-Nyami in 1989, for example, cleared approximately seven hundred thousand dollars from only two international safari hunting concessionaires. They also received significant funds from cropping 1,500 impala animals. Thirty thousand kgs of meat were produced and sold to the local community at a subsidized rate of approximately one Zimbabwean dollar per kg.

Meat is now of critical importance for these communities. People aren't particularly concerned with financial returns. They are concerned with meat, nutrition, and protein as well as the problem of animal control. There is compensation to people for problem animal control, which is increasing rapidly. Big game damaging crops rose from 26,000 cases in 1989 to 80,000 in 1990.

The other area, Gazaland, was the first area and the only area that we know of in Africa to undertake their own international safari hunt operation. They have a professional manager with them, and they have also realized approximately $200,000 going into the local communities. In a number of cases, these have involved the village level and cash handouts to each household, which reflects to the household their dividend from their shareholdmg in the resource. They can, therefore, see a direct connection between the money in their pockets and the elephant which was shot by a safari hunter two months ago. It is very important to get those benefits as close to the ground as possible in order to make that connection between economics and conservation.

There are designated and proposed wilderness areas; however, they are not proposed or designated by the government. They are proposed by the communities themselves for the **first** time. The people are getting benefits from wildlife use and from wildlands, and they are seeing the relevance of keeping these areas. There are certain areas which are rugged and in which there is broken terrain, and there is no habitation. The communities are now wanting to set these aside as wilderness areas. They would never have done this before if they did not get some benefit from wildlands and wildlife.

WILDERNESS ISSUES IN CANADA

Peter Miller*

ABSTRACT

There *is an increasing acceptance in Canada of a goal of preserving 12 percent of the nation's natural ecosystems. Experience in Manitoba illustrates, however, that, despite extensive roadless areas, the task of achieving adequate preservation will not be easy because of rival claims for the use and development of the hand and the non-protective, multi-use policies of government. No resolution of wilderness preservation issues is possible without coming* to *terms with the presence and land claims of aboriginal inhabitants and users of our forests, nor without changes in government policies. Some opportunities for addressing these issues may be found in current sustainable development initiatives and environmental assessments of northern developments.*

A WILDERNESS AGENDA FOR CANADA

When you think of Canada, you may think of a country of vast pristine wilderness areas extending from sea to sea to sea - from the Atlantic to the Pacific to the Arctic Oceans. That is how I and many other Canadians would like to be able to think of our country. The wilderness as homeland for aboriginal lifestyles in harmony with nature, as backdrop to exploration, adventure, and rugged frontier life for European settlers, and as habitat for many forms of wildlife are powerful images in the Canadian psyche. A love of country, for a Canadian, usually includes, as a major component, a love of our wilderness. And do we not have a lot of it? Look at our highway maps, and the vast areas that escape road penetration. It is a liberating thought that a scant three hours' drive from my home in Winnipeg, Manitoba I can come to the end of the road, from where for the next thousands of miles to absolute north, the North Pole, there are no more roads. This is wilderness, the last dream.

It is, however, a dream from which, increasingly, we are becoming rudely awakened. Unmarked on the tourist road map is an extensive network of logging roads to feed our pulp and paper mills and winter roads that are open only a couple of months a year to service remote native communities scattered throughout the north. Also missing from that map is the outline of a Forest Management License Area belonging to a single company, Repap Manitoba, that covers 40 percent of Manitoba's forests, including several provincial "natural" parks. Unmarked, too, are the plans of Manitoba Hydro to construct electrical transmission lines to all of the remote northern communities, plus a major new transmission corridor, including a road, on the hitherto **roadless** east side of Lake Winnipeg to bring power from the proposed Conawapa dam on the Nelson River south for export sales.

In the face of an increasingly rapid evaporation of the wilderness dream, the World Wildlife Fund in Canada, in conjunction with many other environmental groups, has spearheaded its Endangered Spaces campaign. The objective, derived from the **Brundtland** Commission's Our Common Future (World Commission on Environment and Development, **1987),** is to **realize** the target of legally protecting for preservation 12 percent of Canada's lands and waters and to include representation from all of the natural regions (as these are defined by each jurisdiction). The deadline for this achievement is the year 2000, on the assumption that the opportunities for such significant protection are unlikely to remain any longer than that. The realization of this goal requires first the establishment of system plans in each jurisdiction and then the legal commitment of lands and waters to **fulfil** these plans. The visible focus of the Endangered Spaces lobbying effort is the circulation for signatures of a "Canadian Wilderness Charter" that calls for a commitment by governments, industries, environmental groups, and citizens to such preservation on the grounds of multiple values that wilderness represents and sustains.

THE FEDERAL STANDPOINT

Canada's federal government has subscribed in principle to the land objectives of the Endangered Spaces campaign, but has not, so far, committed Canada to the like preservation of all marine ecosystems. According to Harold Eidsvik, a senior

*Chair, Department of Philosophy, University of Winnipeg, Winnipeg, Manitoba, Canada **R3B 2E9.**

Federal Parks planner, Parks officials have identified 39 natural regions, 22 of which have one or more national parks. Of the remaining 17 natural regions, five have provincial park coverage. In four of the remaining 12 regions, bird or game sanctuaries are located. Federal Park Service studies have identified potential national parks in five of the remaining eight regions. The other three regions in northern Quebec are complicated by native land claims and have no effective protection at present (Eidsvik, 1989).

Looking at the potential for further preservation, Eidsvik notes that 72 percent of Canada is roadless, i.e., more than 16 kilometres (10 miles) from a road, and 2.4 percent of the country consists of such roadless areas lying within national and provincial parks. Compare these figures with the U.S., which has (excluding Alaska) 1.7 percent of its area legally designated as wilderness and 5.4 percent more of its area roadless. If Alaska is added back in, then legally designated wilderness areas for the entire U.S. rise to 3.9 percent and additional roadless areas rise to 11.7 percent. Concludes Eidsvik:

> **Therefore the potential for converting unprotected wildlands to legally protected areas remains large in all of Canada except for Nova Scotia, New Brunswick, and Prince Edward Island. This represents a unique opportunity of world significance.**
>
> **However, although Canada has vast wildlands, the competition for their use is intense. Native land claims will leave extensive areas wild, but there may be restraints on who may use these lands. Hydro-electric development is another continuing pressure, as are the forest and mining industries. Canada, therefore, has a deceptive wildness, since behind every square kilometre sits a lawyer and a plan. To ensure our future, an adequate number of these plans must be made for wilderness establishment** (Eidsvik, 1989, p.44).

MANITOBA ISSUES

That is an overview of the Canadian scene. Now I want to focus on preservation issues as they appear in the province I know best, Manitoba. Like the federal government, the Premier of Manitoba has also publicly subscribed to the 12 percent land preservation target, with representation from each natural region. It would seem, then, that the major political battles have been won and that the legal embodiment of adequate preservation objectives is as good as done. Regrettably, that is not the case.

In Manitoba the Parks Branch has identified 12 natural regions. About 9.7 percent of Manitoba's area is already classified as park or reserve lands, the highest proportion so designated of any jurisdiction in Canada. But only five of Manitoba's 12 natural regions find protection in those areas; seven more are still vulnerable. And those that are included are not really protected, because Manitoba also has one of the least restrictive land-use policies for its parks. Once we remove those areas which do not prohibit resource extraction or are too small for ecosystem protection, we are left with only 1.6 percent of Manitoba protected; and if we remove from that the areas where sport hunting is permitted, only 0.5 percent remains (Elliott, 1991; Watkins, 1990; Hummel 1989a, p.279). Even this is questionable, since mineral exploration is currently taking place in our only provincial wilderness" park, Atikaki, and the Department of Tourism has allowed fly-in fishing lodges to be built on all of the major lakes in this park'. In other words, lines have been drawn on a map to designate preserved natural areas, but most fail miserably to protect the dream of pristine, untrammelled, and unexploited wilderness. So the open question remains, what feasibly can remain of that dream once the political, social, and economic realities have been taken into account? I do not know, but I want to discuss what some of these constraining realities are.

Criteria for Wilderness Preservation

One of the most basic issues is to specify conceptions and acceptable criteria for the characteristics of wilderness to be preserved. Most general and fundamental on a global basis are the preservation of essential ecological processes and biodiversity. The preservation of biodiversity, not only of species but also within-species genetic diversity, is maximized through the preservation of diverse ecosystems at as fine-grained a classification as possible. For the sake of wilderness experience and ecosystem security under severe impacts, such as extensive fires and climatic extremes, each ecosystem type should be represented by as large an area as possible. Nor, ideally, should preserved ecosystems be just islands within a sea of development. They need to be properly buffered against externally originating impacts and should form a connected system in order to permit nomadic species to migrate and allow ecological succession across transition zones under conditions of climate change. In other words, the image of wilderness zone allocation should be not that of islands in a sea of development, but of a continent-wide Swiss cheese containing limited pockets of development. The nucleus of such a conception appears in a recent wildlife policy document endorsed by all of the provincial and federal ministers

responsible for wildlife (Wildlife Ministers' Council of Canada, 1990). This document takes an ecosystem approach to wildlife, which it defines as any natural organism of any species. It also advocates corridors for migration and succession under climatic change. This policy statement is, I think, one of the most important allies preservationists have.

Despite the verbal commitments of federal and provincial politicians and the aforementioned wildlife policy statement, I can't believe that our wilderness Swiss cheese can become a legally protected reality without a great deal of struggle and negotiation, and perhaps not at all. Let us consider further what is arrayed against it.

Wilderness Preservation Goals

My guess is that a full realization of Canada's recently adopted wildlife policy requires a lot more than the 12 percent Brundtland figure. One political battle will be to obtain the further stipulation that at least **12** percent of each natural region shall be protected. Government has a powerful temptation to substitute an excess of **12** percent of non-productive northern lands which lack competing commercial utility in place of a lesser amount of those more southerly ecosystems, which include the lands already largely converted to agriculture and the mid-level forests upon which our pulp and paper companies have their operations and expansionist designs. But that leaves most vulnerable and unprotected precisely those ecosystems which have the greatest commercial economic value. It should also be understood that the minimum 12 percent preserved per region should be calculated not just on the extent of remnant wild ecosystems, where these exist, but on their original extent before agricultural and forestry conversions took place. For example, the tall grass prairie, whose northernmost range occurs in southern Manitoba's agricultural region, has almost disappeared from the Province and from Canada. We should try to preserve 100 percent of the remnants and even then will have only skimpy plots that are each but a few hectares in size. The Provincial Government, to its credit, has been supportive of private initiatives to increase the areas of tall grass prairie under protection.

Lack of Protection in the Parks

I do not know if our Premier thinks that adding another 2.3 percent to the 9.7 percent of the Province in Manitoba's existing parks will do the job of securing the 12 percent objective. It will not because most of the provincial parks permit logging operations. Most were carved out of public forest lands and our Forest Branch considers virtually all to be a part of our commercial forest inventory. The most succinct manifestation of this mentality appears in its definition of "wood **fibre** supply" as "the total volume of standing trees in Manitoba" (Workbook on Forests, 1990 **p.25).** That is a scary thought. The mission statement of the Forestry Branch makes explicit the principle that it is to provide for other uses of forestry lands "where the provision of same complements and does not conflict with existing or future forest harvesting operations" (Mission and Roles, 1989). I understand that there has been something like a religious conversion within the U.S. Forest Service regarding the non-commercial values of public forests. The British Columbia Forest Service has also received a wilderness preservation mandate in addition to its commercial forestry mandate, as discussed at this conference by Terje Vold, wilderness management forester for the Brithish Columbia Forest Service. [Editor's note: See Vold in section VI of this publication.] In Manitoba, however, they have yet to see the light. Rather they illustrate the claim of Monte **Hummel,** head of the World Wildlife Fund of Canada, that the chief obstacle to wilderness preservation is the so-called "multiple-use" philosophy for forests, which recognizes multiple use only when one of the uses is timber harvests **(Hummel** 1989b).

Aboriginal Peoples

I spoke with Michael Anderson, who is the Research Director of the Natural Resources Secretariat of Manitoba Keewatinowi Okimakanak, which is an alliance of Manitoba's northern Cree **bands**[2]. Mike stressed two points. One is his conviction that it is not government but economic interests that manage the environment. These may be the giant pulp and paper companies (who just won a postponement of the deadline for introducing stricter pollution controls across Canada) or they may be the traditional Cree users. His other point was that there is no such thing as pure wilderness in our boreal forests. They are instead a quasi-agricultural land intensively used by the Cree from one side of Canada to the other. The Cree have engaged in wildlife management for centuries by refraining from hunting or trapping particular species when their populations drop. The intense use and management by aboriginals of such vast areas is unparalleled in North America. Indeed, I have been very surprised that this conference on the economic value of wilderness has had so little to say about subsistence users of wilderness. This dearth, I think, illustrates Mr. Anderson's point about the distinctiveness of the Canadian scene from the U.S. on aboriginal use. Perhaps the Alaskan situation provides a closer parallel.

Not only are the Cree the aboriginal occupants and users of Canada's boreal forests, they claim aboriginal title to the land, which in many cases has never been extinguished by treaty. As well, in cases where treaties have been signed, the settlement of land claims is in many cases unfulfiied. There can be no resolution of land-use allocations until aboriginal land claims have been settled.

I regard the aboriginal presence and claims to aboriginal title throughout the boreal forests to be perhaps the most critical factor governing the prospects for extensive wilderness preservation in Canada's north. On the one hand, the native residents of our north have embraced and **practised** a philosophy of stewardship towards Mother Earth which has left intact natural ecosystems despite centuries of use. On the other hand, the populations of their communities, which are scattered throughout the forest region and usually contain extreme poverty, continue to grow in numbers and demand a more equitable share of the goods and services of the larger society. They are looking forward to electrification from the Hydro grid and hope to have all-weather roads constructed to supplant the seasonal winter roads that connect them to the outside world. They also have their own development organizations **looking** for ways to foster economic development. Will they not, despite their land stewardship philosophy, become expanding islands and networks of industrial development throughout the boreal forests? Any viable preservation initiatives must take account of the aboriginal presence, aspirations, and claims and will probably have to incorporate co-management features and permit continued land and wildlife utilization by aboriginals.

Further Prospects to Affect Wilderness Policy

Thus, although we have verbal assent from both the federal and provincial governments to increased preservation, there are multiple social and economic pressures and an entrenched resource philosophy and policies arrayed against it; and there is good reason to believe that either the Provincial Government does not know the implications of its commitment or else has a watered-down version in mind that is closer to the so-called "multi-use" status quo than many of us would **find** acceptable. In closing, I wish to mention two channels by which policies may be opened to further change.

The first of these is the "sustainable development" philosophy, which has been verbally adopted by Canada's federal and provincial governments with initial implementation through advisory "round tables" on reconciling the economy and the environment in each jurisdiction. Again, the concept of sustainable development is a contested one. Many in the environmental community are convinced that it is just an occasion to throw a green cloak over business as usual, and there is much evidence to support that view. Our Provincial Government has been very cautious and limited in its provision of opportunities for public debate and significant input on this philosophy. Nonetheless, because of the broad subscribership from business and government to the concept of sustainable development and because the economic pressures to develop the land will not go away, I prefer to take the sustainable development initiative as a political opportunity to further define and specify this vague and ambiguous philosophy so as to give it a more significant environmental content than our government is currently willing to recognize. Indeed, there is a unique opportunity at hand in Manitoba to work out a viable implementation of sustainable development policy. Canada's newly founded International Institute for Sustainable Development is headquartered in Manitoba. Manitoba also represents, within the microcosm of a single political jurisdiction, many of the global issues that the sustainable development philosophy was designed to address, including a mixed industrial/agricultural/resource economy with large pockets of poverty, extensive natural ecosystems in need of preservation, and a large indigenous aboriginal population. If we could work out an economic/social/environmental model that could suit Manitoba's needs, it might also provide an example of what is required at the global level.

The second channel that is opening up is forthcoming joint federal/provincial environmental assessments of our massive northern hydro-electric projects and the Repap bleached pulp development. These assessments will be conducted by panels of independent experts, with significant amounts of public input supported by the availability of funding for intervenors to present alternative analyses from those of the proponents. Indeed, that is why I am at this conference: to learn what I can about some of the concepts and tools for conducting such analyses.

A formidable task lies ahead in plotting a course that can reconcile wilderness values with other economic, social, and cultural aspirations and needs. In Manitoba, at least, that won't get done without major commitments from environmental groups, the native community, governments, and industry to see the process through.

REFERENCES

Eidsvik, Harold. 1989. Canada in a global context. In:
Hummel 1989a.

Elliott, Alison. 1991. Endangered spaces. (A multi-media presentation on Manitoba's endangered spaces.)

Hummel, Monte, ed. 1989a. Endangered spaces: The future for Canada's wilderness. Toronto: Key Porter Books.

Hummel, Monte. 1989b. The upshot. In: **Hummel** 1989a.

Mission and Roles Statements of the Manitoba Department of Natural Resources. 1989.

Watkins, William G. 1990. A Survey of resource extraction and land use policies in Canada's park systems. Federal/Provincial Parks Council.

Wildlife Ministers' Council of Canada. 1990. A wildlife
policy for Canada. Ottawa: Canadian Wildlife Service.

Workbook on Forests. 1990. Produced by the sustainable development Secretariat of the province of Manitoba as part of the sustainable development land and water strategy.

World Commission on Environment and Development. 1987. Our common future. Oxford: Oxford University Press.

ENDNOTES

1. Reported in conversation by Alison Elliot, who is leading Manitoba's Endangered Spaces campaign. She can be reached c/o Manitoba Naturalists Society, 302-128 James Avenue, Winnipeg, Manitoba, Canada, **R3B** 0N8.

2. Michael Anderson, MKO, 3 Station Road, Thompson, Manitoba, Canada **R8N** ON3.

Part IV. Nonconforming Opportunity Costs of Wilderness

COMMODITY BENEFITS FROM WILDERNESS: SALMON IN SOUTHEAST ALASKA

Ronald J. Glass and Robert M. **Muth***

ABSTRACT

Wilderness is usually associated with non-commodity values, but it can also provide substantial commodity benefits, as is the case with salmon in southeast Alaska. Southeast Alaska, which is still predominantly wilderness, has historically provided spawning and rearing habitat for all five species of salmon native to the Pacific Northwest. Salmon are harvested for commercial, sport, and subsistence purposes. During 1987, theex-vessel monetary value of commercially caught salmon in southeast Alaska was $72 million. Commercial salmon fishing and associated processing are a major source of employment in the region. Residents of southeast Alaska also enhance their level of living through subsistence harvesting of salmon, as well as other resources. Expressing the values associated with subsistence harvesting in monetary terms tends to be a subjective task since market and subsistence value systems originate in different contextsSport fishing for salmon also contributes food and satisfaction to users, as well as stimulating local and regional economies through related expenditures.while evidence relating to the effects of development on salmon viability has been inconclusive, any change in existing land use certainly involves risk.

INTRODUCTION

Although wilderness is most often associated with amenity and ecological values, both **Congressionally**-designated wilderness areas and those that exist in a de facto sense, can provide substantial commodity benefits as well. Historically, southeast Alaska - an area that retains much of its wilderness character today - provided ideal habitat supporting large runs, and associated harvests of each of the five species of Pacific salmon. While most salmon harvesting actually occurs in marine or estuarine environments, salmon require clean, fresh water streams on associated uplands for spawning and rearing habitat. Although all live salmon species (king, sockeye, silver, pink, and dog) spawn in southeast Alaska, the larger runs of king **salmon** (Oncorhynchus tschawytscha) migrate to the upper reaches of major river drainages in Canada - areas characterized by their primarily pristine condition.

Southeast Alaska has been predominantly wilderness throughout its history. The region is sparsely populated, with a land area about the size of the State of Maine, the bulk of which is made up of the Tongass National Forest. Of the nearly *17* million acres that comprise the Tongass National Forest, 5.4 million acres possess formal status as Congressionally-designated wilderness. In addition, there are approximately 10.4 million acres of **roadless** land remaining on the Tongass National Forest that are not designated wilderness, but retain de facto wilderness status. In total, about 94 percent of the Tongass National Forest - an area roughly the size of the State of West Virginia - is either designated wilderness or remains in an unroaded condition.

The basis for allocating a public good such as wild fisheries or other common property resources is not well established. Needless to say, the relevant values are far more complex than merely securing the highest net monetary returns - the criterion often cited as the primary objective of private firms. Public policy often reflects society's willingness to sacrifice short-term monetary gains in order to secure broader social objectives, such as a more equitable distribution of benefits, a stable resource supply, or community stability. Valuation of public resources must consider this variety of benefits, many of which are not readily expressed in monetary terms. In cases where the value resource use lends itself to monetary measurements, public well-being may not be reflected by this measure alone - intangible benefits may, in fact, be more important. Even when valuing commodity benefits alone, there are difficulties related to distribution, allocation, and stabilization concerns that are not readily expressed in monetary terms.

*The authors are Research Economist, USDA Forest Service, Northeastern Forest Experiment Station, Burlington, Vermont, and Associate Professor, Department of Forestry & Wildlife Management, University of Massachusetts, Amherst, Massachusetts.

Our inability to clearly identify discreet claimant groups makes it difficult to make allocative decisions, even when considering material payoffs. In Alaska, while there are conceptual difficulties in distinguishing among commercial, subsistence, and sport fishing (Glass et al., 1989; Smith, 1981), legal definitions have been specified by legislative bodies or through judicial review. Although these definitions may distort or ignore traditional sociological, cultural, or economic dimensions (e.g., the meanings, motivations, dependencies, social functions, or ultimate payoffs) of resource use, they provide a basis for resource allocation. In order to fish commercially for salmon in Alaska, for example, a limited entry permit (which may be bought and sold on the private market) is required. These permits were initially provided to commercial fishers by the Alaska Commercial Fisheries Entry Commission. Sport fishing is also defined by law, but relates to methods of harvest rather than motivation or payoffs. Most sport fishing participants, of course, are required to purchase a license. In contrast, subsistence is defined in Federal law and State law in terms of rural residency and traditional use (Muth, Dick, and Glass, 1991). Complicating matters further, there are also special State of Alaska regulations that permit harvesting certain species for personal use, this being neither sport nor subsistence as legally defined. Despite the difficulty of developing conceptually-distinct categories of beneficiaries, the magnitude of the salmon harvest in southeast Alaska suggests that considerable benefits are realized regardless of how, and to whom, they are distributed.

THE SOUTHEAST ALASKA ECONOMY

Southeastern Alaska has an integrated three-sector economy with private (market), public (government), and subsistence sectors (Glass and Muth, 1989; Glass et al., 1990). The public sector represents an important contribution to the economy of southeast Alaska. It directly accounts for 38 percent of all reported employment for the region and provides a myriad of services, including unemployment compensation, schooling, and medical assistance. Public investment for capital construction not only provides facilities, but also stimulates other sectors of the economy. Residents of Alaska also receive permanent fund dividend checks each year from the state government - a sum that amounted to $708 for every man, woman, and child in 1987. Further, fish, wildlife, and other publicly-owned resources are utilized by private individuals for a variety of income-generating purposes.

The private sector provides for the allocation of resources through the market system and is the major source of employment in the region. Included in this sector are commercial fishing and related fish processing, both important sources of employment and income in southeastern Alaska.

Subsistence harvesting provides an opportunity to enhance the standard of living of many rural residents. Many subsistence foods are preferred by residents to alternatives available through commercial outlets. These preferences are related to nutritional values (Drury, 1985) as well as cultural reasons (Usher, 1976; Newton and Moss, 1983). Historically, subsistence gathering was the predominant source of survival for southeast Alaskan residents, but subsistence resource use is now one component of the package of goods and services that, taken together, provide a reasonable level of living for many Alaskans. Although many people supplement their cash incomes through subsistence harvesting, subsistence harvests serve a particularly critical function as a buffer during periods of scarcity associated with the boom-and-bust cycles and seasonal fluctuations of the market economy (Muth, 1990). Regardless of the magnitude of individual household incomes, the level of living can be further enhanced by the personal harvest and consumption of fish, wildlife, and other natural resources.

There is considerable integration among the three sectors of the southeast Alaskan economy. Few people - either Native or non-Native - currently residing in the region have a purely subsistence lifestyle. Income derived from the public and private sectors is used to purchase and operate gear used for subsistence harvesting. Fishing gear used to harvest salmon for commercial purposes often serves double duty when used for subsistence harvesting. Public investment stimulates the private sector of the economy, whereas taxes on commercial profits and assets help finance government. Purchases of supplies for subsistence activities stimulate the market economy, as do expenditures related to sport fishing and other recreational activities.

SALMON HARVESTING IN SOUTHEASTERN ALASKA

Within the context of the mixed economic system of southeastern Alaska, salmon are harvested for commercial, sport, and subsistence purposes. The relative magnitude of these harvests and their contribution to social well-being are important considerations for resource managers.

The total ex-vessel value (monetary value received by a fisherman for fish, shellfish, and other aquatic plants and animals landed at the dock or from first

purchasers) of the 1987 commercial **salmon** harvest in southeast Alaska was **almost** $72 million (Table 1). In terms of the total number of **fish** harvested, pink **salmon** (Oncorhynchus eorbuscha) was the leading species, accounting for 41 percent of the total, while Dog **salmon** (Oncorhynchus **keta)** accounted for over one-fourth of the total. However, red **salmon** (Oncorhynchus **nerka)** and silver **salmon** (Oncorhynchus kisutch) led in total market value of the harvest, both of which approached $16 million. Despite their predominance in numbers taken, pink salmon are smaller in size and command lower prices than red and silver salmon. Still, the pink **salmon** harvest had a market value of nearly $14.5 million. Substantially fewer king **salmon** (Oncorhynchus tschawytscha) were harvested than any of the other species, but this species is the largest of the **salmon** and commands a high price. The market value of the king **salmon** harvest was $13.3 million.

The commercial salmon **fishery** in southeast Alaska is highly diversified, and the relative importance of different kinds of commercial fishing gear varied by the species of salmon. Purse seining was the predominant gear type for harvesting pink **salmon** and dog salmon. While both purse seines and set gill nets (primarily in the Yakutat area) made notable contributions, drift gill nets were the leading means of harvesting red salmon. Power trolling was the primary method of harvesting king and silver **salmon.** In total, purse seining contributed the highest value of harvest, based primarily on the large number of fish taken, followed closely by power trolling, which was responsible for a smaller harvest of more highly priced salmon species. The use of drift gill nets also yielded a substantial monetary return, based largely on the harvest of red salmon, a high-priced species.

Despite its seasonality, commercial **fishing** makes a substantial contribution to employment in southeast Alaska (Table 2). Because it is not covered by unemployment compensation, the Alaska Department of Labor does not have **annual** employment records for commercial **fishing** as it does for most other employment activities. However, special studies of commercial **fishing** employment conducted by the Department for the period from 1981 to 1984 **(Lizik,** 1983; Thomas, 1987) indicate an average annual employment of **2,396** in commercial fishing for 1984, with 62 percent attributable to **salmon** fishing. Average annual employment in seafood processing has been over 1,000 since 1984.

By legal definition, subsistence fishers must reside in rural Alaskan communities. Thus, the data presented on the subsistence sector pertain to southeastern Alaska, excluding the urban communities of Juneau and **Ketchikan.** The species of salmon that commanded higher prices in the commercial market were also favored in the subsistence harvest (Table 3). In terms of number of fish taken, red and silver salmon were the leading species, but the much larger **king** salmon were also frequently taken.

People who harvested **salmon** for household consumption employed a variety of gear types. **Almost** 72 percent of the red salmon were harvested by nets. Netting was also the major method of harvesting dog **salmon.** By contrast, rod and reel fishing was the primary means of harvesting king, silver, and pink salmon. Over one-fourth of the dog, silver, and king **salmon** used for household consumption were removed from the commercial catch.

In terms of edible weight of **salmon** harvested for personal use by southeast Alaskan households, king **salmon** was the most favored species, followed by silver and red salmon (Table 4). Despite their relative abundance, pink salmon and dog salmon were utilized to a lesser extent.

An important component of the subsistence lifestyle is the sharing and distribution system. Forty-one percent of southeast Alaskan households gave salmon to other households, and 56 percent received salmon from other households (Table 5). King salmon, followed by silver **salmon,** was the most common species both given and received. It should be noted that, in addition to **salmon,** many other fish, shellfish, mammals, bids, and plants are shared among southeast Alaskan households (Kruse and Muth, 1990).

Data are also available on the salmon sport fishing effort and harvest in southeastern Alaska for 1987 (Mills, 1988). A total of 82,485 anglers participated in 328,272 fishing trips that involved 379,727 days **fishing.** While those figures may appear modest, they must be considered within the context of the sparse population and inaccessibility of the region.

Among the three types (commercial, sport, subsistence) of southeast Alaska salmon harvesters, the commercial catch far exceeds the others, while the subsistence harvest is only slightly greater than the sport harvest (Table 6). In fact, the sport catch is larger than the subsistence harvest for silver salmon. By measure of number of fish caught, pink salmon and silver salmon are the most commonly taken by sport fishers. By weight, silver and king salmon are the most prominent. The relatively small sport harvest of red and dog salmon is partially attributable to the reluctance of these species to strike conventional sport **fishing** lures and baits.

A better picture of the comparative harvest among commercial, subsistence, and sport fishing can be accomplished by adjusting the raw data presented (Table 6) to neutralize definitional overlap and avoid double counting. Thus, the quantity of fish removed from the commercial harvest for personal use was subtracted from the commercial harvest and counted as part of the subsistence harvest (Table 7). Also, since rod and reel **fishing** characterized both sport and subsistence harvest, the total subsistence take was combined with the sport catch, and then subsistence rod and reel **fishing** subtracted from the total. The resulting figures demonstrate the relative role of commercial fishing in the total harvest in southeast Alaska: 98.3 percent of the salmon harvest in 1987 was harvested for commercial purposes. Only in the case of king salmon did the combined subsistence and sport harvest exceed 10 percent of the total catch. The subsistence and sport harvest combined accounted for less than 1 percent of the total for both pink and dog salmon.

DISCUSSION

The wholesale monetary value ($72 million in 1987) of the raw commercial salmon harvest alone is quite impressive. Further, value is added as salmon are processed and transported to market. Through the market system, salmon are made available to consumers on the state, national, and international levels. The salmon fishery also provides a major source of employment, albeit highly seasonal, for both commercial fishers and fish processors. Wages and other income from commercial salmon fishing stimulate activity in the other sectors of the economy. Besides this, commercial fishers have a lifestyle that may be as unique as that attributed to those involved in subsistence, that is, commercial fishers can also gain satisfactions of participation itself besides the monetary remuneration that they receive (Gatewood and **McCay,** 1990; Binkley, 1990).

Valuing subsistence activities in monetary terms is extremely difficult because such activities provide not only material goods that may be treated as income in-kind, but also psychological and sociocultural returns that defy measurement on an interpersonal basis. Subsistence resources certainly contribute to the level of living for many rural Alaskans. Aside from the goods produced, participation in the subsistence lifestyle reaps its own rewards. The flow of benefits through the sharing and distribution system to other members of the community is another aspect of subsistence that must be considered. Applying values based on market prices to the subsistence salmon harvest can be useful in estimating the monetary value of the material component of subsistence but must be interpreted with caution. Value systems originating in different contexts, even if expressed in a common denomination, can be compared only subjectively. The intangible component of subsistence defies monetary measures.

A myriad of benefits can also be attributed to sport **fishing.** While the food caught may be considered as income in-kind, as with subsistence fishers, other benefits accrue to participants. The value of these benefits is sometimes estimated using **nonmarket** valuation techniques, although these approaches have conceptual and methodological, as well as empirical, limitations.

Regional economic benefits are often attributable to expenditures by sport fishers. Purchases related to sport fishing stimulate the economy and have secondary effects that enhance regional employment and income. While these economic impacts are often insignificant on a national basis, they can be important to rural southeast Alaskan communities. Sport fishers, as is the case with commercial and subsistence fishers, also received psychological and sociocultural payoffs from participation. As previously discussed, it is often extremely difficult to differentiate subsistence from sport fishing in contemporary societies based on behavioral measures alone.

As the preceding discussion illustrates, human beings capture substantial commodity benefits from the abundant salmon stocks that return every year to spawn in southeast Alaska. Although fisheries' management activities (fish passes, fish ladders, hatcheries, woody debris removal, etc.) are playing an increasingly important role in providing viable salmon population levels, their sustainability is largely dependent on the undeveloped, wilderness environments that contain unpolluted surroundings, naturally regulated water flows, food sources, protection from predators, and other conditions necessary for successful spawning and rearing to take place. Some commodity benefits, such as cash paid for commercially harvested salmon, are often directly measurable, but others are more difficult to measure, such as the in-kind contributions of subsistence-caught **fish** used for household consumption.

Salmon thrive in the wilderness environment, but there is considerable uncertainty about the effects of developmental activities on salmon viability. There certainly may be all-or-nothing situations, such as dam construction at key locations, which prohibit adults from reaching spawning habitats and, thus, decimate wild salmon stocks in that particular drainage. However, most of man's developmental activities are

likely to impact salmon stocks in a cumulative and often more subtle manner, in which reliable estimates of the duration and magnitude of changes are largely unknown. Since a number of factors influence salmon populations, it is often difficult to measure the effects of a particular developmental action. As a result, much of the research on the impact of development on the health and vitality of **salmon** stocks has yielded conflicting or inconclusive results (Meehan, 1974). Even if it were concluded that the proper precautions could neutralize any major negative impacts of development on salmon viability, there still exists the threat that such precautions will not be adequately implemented.

As modernization and resource development continue to increase world-wide, fisheries' resources are often among the casualties. Recent examples range from those in advanced industrial societies (e.g., the recent listing by the United States government of certain Columbia River salmon species as threatened or endangered due to impacts from hydropower facilities) to numerous examples from developing countries in which naturally occurring fisheries' populations have been dramatically reduced or entirely eliminated by habitat modification associated with deforestation, agricultural development, soil erosion and siltation, hydroelectric facilities, chemical waste discharge, or petroleum development. Since wilderness conditions provide the ecological context within which substantial commodity non-commodity benefits are derived from wild salmon stocks in southeast Alaska, development actions within productive drainages pose serious risks. As a consequence, modification of wilderness environments must be undertaken with deliberation and caution.

REFERENCES

Binkley, M. 1990. Work organization among Nova **Scotian** offshore fishermen. Human Organization. **49(4):395-405.**

Drury, H. M. 1985. Nutrients in native foods of southeastern Alaska. Journal of Ethnobiology. **5(2):97-100.**

Gatewood, J. B.; **McCay,** B. J. 1990. Comparison of job satisfaction in six New Jersey fisheries: Implication for management. Human Organization. **49(1):395-405.**

Glass, R. J.; R. M. Muth. 1987. Pitfalls and limitations in the use of fishery valuation techniques. Transactions of the American Fisheries Society. **116:381-389.**

Glass, R. J.; R. M. Muth. 1989. The changing role of subsistence in rural Alaska. Transactions of the North American Wildlife and Natural Resource Conference. **54:224-232.**

Glass, R. J.; Muth, R. M.; Flewelling, R. 1990. Distinguishing recreation from subsistence in a modernizing economy. In: **Vining, Joanne,** ed. Social science and natural resource recreation management. Boulder, CO: **Westview** Press: 151-164.

Harmon, D. 1987. Cultural diversity, human subsistence and national park ideal. **Environmental** Ethics. **9:147-158** (summer).

Kruse, J.; Muth, R. M. Subsistence use of renewable resources by rural southeast Alaska residents. Institute of Social and Economic Research, University of Alaska, Anchorage, AK. February 10, 1989.

Lizik, K. 1983. Alaska **fish** harvesting employment. Alaska Department of Labor and Commercial Fisheries Entry Commission. Juneau, AK. 51 pp.

Meehan, William R. 1974. The forest ecosystem of southeast Alaska: 3 fish habitats. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station; General Technical Report PNW-15.

Mills, M. J. 1988. Alaska statewide sport fisheries harvest report 1987. Fishery data series No. 52. Alaska Department of Fish and Game, Division of Sport Fish; Juneau, AK.

Muth, R. M. 1991. Community stability as a social structure: The role of subsistence uses of natural resources in southeast Alaska. In: Lee, R. G.; Field, D. R.; **Burch,** W. R., Jr., eds. Community and forestry. Boulder, CO: **Westview** Press: 211-227.

Muth, R. M.; Glass, R.E. 1991. Subsistence use of wildlife resources in Alaska: Policy implications for wildlife management in modernizing economies. In: **Mangun,** W. R., ed. Public policy issues in wildlife management. New York: Greenwood Press: 101-115.

Newton, R.; Moss, M. 1983. The subsistence **lifeway** of the Tlingit people: Excerpts of oral interviews. Juneau, AK: U.S. Department of Agriculture, Forest Service, Alaska Region Report No 179.

Sharif, M. 1986. The concept and measurement of subsistence: A survey of the literature. World Development. **14:555-557.**

Smith, C. L. 1981. Satisfaction bonus from salmon fishing: Implications for economic evaluation. Land Economics. **57:181-194.**

Thomas, Kathleen. 1987. Alaska seafood industry employment: 1977-1984. **Alaska** Department of Labor, Employment Security Division; and Alaska Department of Fish and Game, Commercial Fisheries Entry Commission; Juneau, AK.

Usher, P. J. 1976. Evaluation country food in the northern Native economy. **Artic. 29(2):105-120.**

Table 1. Estimated number of commercially harvested salmon and value by species and gear type, Southeast Alaska, 1987

Species	NUMBERS OF FISH HARVESTED AND VALUE BY GEAR TYPE											
	Purse Seine		Drift Gillnet		Set Gillnet		Hand Troll		Power Troll		ALL	
	No. Fish thousands	Thousands of dollars	No. Fish thousands	Thousands of dollars	No. Fish thousands	Thousands of dollars	No. Fish thousands	Thousands of dollars	No. Fish thousands	Thousands of dollars	No. Fish thousands	Thousands of dollars
King (Chinook)	6.29	156	a.44	134	2.07	54	32.05	1,395	236.10	11,541	284.95	13,280
Red (Sockeye)	310.92	3,365	736.99	9,157	259.01	3,102	2.13	25	7.65	a9	1,316.70	15,738
Silver (Coho)	126.95	985	165.65	1,873	124.63	1,379	183.17	2,093	857.72	9,426	1,458.12	15,756
Pink (Humpy)	7,070.03	11,242	1,361.19	2,566	13.04	15	134.33	173	351.90	472	8,930.49	14,468
Dog (Chum)	1,243.19	6,981	749.04	5,475	15.01	61	3.01	17	9.82	54	2,020.07	12,588
TOTAL	8.757.07	22,730	3,021.31	19,205	413.76	4,611	354.69	3,704	1,463.20	21,582	14,010.33	71,832

Source: Alaska Commercial Fisheries Entry Commission, 1989.

Table 2. Commercial fishing and fishery processing employment, Southeast Alaska

	Average Annual Employment			
Year	Commercial salmon fishing	All commercial fishing	Seafood processing employment	Ex-vessel value of salmon in millions of dollars
1981	1,427	1,966	1,176	68.2
1982	1,553	2,171	1,161	65.4
1983	1,372	2,126	952	51.0
1984	1,496	2,396	881	77.6
1985	WA	NA	1,006	96.7
1986	NA	NA	1,160	97.9
1987	NA	NA	1,150	71.8

Source: Lizik, 1983; Thomas, 1987.

Table 3. Sources of salmon used for personal consumption, rural Alaska, 1987

	Removed from commercial catch		Caught with nets		Caught with rod and reel		All means
Species	Nunberof fish	Percent of total	Number of fish	Percent of total	Number of fish	Percent of total	Number of Fish
King (Chinook)	8,712	26.1	605	1.8	24,046	72.1	33,363
Red (Sockeye)	6,590	12.2	38,558	71.6	8,718	16.2	53,866
Silver (Coho)	11,959	27.8	5,199	12.1	25,824	60.1	42,982
Pink (Humpy)	5,490	17.8	4,880	15.8	20,487	66.4	30,388
Dog (Chum)	3,802	28.3	6,098	45.5	3,488	26.1	13,388

Source: Kruse and Muth, 1989.

Table 4. Mean pounds of edible salmon harvested by species per household, rural Southeast Alaska, 1987

Species	Mean pounds of edible fish
King (Chinook)	60
Red (Sockeye)	27
Silver (Coho)	39
Dog (Chum)	10
Pink (Humpy)	8
Species	143

Source: Kruse and Muth, 1989.

Table 5. Percent of households giving and receiving salmon from other households, rural Southeast Alaska, 1987

	Percent of Households	
Species	giving salmon to other households	receiving salmon from other households
At least one species	41	56
King (Chinook)	27	39
Red (Sockeye)	14	22
Silver (Coho)	20	25
Dog (Chum)	7	7
Pink (Humpy)	7	9

Source: Kruse and Muth, 1989.

Table 6. Comparison of salmon harvest by species for commercial, subsistence, and sport fishing, southeast Alaska, 1987

	Number of fish taken					
	Commercial[1]		Subsistence[2]		Sport[3]	
Species	No. of fish	Thousands of pounds	No. of fish	Thousands of pounds	No. of fish	Thousands of pounds
King (Chinook)	284,950	4,530.7	33,363	508.5	24,324	386.8
Red (Sockeye)	1,316,700	8,031.9	53,866	229.8	9,374	57.2
Silver (Coho)	1,458,120	11,225.2	42,982	330.7	50,284	387.2
Pink (Humpy)	8,930,490	29,470.6	30,857	67.7	57,060	188.3
Dog (Chum)	2,020,070	18,382.6	13,388	82.8	5,207	47.4
TOTAL	14,010,330	71,641.0	174,456	1,219.5	146,249	1,066.9

1 Alaska Commercial Fisheries Entry Commission, 1989.

2 Kruse and Muth, 1989.

3 Mills, Michael J., 1988.

Table 7. Comparison of commercial and sport-subsistence salmon harvest by species, southeast Alaska,

	Commercial harvest		Subsistence-sport harvest		Total
Species	No. of fish thousands	Percent of total	No. of fish thousands	Percent of total	Thousands of fis
King (chinook)	276.2	89.2	33.6	10.8	309.8
Red (sockeye)	1,310.1	96.0	54.5	4.0	1,364.6
Silver (coho)	1,446.2	95.5	67.4	4.5	1,513.6
Pink (humpy)	8,925.0	99.3	67.4	0.7	8,992.4
Dog (chum)	2,016.3	99.3	15.1	0.7	2,031.4
TOTAL	13,973.8	98.3	238.0	1.7	14,211.8

Sources: Alaska Commercial Fisheries Entry Commission, 1989; Kruse and Muth, 1989; Mills, Michael J. (Basic data is from Table 6, but has been recalculated as described in text.)

OPPORTUNITY COST OF WILDERNESS DESIGNATION FOR THREE ROADLESS AREAS WITHIN THE LOLO NATIONAL FOREST

Fred J. Stewart, David Browder and Jerry D. Covault*

ABSTRACT

Linear programming was used to model some forest-wide economic effects of assigning threroadless areas in the Lolo National Forest entirely to wilderness or, conversely, makingall the land in theroadless areas eligible for possible timber managementThe effects of roadless area land allocations specified by tiLolo National Forest Plan were also modeled for comparison purposes. Existing land management standards and guidelines were applieuniformly across all three models.

INTRODUCTION

It has not yet been determined which National Forest roadless lands in Montana will become federal wilderness. The Lolo National Forest Plan', which went into effect in 1986, recommended a certain pattern of allocation to each of the roadless areas within the Lo10 National Forest. For the three areas considered here, each has a portion assigned to timber management, a portion to roadless management, and the remainder to other uses, such as wildlife winter range and grazing. Proposed statewide wilderness bills have often deviated significantly from the Lo10 Plan's recommendations for these areas. An important issue in the continuing debate has been the economic value of timber management in these areas, both from the standpoint of the economic efficiency and the possible economic impact on the timber industry in jobs and income. In this paper we provide estimates of the values produced by assigning certain roadless areas entirely to wilderness or by making them all open, within the guidelines of the Lolo National Forest Plan, to the possibility of timber management. When each of these two contrasting land allocations are combined with the existing allocation of the remainder of the Lo10 National Forest and a present net value maximization is done using the Lo10 National Forest's FORPLAN[2] model, we get some indication of the forest-wide economic tradeoffs of expanding either wilderness or timber harvest on the Lolo National Forest. Although the results of this analysis are not directly applicable to any other forest, the technique is straightforward and could prove useful to forest managers analyzing potential allocations of large areas of public land.

STUDY AREA CHARACTERISTICS

The Lolo National Forest is located in west-central Montana and contains about hvo million acres of the National Forest System. The Forest contains four designated federal wilderness areas and 36 identified roadless areas. The final status of these roadless areas has awaited the passage of a state-wide wilderness bii, but all other lands in the Lo10 National Forest are currently managed under the guidelines of the Forest Plan. The roadless areas selected for this study were Quigg Peak, Great Burn, and Cube Iron-Silcox. All three areas have been proposed for wilderness under one or more of the proposed Montana wilderness bii.

Quigg Peak is arguably the most accessible proposed wilderness within the Lolo National Forest. It is adjacent to over 20 miles of the Rock Creek road, a very popular road for fishing Rock Creek, a blue ribbon trout stream. People can park along twenty miles of road or at one of the four campgrounds along Rock Creek and be within a ten minute walk of the proposed wilderness. Much of the area is grass-covered slopes with scattered conifers so cross-country travel is relatively easy. The area has dramatic views of surrounding mountains and Rock Creek, solitude within a short distance of the road, and opportunities for wildlife viewing of populations of bighorn sheep, deer, and elk. There are no lakes or large streams, but the area is popular for deer and elk hunting. The majority of the area's users complete their visits within a day rather than taking extended backpacking or horse packing trips.

The Great Burn proposed wilderness is characterized by peaks rising from a 40 mile long hydrologic divide between Montana and Idaho. Cirque basins fall away

*Authors are Forest Economist, Operations Research Analyst, and Recreation Forester on the Lo10 National Forest in Missoula, Montana.

from this main ridge. Alpine lakes are the source of streams that offer fishing opportunities and scenic beauty for visitors. A wide variety of wildlife, including elk, moose, deer, mountain goats, bears, and many kinds of bids and small animals, are found within the area, which has a well-developed trail system. The effects of the three million acre 1910 **fire** are evident in the huge larch snags in the low and mid-elevation slopes and the whitebark pine snags in the higher elevations.

The southern boundary of the Cube Iron-Silcox **roadless** area is located within three miles of the town of Thompson Falls. The lower elevations are heavily forested, typical for the mountains in the vicinity. Higher elevation ridges are adjacent to grassy or brushy parks, which give views of surrounding peaks and the Clark Fork River. Prehistoric glaciers produced basins that now contain numerous lakes. Wildlife viewing and hunting are important activities, as are hiking, camping, **fishing,** and berry picking.

STUDY METHODOLOGY

The above area descriptions emphasize the non-market values associated with the three **roadless** areas. Although some of these values would be affected by timber management, in this study we focused on forest-wide changes in timber management revenues and costs associated with alternative allocation schemes for three **roadless** areas. These areas were selected because they are typical of the areas where disagreement exists among wilderness proposals. Using the **Lolo** National Forest's **FORPLAN** model, three possible allocations were modeled for the land in the three **roadless** areas: 1) All land as wilderness; 2) All land as eligible for timber management; 3) All acres assigned to the use proposed in the **Lolo** Forest Plan. The modeling was done using **FORPLAN** software at the Department of Agriculture Fort Collins Computer Center (FCCC). It is important to note that simply making land available for timber harvest did not necessarily mean the forest-wide linear programming solution would assign that area to timber management. There are a number of physical, vegetative, and economic requirements that eligible land must meet before it can be managed for timber. For example, trees are rarely harvested on high elevation lands because of low volumes, short growing seasons, possible visual impacts, high logging costs, etc. Thus, making all land in the three **roadless** areas eligible for timber management meant only that timber management would be considered as an option. If an eligible area met the physical and vegetative criteria for timber management, the **FORPLAN** matrix contained timber management options for the area. To determine which areas were economically **suitable**[3], the models were rerun until the first decade's marginal cost to produce the last unit of timber matched the comparable marginal cost from the model that contained the Forest Plan land allocations. In other words, an area was economically unsuitable if applying timber management to an otherwise suitable area forced the first decade forest-wide marginal cost of timber above a certain value. This marginal cost was determined from the linear programming solution's shadow price for the constraint that set the minimum timber volume for the **first** decade.

RESULTS

In making all land in the three **roadless** areas available for timber harvest, the Lo10 Forest Plan standards and guidelines were applied. Areas with visual sensitivity required timber prescriptions that met visual requirements; big-game winter range had to be managed with timber prescriptions that enhanced and/or protected the big-game resource values; and so on. As mentioned above, we determined what acres were actually managed for timber by setting the first decade timber output for each model at a level that matched the $247 marginal cost of the last unit of the 107 MMBF (million board feet) for the Forest Plan allocation. (This is a cost because the **Lolo's** twelve decade **FORPLAN** model contains revenues and activity costs that produce a negative present net value when the first decade harvest is set at 107 **MMBF/year.)** For the "all wilderness" and "all available for timber management" simulations we ran each model repeatedly with different first decade timber output levels until we matched this cost.

The acres to which the model's solution applied timber management prescriptions at this marginal cost level become the timber land base for each alternative. Table 1 shows the current land assignment under the Forest Plan with 10,854 acres of the three **roadless** areas in timber management, as well as the increase in timber management acres when all land in the three **roadless** areas is available for timber harvest. The **first** decade's annual Allowable Sale Quantity **(ASQ)**[4] of 107 MMBF would increase by 5.3 **MMBF/year** with the additional land from the three **roadless** areas. (Note that because the **Lolo's FORPLAN** model does not force any particular spatial pattern of outputs, the additional 5.3 **MMBF/year** could come from anywhere within the Forest areas suitable for timber management.)

With the land allocated as specified in the Lo10 Forest Plan, approximately 93 percent of the land available forest-wide for timber harvest, and which meets all

physical, vegetative and management standards, is economically suitable. Table 1 shows that the picture is quite different in the three **roadless** areas, with only 35 percent of the qualifying acres available for timber harvest under the Lo10 Forest Plan allocation meeting the economic suitability criteria. Producing additional timber from the three areas by makmg all the acres eligible for timber harvest would result in 57 percent (Table 1) of the qualifying land becoming economically suitable, still far below the proportion of economically suitable timber land for the entire forest. The linear programming solution for this allocation has a forest-wide present net value **(PNV)**[5] that is **$2,141,000** less than the PNV for the model containing the land allocated based on the current Plan. The additional acres of timber management produces an increase in the forest-wide ASQ of about 5.3 MMBF/year (Table 1). Any further acres would push the marginal cost for timber in the first decade above the **$247/acre** marginal cost. Note that 93,277 acres are excluded from timber management because, although they were made available for timber, they do not meet Lo10 National Forest management standards. These acres, when combined with the 43,951 acres of economically unsuitable land, make up 69 percent of the land in the **roadless** areas and show that the majority of the acres would continue to be managed for other uses than timber production. Even less timber volume would probably be available from **roadless** areas if the Forest Service reduces timber harvest in those areas identified as "below-cost." In contrast, allocating the three areas to wilderness increases the forest-wide twelve-decade PNV by $4360,000 as a result of reducing timber management. This, however, does lead to a reduction of 5 MMBF in the **first** decade's ASQ.

Economic impacts in the local community, as measured by jobs and income, are directly related to the level of timber harvest (Table 2). These negative effects of increasing the amount of wilderness could be at least partially offset in the long run by additional employment and income opportunities created primarily by expanded wilderness recreation activities, but we did not model the economic benefits of additional wilderness as there is no anticipated increase in wilderness use in the immediate future.

CONCLUSION

Until there is a federal wilderness bill for the State of Montana, the controversy will continue about the magnitude of costs associated with the assignment of **roadless** lands to wilderness. In those areas where timber management on **roadless** lands is economically marginal, the present net value **(PNV)** of a National Forest's **FORPLAN** model may actually increase by allocating marginal land to wilderness management. This increase in PNV is in addition to the positive non-market values associated with wilderness assignment, such as scenic quality or wildlife habitat. At the same time, reductions in timber volume may result in corresponding reductions in local income and employment. One measure of the cost of wilderness is the economic cost of additional timber volume from **roadless** areas that would otherwise remain **roadless** if economic efficiency were the only consideration. While adding 206,000 acres to wilderness would increase the Lo10 **FORPLAN** model's PNV by **$6,504,000** compared to an allocation that would not withdraw the **roadless** areas from timber management, it would also mean a reduction of 10.3 MMBF of timber annually and a reduction of 133 jobs and **$3,082,000** in local income. The tradeoff, at least in the short-run, is between wilderness with its non-market values and economic efficiency and timber harvest with its associated local employment and income impacts.

ENDNOTES

1. National Forests are required by the National Forest Management Act of 1976 (NFMA) to operate under a forest plan that sets many management standards and guidelines, predicts certain forest-wide outputs, and allocates the land to specific broad categories of permitted uses. The Forest Plan is based on an accompanying Environmental Impact Statement (EIS) and represents the proposed action of the EIS. The analysis procedure used in developing the Plan is documented in the EIS.

2. **FORPLAN** is the name given to the package of programs developed by the Forest Service to enable National Forests to do forest-wide quantitative modeling using linear programming (LP). **FORPLAN** programs generate matrices, give formatted reports of solutions, and, in general, do everything but solve the problem itself, a task reserved for commercially available software. A typical **FORPLAN** model contains all possible schedules of activities and outputs, with associated costs and benefits for each acre of the area being modeled. **FORPLAN** was designed to allow users to easily incorporate into their models such standards as non-declining timber volumes and ending inventory constraints.

3. Economically suitable land in this study is defined as those acres eligible for timber harvest which produce timber at a cost equal to or less than the marginal cost ($247) per thousand board feet of timber in the **FORPLAN** model solution for the **Lolo** National Forest Plan's existing land allocation and first decade average annual timber output (107 MMBF).

4. The annual allowable sale quantity (ASQ) for the **Lolo** National Forest represents a maximum amount of timber that can be sold by the Forest operated under the Lo10 Forest Plan. The ASQ is commonly expressed on an annual basis, but is actually calculated on a per decade basis because the **Lolo's FORPLAN** model contains inputs, outputs, and constraints expressed as decade totals for the twelve decades of the planning period. The plan sets an annual ASQ of 107 million board feet for the first decade **(1986-1995).**

5. This present net value was maximized over the 120 year planning period by the linear programming solution to the Lo10 National Forest's **FORPLAN** model. It is based on projected costs and revenues prepared for the **Lolo's** Plan. The discount rate used was 4 percent.

TABLE 1. Acreage under three management allocations for the Quigg Peak, Great Burn, and Cube Iron-Silcox roadless areas on the Lolo National Forest

	Current Plan[1] (Acres)	All Timber Eligible[2] (Acres)	All Wilderness[3] (Acres)
Quigg Peak (69,820 Acres)			
Available for Timber Mgmt.	4,442	28,573	
Economically Suitable	1,391 (31%)	11,552 (40%)	
Economically Unsuitable	3,051 (69%)	17,021 (60%)	
Non-Timber Mgmt.	**65,378**	**41,247**	**69,820**
Great Burn (98,500 Acres)			
Available for Timber Mgmt.	**8,940**	**62,597**	
Economically Suitable	**3,459 (39%)**	**44,096 (70%)**	
Economically Unsuitable	**5,481 (61%)**	**18,501 (30%)**	
Non-Timber Mgmt.	**89,560**	**35,903**	**98,500**
Cube Iron-Silcox (38,100 Acres)			
Available for Timber Mgmt.	**17,944**	**21,973**	**0**
Economically Suitable	**6,004 (33%)**	**8,544 (39%)**	
Economically Unsuitable	**11,940 (67%)**	**13,429 (61%)**	
Non-Timber Mgmt.	**20,156**	**16,127**	38,100
Three Area **Totals** (206,420 Acres)			
Available for Timber Mgmt.	**31,326**	**113,143**	**0**
Economically Suitable	**10,854 (35%)**	**64,192 (57%)**	
Economically Unsuitable	**20,472 (65%)**	**48,951 (43%)**	
Non-Timber Mgmt.	**175,094**	**93,277**	**206,420**

[1] Land allocations as currently specified by the Lolo National Forest Plan.

[2] This column gives acres that would result from making all of the three roadless areas eligible for timber management, i.e., if an area meets all physical, vegetative, and economic standards for timber management, then it will be managed for timber harvest over the 120 year planning period.

[3] This column gives the modeling results of managing all acres in the three roadless areas as wilderness.

TABLE 2. Effects of differing land allocations for Quigg Peak, Great Burn and Cube Iron-Silcox **roadless** areas

	Change from **Lolo** Forest Plan Land Allocations For the Three **Roadless** Areas to:		
	All Land Eligible for Timber Mgmt.	**All Land Managed as Wilderness**	**Column 1 minus Column 2**
Economically Suitable Acres	**+ 53,338**	**- 10,854**	**+ 64,192**
Economically Unsuitable Acres	**+ 28,479**	- 20,472	+ 48,951
Allowable Sale Quantity[1] (MMBF/Yr)	+ 5.3	- 5.0	+ 10.3
Present Net **Value**[2] ($)	**- $2,141,000**	**+ $4,363,000**	**- $6,504,000**
Timber Related **Jobs**[3] (Jobs)	+ 70	**- 66**	**+ 136**
Timber-related Income **($)**	**+ $1,586,000**	**-$1,496,000**	**+ $3,082,000**

[1] Computed using the **Lolo FORPLAN** model, with the timber output determined by setting the marginal cost of timber production equal to the marginal cost of timber production for the last unit of timber in the current forest plan.

[2] Computed using **Lolo** National Forest **FORPLAN** model.

[3] Estimates for jobs and income effects are based on an economic input-output model **(IMPLAN)** of the five county region in west-central Montana that contains the Lo10 National Forest. (See the Appendices to the **Lolo** National Forest Plan Final Environmental Impact Statement for additional details.)

STREAMFLOW NEEDS AND PROTECTION IN WILDERNESS AREAS*

Thomas C. Brown**

ABSTRACT

There is not consensus on how much of the naturally occurring streamflow is needed to maintain the natural character of a wilderness area, or on the value the public assigns to instream flow in wilderness areas. The courts have yet to quantify reserved rights for any wilderness areas. Recent economic studies of the value in stream flow indicate that recreation value alone is generally insufficient to justify reservation of all but minimum stream flows. If wilderness designation implies that more than minimum flows are needed, their economic justification must lie in their preservation existence value. The few studies that have addressed the existence value of instream flow suggest significant economic value, but provide little specific guidance for decisions about water flow in wilderness areas.

Water has not been a major issue for most designated wilderness areas, largely because these wilderness areas are at the headwaters. However, the wilderness water issue promises to grow in importance as more areas downstream of current or potential diversions (such as areas managed by the Bureau of Land Management) are considered for wilderness designation. Wilderness advocates worry that water use upstream of the wilderness boundary will seriously reduce the quantity or quality of water flowing through the wilderness area, interfering with the area's riparian ecology. And private land owners upstream of the wilderness area worry that their management options or property values will be affected by constraints on water use that may follow wilderness designation. This controversy may make wilderness designation of downstream areas very difficult. The future feasibility of wilderness designation of downstream areas may rest on reaching some consensus about wilderness water issues.

A designated wilderness, as stated by Congress in the 1964 Wilderness Act (**16** U.S.C. **1131-1136**), is "an area of undeveloped Federal land retaining its primeval character and influence...which is protected and managed to preserve its natural conditions...with the imprint of man's work substantially unnoticeable..." (section **2[c]**). Wilderness areas were to be managed "in such a manner as will leave them unimpaired for future use and enjoyment as wilderness..." (section **2[a]**) and for the following management purposes: recreation, scenery, education, conservation, science, and history (section **4[b]**). However, to placate Western water interests, the Act also allows the President, in wilderness areas on national forests, to "authorize prospecting for water resources, the establishment...of reservoirs...and other facilities needed in the public interest..." and asserts that "nothing in this Act shall constitute an...exemption from State water laws" (section 4(d)). Thus, the Act both suggests that pristine conditions are necessary in wilderness areas, and allows for major construction and water diversions.

This contradictory direction allows considerable disagreement about what flows are implied by wilderness designation. At one extreme, one might focus on the six management purposes mentioned in the Act, requesting just enough flow to satisfy the specific purposes that were most important in a given wilderness area. For example, the conservation purpose could support sufficient flows to assure the survival of fish and other aquatic organisms, and the recreation and scenic purposes could support sufficient flows for fishing, floating, viewing, and other activities. Additional flows would be requested if the conservation purpose also supported stream channel maintenance, Still more flows would be needed if optimum rather than minimum flows were requested for these management purposes. At the other extreme, one might argue that "natural conditions" imply virgin flows, that is, all flows that would exist in the absence of land or water management upstream of and within the wilderness area. As **Vassallo** (1986) puts it, "the minimum is natural flow" (p. 392).

This paper will consider three questions related to these issues: (1) how much flow is required to satisfy the different requirements of the Wilderness Act, (2) what are the mechanisms for protecting this flow, and (3) do economic studies of the value of streamflow offer any insights about these issues?

*Much of this material appeared earlier in Brown (1991).

**Rocky Mountain Forest and Range Experiment Station, U.S. Forest Service, Fort Collins, Colorado 80526.

INSTREAM FLOW NEEDS IN WILDERNESS AREAS

Instream flow needs for fish and other aquatic organisms have been studied on many rivers. Flow needs differ by species and by type of river channel, and the timii of flows can be critical. Nevertheless, several authors have suggested rules of thumb (Stalnaker, 1980) that can give us an idea of fish flow needs. For example, Tennant (1976), based on observations of many rivers, concluded that fish habitat would be "good" if winter (October to March) flows were never below 20 percent of mean annual flow and summer (April to September) flows were never below 40 percent of mean annual flow. Similarly, fish habitat would be "excellent" if at least 30 percent and 50 percent of mean annual flow were maintained during these two seasons, respectively, "outstanding" if 40 percent and 60 percent of mean annual flow were maintained, and "optimum" if from 60 to 100 percent of mean annual flow were maintained. Tennant certainly suggests that fish do not require complete virgin flows to thrive. Furthermore, fish habitat simulation models in current use today (see Lamb [1989]), while not producing instream flow standards or recommendations, still indicate that less than virgin flows are needed to support viable fish populations.

Tennant's (1976) and other guidelines are not explicit about the effect on fish populations of flows above the recommended levels, except to recommend periodic flood flows for channel maintenance. It may be reasonable to assume that full virgin flow at any given time is not detrimental to fish habitat, and that the marginal value of instream flow for fish habitat gradually drops as flow reaches its maximum, as in Figure 1. The figure illustrates the general principal of diminishing marginal returns to flow, which may apply at any one time, or over an entire year assuming a favorable time distribution of flows within the year. However, Nehring (1988) has found in several Colorado streams that unusually high natural flows in the spring tend to wash young fish downstream, lowering populations. In these circumstances, the value of flow for fish habitat is better represented by the relationship shown in Figure 2.

Instream flow needs for recreation have received considerable attention. Brown et al. (1991) list nearly 30 studies that report on the relationship of streamflow quantity to recreation quality or value. A few of these studies focus only on the minimum flows needed to make certain recreation activities possible, but most studies go beyond minimum flows to look at the full relationship of flow to recreation quality. Essentially all of these studies indicate that flow, whether for fishing, boating, or shoreline use, positively contributes to the recreation experience up to some maximum flow level, beyond which additional flow detracts from the experience, as in Figure 2. The flow level at which recreation quality or value is maximized differs among activities (with rafters, for example, preferring more flow than anglers), but too much flow is always a possibility. Of course, as the total value of flow reaches a maximum, the marginal value (indicated by the slope of the total value curve) reaches zero, with additional contributions of flow assigned a negative value.

Clearly, flows desired for recreation may be above or below the flows naturally occurring at any given time. For example, in snow-fed streams of the Rocky Mountains, flows during the spring snow melt are often above those desired by recreationists, and flows in the late summer and fall are typically lower than those desired for many activities. Thus, recreation alone may not require virgin flow levels, especially during part of the year, and is generally enhanced by a redistribution of flows within the year.

Channel maintenance requires base flows, plus occasional flows at much higher levels than are generally needed by fish or most types of recreation (Richards, 1982). During those occasional times when flood-level flows are required, the value of flows for channel maintenance can perhaps be depicted as in Figure 3, where the value of flows is minimal until flow approaches the maximum potential level. And during times when only base flows are needed, perhaps Figure 1 best depicts the contribution of flow to channel maintenance.

The U.S. Forest Service is claiming a reserved right to sufficient flows to maintain stream channels in good hydrologic condition. The Forest Service first tested this approach in the 1982 adjudication of the Big Horn River in Wyoming, where the agency estimated that about 78 percent of mean annual flow was needed for channel maintenance. The Forest Service settled out of court for considerably less when it feared that the measurement method it had used was not ready to withstand a court test (Romm and Bartoloni, 1985). More recently, in preparation for a Colorado case, the Forest Service quantified and requested channel maintenance flows for many stream reaches in forests of the Platte River watershed along the Front Range of the Rocky Mountains. Requested flows for 16 carefully studied stream reaches varied from 24 to 56 percent of mean annual virgin flows (personal communication, James Maxwell, USFS Region 2, 1991). Requests varied among rivers depending on stream morphology and flow timing, and on all rivers a greater proportion of flow was requested in wet years than in dry years. While these flows would not be identical to those needed for fish habitat or recreation, there would be considerable overlap, suggesting that combined flows

for conservation and recreational purposes would be less than virgin flows.

Four recent Bureau of Land Management interdisciplinary studies provide an indication of the flows considered necessary for a mix of uses (see Jackson et al. [1989] on the interdisciplinary process). The proposed flows of each study are those needed to provide good conditions for the specified uses (i.e., the requests are not bare minimums).

First, on Beaver Creek, a tributary of the Yukon River in Alaska and a congressionally designated National Wild River, the study team focused on fish survival and recreational boating and camping in recommending the following **minimum instream** flows: **100** percent of virgin winter flows to maintain the fishery; 80 percent of virgin spring flows for channel maintenance (especially to maintain gravel bars and pools to facilitate camping and viewing); and 90 percent of the lesser of actual or mean monthly summer flows to keep boating portages down to a reasonable level for recreationists (Van Haveren et al., 1987). On an average **annual** basis, this amounts to a minimum flow request of roughly **80** to 90 percent of virgin flows.

Second, on the Gulkana River, another National Wild River in Alaska, minimum flow requests, primarily for boating, **fish** habitat, and channel maintenance, **equalled** mean monthly flows for all but the high flow months of May to July, when less than mean flows were considered acceptable except for periodic flood flows for channel maintenance (Shelby et al., 1990). On an average **annual** basis, roughly **60** percent of virgin flows were requested.

Third, on the Dolores River below **McPhee** Dam in Colorado, proposed flows for recreation, fish habitat, and channel maintenance equalled, on an average annual basis, roughly 35 percent of virgin flows (Vandas et al., 1990). This proposal was constrained by the existence of substantial upstream diversions.

Fourth, on a stretch of the San Pedro River in Arizona, now dedicated as a National Conservation Area, flow recommendations focused on fish and wildlife habitat, riparian vegetation, and aesthetics. During the winter, spring, and fall periods, the lesser of median daily or actual flow was requested, while during the summer period flows equal to median winter flows, plus 60 percent of flood flows, were requested (Jackson et al., 1987). On average this amounts to a recommended minimum flow of roughly **30** percent of virgin flows.

These four studies indicate that flow recommendations can vary **significantly,** depending on physical (hydrologic and morphologic) characteristics, as well as featured **instream** flow uses, and that complete virgin flows are not necessarily required for satisfying **multi-criterion instream** needs.

The role of streamflow in maintaining "natural conditions" within wilderness areas may differ from its role in providing for recreation, fish habitat, or stream channel maintenance. If "natural conditions" implies full virgin flows, then perhaps it is unreasonable to assume that different increments in flow are of different value. Rather, as in Figure 4, the value of flow in wilderness may be constant, with each increment of flow contributing equally to the natural character of the wilderness. Or, to take a more preservation-oriented position, perhaps the last increments of flow, up to completely natural flows, are the most valuable flows, as in Figure 3. Alternatively, it may be reasonable to assume that the law of diminishing returns applies also to naturalness, and that Figure 1 best depicts the overall value of flow in wilderness. In any case, it should be noted that if some quantity short of complete virgin flow is obtained, it will matter just as much when those flows are available as how much of the virgin flow is available.

PROTECTION OF FLOWS FOR WILDERNESS AREAS

Applications for water diversions must be **filed** with appropriate agencies. The guidelines that most states and pertinent federal agencies use to review such applications include considerations for **instream** flow (Shupe, 1989a). The permitting process could be used to protect downstream wilderness areas from unreasonable reductions in streamflow. However, denial of water diversion applications during the permit review process does not offer the security of a dedicated water right. Such a right is necessary to put **instream** flow on the same legal footing as consumptive use rights for such purposes as irrigation and municipal withdrawals.

There are basically two approaches to obtaining legal entitlement to **instream** flow for wilderness areas: filing for a new water right and transfer of existing water rights to **instream** uses.

New Water Rights

State **instream** flow laws and the federal reserved rights doctrine offer two vehicles for protecting **instream** flows. Over the past **20** years or so, many states have altered their water laws to include **instream** flow as a beneficial use of water, allowing individuals, private groups, and/or state agencies (depending on the state) to hold **instream** flow rights (Tarlock, 1978; **MacDonnell,** 1989). For example, Colorado's 1973 **instream** flow law empowers the Colorado Water

Conservation Board to hold **instream** flow water rights on behalf of the public (Shupe, 1989b) and Alaska's 1980 amendments to the state's Water Use Act allow government agencies or private persons or groups to **file** for and hold reservations for **instream** flow (Harle, 1989).

While **instream** flow rights offer a viable option for **instream** flow protection in many locations, and are a welcome alteration to the historic "use it or loose it" philosophy of water law in states following the doctrine of prior appropriation, there are three limitations of such rights for protecting water for wilderness areas. **First, instream** flow rights, when authorized, are junior to already existing rights on the respective stream. Thus, they are of little use in streams that are already fully appropriated, except if they help avoid **flow-**reducing transfers of senior rights via the "protection of juniors" rule of appropriate rights. And on partially appropriated streams they are least effective when most needed, during dry years when **instream** flow protection is most critical. Second, some **instream** flow laws allow protection of only the minimum flow needed for specific purposes, and such minimum flows may be a small fraction of natural flows. Third, not all states recognize **instream** flow rights, and even where an **instream** flow law exists, it may not cover all possible uses of **instream** flow (see lists of state **instream** flow laws in **McKinney** and Taylor **[1988];** Reiser et al. **[1989]; MacDonnell** and Rice **[1989];** and Shelby et al. **[1992]).**

Federal reserved rights are sometimes obtainable for land areas specially set aside by Congress. Reserved water rights were first asserted for Indian reservations, but have been expanded to other federal reservations, including national parks and forests (Brooks, 1979; Wiion and Anderson, 1985; Mead, 1986; Marks, 1987).

Reserved rights are only obtainable for primary purposes specified in the legislation setting aside the land area, and then only for the amount of water necessary for such purposes. While the Wilderness Act specifies several specific purposes for which water might be reserved (mentioned above) that do not seem to call for virgin flows, it also emphasizes "natural" and "primeval" conditions (see Wilkinson and Anderson **[1985]; Tarlock [1986]; Vassallo [1986];** Marks **[1987]).** Thus, the impact of a reserved right on water flow in a wilderness area is critically dependent on a resolution of the question of Congressional intent regarding the purpose of the land reservation.

Prior to the late **1980's,** reserved rights were not mentioned in the laws establishing wilderness areas. However, three recent additions to the wilderness system in Nevada (P.L. **101-195,** 103 Stat. **1784),** New Mexico (P.L. 100-225, 101 Stat. **1539),** and Washington (P.L. **100-668,** 102 Stat. **3961)** expressly reserved "sufficient," the **"minimum,"** or the **"necessary"** flows, respectively, to **fulfill** the purpose of wilderness designation. Note, however, that these reserved flow levels were not carefully defined or quantified in the legislation. Meanwhile, two unsuccessful 1991 Congressional wilderness proposals for Colorado (the Allard/Schaeffer Bill H.R. 1369 and the With/Brown Bill S. 1029) expressly denied the possibility of federal reserved rights for the new wilderness areas at issue.

The designation of federal reserved rights encounters stiff opposition in some areas for several reasons. First, such rights are retroactive to the date of the land reservation, thereby possibly usurping rights that had been established since the land reservation. A reserved right for an existing wilderness area obtained pursuant to the wilderness designation could have a priority date as far back as 1964 if it was one of the original wilderness areas designated by Congress. Of course, a reserved right for a new wilderness area would be junior to all existing rights on the stream. Second, because reserved rights for a designated wilderness area have not yet been quantified in court (i.e., because the question of just what flows are necessary to "fulfill the purpose" of a wilderness area has not been answered), reserved rights in wilderness areas entail considerable uncertainty. Water use interests may fear that a wilderness area might be awarded all natural flows, which would, of course, seriously interfere with upstream diversions for other uses. Thiid, reserved rights could interfere with transfers of senior rights from downstream to upstream of a wilderness area, because such a transfer would diminish the flow through the wilderness area (Marks **[1987, p. 654]** describes a Colorado example). Finally, reserved rights could preclude future upstream claims. The last two reasons apply equally to reserved rights and state **instream** flow rights, but the impact of reserved rights would be greater to the extent that reserved rights would reserve more water than the minimums that would apply under the state **instream** flow laws.

The reserved rights issue for wilderness areas was formally raised by the Sierra Club in a 1984 legal action that attempted to force the federal government to assert federal reserved rights for existing designated wilderness areas in Colorado (Marks, 1987). In response to this action, the U.S. Court of Appeals (911 **F.2d** 14051422 **[10th** Circuit]) concluded in 1990 that the Forest Service was not obligated to assert federal reserved rights in the absence of a threat to the wilderness character of the Colorado wilderness areas, and that, to date, the wilderness characteristics had been sufficiently preserved. Although not denying the possibility of federal reserved water rights for wilderness areas, the Court of Appeals vacated a 1985

U.S. District Court judgment that federal reserved water rights do exist in designated wilderness areas, asserting that the issue was not ripe for review given the lack of a threat to the wilderness water resources in question. The contradictions in the Wilderness Act and the resultant confusion in the courts have led to calls for Congress to pass additional legislation clarifying its intent (e.g., Colbourn [1988]).

Transfer of Existing Water Rights

Transfers of water rights occur as gifts or purchases. As water has become more scarce in the Western United States, purchases of water rights have become more common, and water markets have begun to play a more important role in water allocation (see Saliba et al. [1987a and 1987b] for descriptions of Western water markets). Opportunities to market water vary, of course, depending on local laws and institutional constraints. In some locations and for some categories of water, markets are well established. Perhaps the best known example is the market for shares of water from the Colorado Big Thompson project in northeastern Colorado (Howe, 1986; Saliba et al., 1987b). In other locations occasional transactions occur without the aid of a well established market (Colby, 1990). And, in addition to permanent transfers of water rights, water options, usually for cities to use agricultural water during dry years, are becoming more common (see, for example, Quinn [1989] or Holburt et al. [1988] on the Metropolitan Water District in southern California).

Most transfers of water rights or options have been for consumptive use of water, but transfers for **instream** flow purposes are becoming more common. The Water Intelligence Monthly (Stratecon, Inc., Claremont, California) and its predecessor, the Water Market Update (Shupe and Associates, Inc., Santa Fe, New Mexico), have listed numerous purchases of water for **instream** flow. As summarized by Brown (1991), these purchases include transfers in perpetuity (of water rights) and leases for shorter periods (usually only the current year). Prices of such transfers are generally below $10 per acre-foot per year. Most purchases were from irrigators, and were used to augment unusually low flows. Currently, only a few states specifically provide for transfers of water rights within their **instream** flow programs (MacDonnell et al., 1989), but other states are considering changes to facilitate such transfers (Williams and McHugh, 1990).

VALUE OF INSTREAM FLOW FOR WILDERNESS

What is water for wilderness areas worth? The transactions mentioned above do not indicate a high value for **instream** flow, but actual transactions for **instream** flow probably do not indicate the full economic value of **instream** flow, principally because the public good nature of **instream** flow makes it difficult for interested parties to participate in the transaction (and easy for others to obtain a free ride). Perhaps studies of the economic value of **instream** flow can offer additional evidence. Economic value studies fall into two groups, those that focus on recreation value, and those focusing on the total economic value, including preservation or existence value.

Recreation Value

Table 1 lists ten studies of the value of **instream** flow for recreation. Recreation activities studied include fishing, boating, and general shoreline activities (camping, picnicking). Except for Hansen and Hallam's (1991) use of cross-sectional analysis across the 48 contiguous states, the studies focused on specific rivers and used either the contingent valuation method (CVM) or the travel cost method (TCM). Most studies showed the value of flow reaching a peak and then decreasing (as in Figure 2) as the flow level increased (for more on this concave relation, see Brown et al. [1991]). On an acre-foot basis, the CVM and TCM studies found that the marginal value of flow at times of low flow varied from less than $1 to over $45. That is, recreationists were apparently willing to pay from $1 to $45 for an additional acre-foot of water to augment relatively low flows during periods of recreation use. Higher values within this range tended to be found on smaller rivers (where an acre-foot of water would have a greater relative impact) and more heavily used rivers. Hansen and Hallam's (1991) cross-sectional analysis indicated that marginal values of flow for fishing were below $10 per acre-foot in most regions of the country, but considerably above that in some areas, especially the drier, southwestern states.

The value of **instream** flow in a particular river may be higher than those values listed for the individual recreation activities in Table 1, for three reasons. First, the values of different activities are additive where participants in more than one activity can concurrently take advantage of increased flows without experiencing significant decreases in recreation quality due to crowding. Second, the values apply to the stretch of river studied. The willingness to pay of recreationists downstream of the study stretch would add to the economic values. Third, leaving water in the stream makes it available for other uses downstream, such as electric energy production. The studies by Daubert et al. (1979), Duflield et al. (1992a), Hansen and Hallam (1991), and Loomis and Creel (1992) compared the value of **instream** flow to the values of withdrawal for irrigation. The studies found that, during low flow periods, the value of

instream flow was often greater than the marginal value of withdrawal for irrigation.

Preservation Value

Streamflow is of value for more than just the recreation opportunities that it provides. River recreationists may be willing to pay some additional amount to preserve aquatic habitat or pristine streamflow conditions, and people who never visit a wilderness river may value maintenance of such conditions. Table 2 lists four water flow studies that focused on what has been called "total economic value" (Peterson and Sorg, 1987); that is, on not only the value of instream flow or onsite recreation but also on peoples' willingness to pay for preserving instream flows for future generations (bequest value) or just for the knowledge that such flows are preserved (existence value). All four studies used the contingent valuation method. Three of the studies focused on rivers, while the other focused on a lake.

Total values obtained in the studies varied from $15 to $115 per household per year. Many reasons could be posited for the differences among the five estimates listed in Table 2. Of key importance is the nature of the "good" that is being hypothetically purchased in each of the studies (the specific improvement in flow that is described in the contingent valuation question). The goods vary from guaranteeing protection from any development to augmenting flows via purchase of water.

Contingent valuation studies of existence value may be subject to unexpected biases and influences (Peterson and Sorg, 1987; Kahneman and Knetsch, 1992), such that the values are not directly comparable to market values or even to contingent valuation estimates of recreation value. Furthermore, the values obtained in such existence value studies are not easily expressed in terms of specific quantities of water, because the goods being purchased have typically not been carefully defined. However, these studies do suggest significant public concern about maintaining healthy flow conditions. Further, the studies consistently show that most of the total value is associated with bequest and existence motives, rather than use motives. This suggests that the values that recreationists place on instream flows underestimates the full social value of maintaining instream flow.

What do these economic studies of the recreation and preservation value of instream flow have to offer to the debate about wilderness water needs? First, although they show substantial recreation value to instream flow, the values apply to low flow times. The concave relation between recreation quality or value to flow suggests that recreation values provide little support for maintaining virgin flow conditions in wilderness areas. Second, the existence value studies indicate that existence value is likely to be greater than recreation value. However, the existence value studies provide little indication about the marginal value of flow, and little specific guidance about the value of flow as flows approach virgin conditions.

SUMMARY AND CONCLUSIONS

Aside from denials by water and land management agencies of applications to divert flow, two basic mechanisms exist for preserving instream flow for wilderness areas, creation and transfer of water rights. Establishment of new rights via legal action will not necessarily be successful, mainly because flow in many basins is already fully appropriated, especially in drier areas where the water issue is most pressing, and because of the strong opposition that reserved rights encounter in some locations.

Market transactions of water are becoming more common, and some transactions have been for instream flow augmentation. Both transaction evidence and economic value studies indicate that there is substantial value to instream flow which often exceeds the marginal value of alternative uses such as irrigation. The prices actually paid for instream flow in recent transactions tend to be lower than the values indicated in most economic value studies, but this is reasonable since the mechanisms for purchase of water for instream flow probably fail to reflect the willingness to pay of most interested parties, who remain either intentional or unintentional free-riders of the transactions.

Values established in instream flow transactions to date, as well as those estimated for recreation uses of instream flow, reflect the value of flow increments in times of relatively low flow. It is reasonable to expect that the marginal value of flow for all but preservation goals diminishes to zero at some level as flow increases. Studies so far offer little guidance about the marginal value of flow in wilderness areas, where preservation of more or less natural conditions is also a recognized goal. Assuming flows are timed sufficiently well, diminishing marginal utility probably applies to wilderness water as well, but the marginal value of streamflow in wilderness areas, as flow approaches virgin conditions, is likely to be greater than the marginal value of like increments in flow in non-wilderness locations.

REFERENCES

Bishop, R.; Boyle, K.; Welsh, M.; Baumgartner, R.; Rathbun, P. 1987. Glen Canyon Dam releases and downstream recreation: An analysis of user preferences and economic values. Heberlein-Baumgartner Research Services, Madison, WI.

Brooks, H.T. 1979. Reserved water rights and our national forests. Natural Resources Journal. 19(2): 433-443.

Brown, T.C. 1991. Water for wilderness areas: Instream flow needs, protection, and economic value. Rivers. 2(4):311-325.

Brown, T.C.; Taylor, J.G.; Shelby, B. 1991. Assessing the direct effects of streamflow on recreation: A literature review. Water Resources Bulletin. 27(6):979-989.

Clonts, HA.; Malone, J.W. 1990. Preservation attitudes and consumer surplus in free-flowing rivers. In: Vining, Joanne, ed. Social science and natural resource recreation management. Boulder, CO: Westview Press. 301-317.

Colbourn, E. 1988. The morality of wilderness: Federal reserved water rights in Western wilderness areas. Yale Law and Policy Review. 6:157-178.

Colby, B.G. 1990. Enhancing instream flow benefits in an era of water marketing. Water Resources Research. 26(6):1113-1120.

Daubert, J.; Young, R. 1981. Recreational demands for maintaining instream flows: A contingent approach. American Journal of Agricultural Economics. 63(4):666-675.

Duffield, J.W.; Neher, C.J.; Brown, T.C. 1992a. Recreation benefits of instream flow: Application to Montana's Big Hole and Bitterroot Rivers. Water Resources Research. 28(9):2169-2181.

Duffield, J.W.; Brown, T.C.; Allen, S.D. 1992b. Economic value of recreation and preservation benefits of instream flow in Montana. Draft Research Paper. Fort Collins, CO: Rocky Mountain Forest and Range Experiment Station, U.S. Forest Service.

Hansen, L.T.; Hallam, A. 1991. National estimates of the recreational value of streamflow. Water Resources Research. 27(2):167-175.

Harle, M.L. 1989. Appropriation of instream flows in Alaska. In: MacDonnell, L.J.; Rice, TA.; Shupe, S.J., eds. Instream flow protection in the West. Boulder, CO: Natural Resources Law Center, University of Colorado, School of Law.

Harpman, DA. 1990. The value of instream flow used to produce a recreational fishery. Fort Collins, CO: Department of Agriculture and Resource Economics, Colorado State University.

Holburt, M.B.; Atwater, R.W.; Quinn, T.H. 1988. Water marketing in Southern California. Journal of American Water Works Association. 20:38-45.

Howe, C.W. 1986. Project benefits and costs from national and regional viewpoints: Methodological issues and case study of the Colorado-Big Thompson Project. Natural Resources Journal. 26:77-93.

Jackson, W.; Martinez, T.; Cuplin, P.; Minckley, W.; Shelby, B.; Summers, P.; McGlothlin, D.; Van Haveren, B. 1987. Assessment of water conditions and management opportunities in support of riparian values on the San Pedro River. Denver, CO: Bureau of Land Management Service Center.

Jackson, W.; Shelby, B.; Martinez, A.; Van Haveren, B. 1989. An interdisciplinary process for protecting instream flows. Journal of Soil and Water Conservation. 44(2):121-127.

Johnson, N.S.; Adams, R.M. 1988. Benefits of increased streamflow: The case of the John Day River steelhead fishery. Water Resources Research. 24(11):1839-1846.

Kahneman, D.; Knetsch, J.L. 1992. Valuing public goods: The purchase of moral satisfaction. Journal of Environmental Economics and Management. 20:57-70.

Lamb, B.L. 1989. Quantifying instream flows: Matching policy and technology. In: MacDonnell, L.J.; Rice, TA.; Shupe, S.J., eds. Instream flow protection in the West. Boulder, CO: Natural Resources Law Center, University of Colorado, School of Law.

Loomis, J. 1987. The economic value of instream flow: Methodology and benefit estimates for optimum flows. Journal of Environmental Management. 24:169-179.

Loomis, J. 1987. Balancing public trust resources of Mono Lake and Los Angles' water right: An economic approach. Water Resources Research 23(8):1449-1456.

Loomis, J.; **Creel,** M. 1992. Recreation benefits of increased flows in California's San **Joaquin** and Stanislaus Rivers. Rivers. **3(1):1-13.**

Marks, J. 1987. The duty of agencies to assert reserved water rights in wilderness areas. Ecology Law Quarterly. **14:639-683.**

MacDonnell, LJ.; Rice, **T.A.;** Shupe, SJ. 1989. **Instream** flow protection in the West. Boulder, CO: Natural Resources Law Center, University of Colorado, School of Law.

MacDonnell, LJ.; Rice, TA. 1989. National interests in **instream** flows. In: **MacDonnell,** LJ.; Rice, TA.; Shupe, SJ., eds. **Instream** flow protection in the West. Boulder, CO: Natural Resources Law Center, University of Colorado, School of Law.

McKinney, MJ.; Taylor, J.G. 1988. Western state **instream** flow programs: A comparative assessment. **Instream** Flow Info. Paper No. 18, U.S. Fish and Wildlife Service, Biol. Rep. **89(2).**

Mead, K.L. 1986. Wyoming's experience with federal non-Indian reserved rights: The Big Horn adjudication. Land and Water Review. 21: 433-453.

Narayanan, R. 1986. Evaluation of recreational benefits of **instream** flows. Journal of Leisure Research. **18(2):116-128.**

Nehrmg, R.B. 1988. Stream fisheries investigations. Fish flow investigations. **Final** report. Federal Aid Project F51. Fort **Collins,** CO: Colorado Division of wildlife.

Peterson, George L.; Sorg, Cindy F. 1987. Toward the measurement of total economic value. Gen. Tech. Rep. RM-148. Fort **Collins,** CO: U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

Quinn, T.H. 1989. The economic and political evolution of water markets in California. Water Resources Update. **79:8-11.**

Reiser, D.W.; Wesche, TA.; Estes, C. 1989. Status of **instream** flow legislation and practices in North America. Fisheries. **14(2):22-29.**

Richards, K. 1982. Rivers: Form and process in alluvial channels. New York: Methuen.

Romm, J.; Bartoloni, K. 1985. New rules for national forest water. Journal of Forestry. **83:362-367.**

Saliba, B. **Colby;** Bush, D.B.; Martin, W.E.; Brown, T.C. 1987a. Do water markets appropriately measure water values? Natural Resources Journal. **27:617-651.**

Saliba, B. Colby; Bush, D.B.; Martin, W.E. 1987b. Water marketing in the Southwest: Can market prices be used to evaluate water supply augmentation projects. Gen. Tech. Rep. RM-144. Fort **Collins,** CO: U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

Sanders, L.D.; Walsh, R.G.; Loomis, J.B. 1990. Toward empirical estimation of the total value of protecting rivers. Water Resources Research. **26(7):1345-1357.**

Shelby, B.; Van Haveren, B.P.; Jackson, W.L.; Whittaker, D.; **Prichard,** D.; **Ellerbroek,** D. 1990. Resource values and **instream** flow recommendations, Gulkana National Wild River, Alaska. Denver, CO: Bureau of Land Management, Denver Federal Center.

Shelby, B.; Brown, T.C.; Taylor, J.G. 1992. Streamflow and recreation. Gen. Tech. Rep. **RM-**209. Fort **Collins,** CO: U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

Shupe, SJ. 1989a. Keeping the waters flowing: Stream flow protection programs, strategies and issues in the West. In: **MacDonnell,** LJ.; Rice, TA.; Shupe, SJ., eds. **Instream** flow protection in the West. Boulder, CO: Natural Resources Law Center, University of Colorado, School of Law. 1-21.

Shupe, SJ. 1989b. Colorado's **instream** flow program: Protecting free-flowing stream in a water consumptive state. In: **MacDonnell,** LJ.; Rice, TA.; Shupe, SJ., eds. **Instream** flow protection in the West. Boulder, CO: Natural Resources Law Center, University of Colorado, School of Law. 237-252.

Stahmker, C.B. 1980. Effects on **fisheries** of abstractions and perturbations in streamflow. In: Glover, John H., ed. **Allocation** of fishery resources, Proceedings of the technical consultation on **allocation** of **fishery** resources; 1980 April; Vichy, France: 366-383. Food and Agriculture Organization, United Nations, New York.

Tarlock, A. Dan. 1978. Appropriation for **instream** flow maintenance: A progress report on **"new"** public Western water rights. Utah Law Review. 211:211-247.

Tarlock, A.D. 1986. Protection of water flows for national parks. Land and Water Law Review. **22(1):29-48.**

Tennant, D.L. 1976. **Instream** flow regimes for fish, wildlife, recreation, and related environmental resources. In: Proceedings of the symposium and specialty conference on **instream** flow needs. American Fisheries Society, Bethesda, MD: 359-375.

Van Haveren, B.; Jackson, W.; Martinez, T.; Shelby, B.; Carufel, L. 1987. Water rights assessment for Beaver Creek National Wild River, Alaska. Denver, CO: BLM Service Center.

Vandas, S.; Whittaker, D.; Murphy, D.; **Prichard,** D.; **MacDonnell,** L.; Shelby, B.; Muller, D.; **Fogg,** J.; Van Haveren, B. 1990. Dolores River **instream** flow assessment. Denver, CO: Bureau of Land Management, Denver Federal Center.

Vassallo, N. 1986. Federal reserved water rights in national forest wilderness areas. Land and Water Law Review. **21:381-396.**

Walsh, R.; **Ericson,** R.; Arostegy, D.; Hansen, M. 1980. An empirical application of a model for estimating the recreation value of **instream** flow. Completion Report No. 101. Fort Collins, CO: Colorado Water Resources Research Institute, Colorado State University.

Ward, F. 1987. Economics of water allocation to **instream** uses in a fully appropriated river basin: Evidence from a New Mexico wild river. Water Resources Research. **23(3):381-392.**

Wilkinson, C.F.; Anderson, H.M. 1985. Land and resources planning in the national forests. Oregon Law Review. **64(1** and **2):201-241.**

Williams, P.R.; McHugh, S.J. 1990. Water marketing and **instream** flows: The next step in protecting California's **instream** values. Stanford Environmental Law Journal. **9:132-197.**

Table 1. Studies of the Recreation Value of Instream Flow

Author (Date)	River (State)	Method[a]	Activity	Marginal value of flow $/af	flow level
Bishop et al. (1987)	Colorado (Arizona)	CVM	rafting fishing	1 c 1	low flow (10,000 cfs) low flow (10,000 cfs)
Daubert et al. (1979)	Cache La Poudre (Colorado)	CVM	fishing shoreline use boating	12 8 5	low flow (100 cfs) low flow (100 cfs) low flow (100 cfs)
Duffield et al. (1992a)	Big Hole (Montana)	CVM	fishing	25	low flow (100 cfs)
	Bitterroot (Montana)	CVM	fish & shoreline	10	low flow (100 cfs)
Hansen & Hallam (1991)	many (all 48 states)	cross-section	fishing	wide range	actual
Harpman flow (40 cfs) (1990)	Taylor (Colorado)	CVM	fishing	2	critical low winter
Johnson & Adams (204 cfs) (1988)	John Day (Oregon)	CVM	fishing	2	mean summer flow
Loomis & Creel (1992)	San Joaquin (California)	TCM	fishing, viewing & hunting	45-116[b]	dry year
	Stanislaus (California)	TCM	fishing, viewing & hunting	11-13[b]	dry year
Narayanan (1986)	Blacksmith Fork (Utah)	TCM	camping, fishing & fishing	1	low flow (80 cfs)
Walsh et al. (1980)	nine rivers (Colorado)	CVM	fishing kayaking rafting	13 4 2	35% of max 1978 flow 35% of max 1978 flow 35% of max 1978 flow
Ward (1000 cfs) (1987)	Chama (New Mexico)	TCM	fishing, boating	25	low boating flow

[a] CVM = contingent valuation method, TCM = travel cost method.
[b] Value within range depends on when during the year the flow increases occur.

Table 2. Studies of the Total Value dnstream Flow

Author	River	Total WTP ($/house/yr)	Percent of total for: use	beq/exist	Good being purchased
Walsh et al. (1985)[a]	**11** rivers in **Colorado**	95	33	**64**	"guarantee that these rivers are **protected...from diversion and dams."**
Loomis **(1987)**	Mono Lake	**115**	**21**	**79**	**first level of improvement in lake level, salinity, bird survival & diversity, visibility**
		39			**second level of improvement**
Clonts & Malone **(1990)**	**15** free-flowing rivers in Alabama	57	**31**	**69**	**preserve the rivers afree-flowing**
Duffield et al. **(1992b)**	5 MT rivers	**15**	20	80	membership in trust fund **"to** buy water needed to increase summer flows . . . for trout **populations...[and]** many species of birds, wildlife, and plants..."

[a] See also Sanders et al. **(1990).**

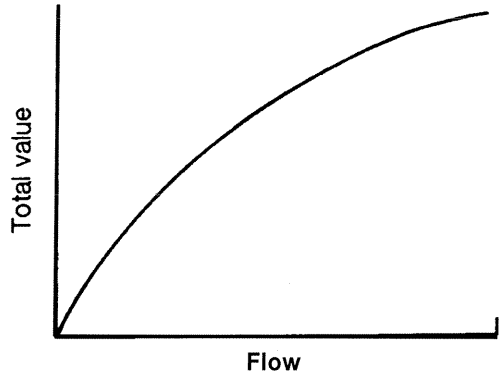


FIGURE 1. Diminishing *marginal returns to flow.*

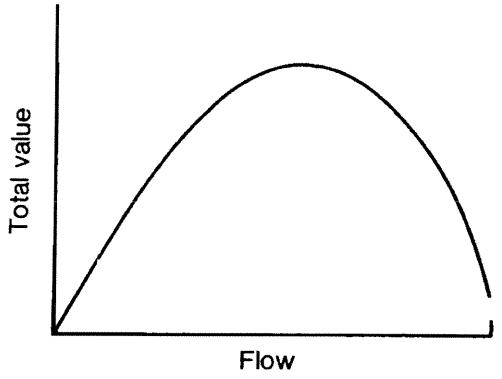


FIGURE 2. Positive, *then negative, marginal returns to flow.*

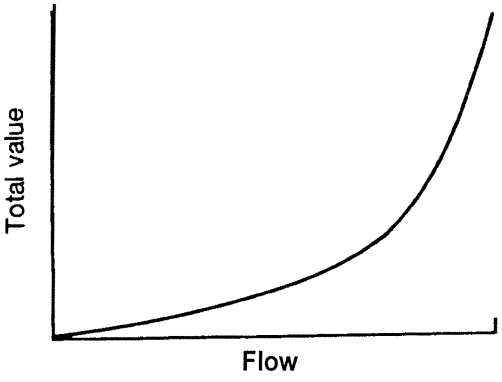


FIGURE 3. Increasing *marginal returns to flow.*

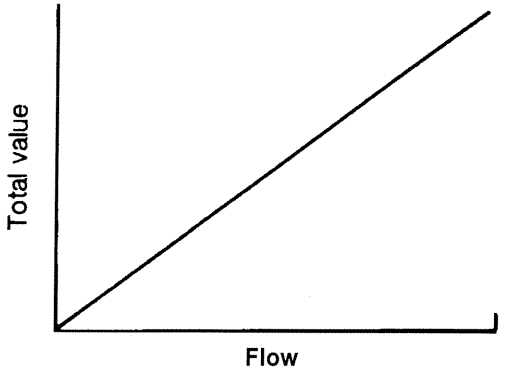


FIGURE 4. *Constant marginal returns to flow.*

Part V. Local Economic Impacts

THE ECONOMICS OF WILDLAND PRESERVATION: THE VIEW FROM THE LOCAL ECONOMY

Thomas Michael Power*

INTRODUCTION

Most of the papers in this section of the proceedings focus upon the professional economist's definition of the economic value of wilderness: what are the trade-offs in the minds of those who value wilderness between more or less wilderness and less ***or more*** of the other goods which the economy is capable of producing? This definition leads directly to measures of economic value built around peoples' willingness to pay or willingness to accept compensation for changes in the availability and quality of wilderness.

Although this **is** the correct definition of the economic value of wilderness within the discipline of economics, this is **not** the definition used by most people living near wilderness areas. Nor is it, I suspect, the definition most public decision-makers have in mind. To these non-economists who have an important say in any **wildland** preservation decision, "economic value" means incremental jobs, income, and economic activity associated with wilderness or the commodities that commercial development of the wildlands could produce.

These are **very** different definitions of "economic value": the one used by professional economists and the one used in most public discussion and debate. The prevalence and, even, dominance of the "job and income" definition of economic value and its conflict with the professional economist's "willingness-to-pay" definition has led me to label the more popular definition "folk economics" to distinguish it from the professional economist's not widely shared definition (Power, **1988a,** pp. xi-xii, and 1988b). The better label may be the one adopted for this set of papers: "local economic impact" as opposed to "economic value."

What is important to keep in mind in communicating with decision-makers and the general public, however, is that in the widely shared economic "knowledge," these two definitions of "economic value" run together in a very confusing way. One can find this melding of the two quite different meanings in the following set of papers. Moisey and Yuan, for instance, end their paper with a comment on the "benefits from . . . wildland-induced visitors" on the local economy. Yet these "benefits" are not the ones that would usually be included in a benefit-cost analysis of wilderness preservation. Rather, they are the **costs** incurred by visitors seeking to make use of wildland. That is, what is a cost in the professional economist's lexicon becomes a benefit in the more dominant language of folk economics.

Economists and **wildland** preservationists have not helped much in clarifying and relating these two definitions. It is almost as if a creative confusion were encouraged by allowing these definitions to run together. For economists this confusion is "creative" because it allows their otherwise arcane and abstract concepts of value to be clothed with the rhetorical power of an economics that deals with the "material means of survival." For **wildland** preservationists, it brings the same rhetorical benefits: in talking about the economic value of wilderness, preservation takes on a more practical, hard-nosed aspect that may appear to speak to people's feelings of economic insecurity.

But there is **little** connection between the "job and income" definition of economic value and the "willingness to pay" measure. If we are to make honest headway in documenting the economic value of wilderness, we need to help the public and **decision-makers** understand the strengths and weaknesses of these hvo quite different approaches to the economics of **wildland** preservation. This introductory paper and those that follow it take some modest steps in that direction. To keep this paper brief, the author has immodestly provided citations primarily to his own work.

ECONOMIC VALUE AND LOCAL ECONOMIC IMPACTS

Of course, there has to be some connection between the economic value of wilderness and the local economic impact of wilderness preservation. If people, in fact, place substantial value on wilderness, it is

* Professor and Chairman of the Economics Department, University of Montana, Missoula, Montana 59812.

highly likely that the pursuit of the values associated with wilderness will be reflected in economic behavior that has a local impact. But the local economic impact may be weak or even negative for several reasons.

First, some wilderness values are "non-use" values, such as existence, bequest, and option values, which do not involve "on-the-ground" activities in or adjacent to wildlands. Yet, preservation may require halting just the type of on-the-ground **wildland-based** economic activities in which locals have long engaged.

This latter possibility underlines the second important issue: the geographic distribution of economic benefits and costs. To the extent that the wildlands are located in rural, relatively unpopulated areas, while those who value the **wildland** characteristics primarily live in distant urban centers, the benefits associated with preservation may primarily flow to distant population centers. This will be true even if local residents also value those **wildland** characteristics. When one also considers the more concentrated local impact of halting extractive activities in wildlands, the skewed distribution of benefits and costs is even more problematic. This type of very familiar distributional problem has long baffled economists, who prefer to focus on more tractable technical resource efficiency problems.

Finally, it has to be kept in mind just why economists have gotten into the business of estimating non-commercial economic values. If market transactions coordinated by financial flows adequately evaluated **all** goods and services, we would not be discussing and analyzing the economic value of wilderness any more than we would be wondering over what the economic value of wheat or two-by-four studs was. The economic value of wilderness is problematic because there are not reliable markets and financial exchanges that document for us what those values are. That is, there are limited market exchanges and money flows associated with **wildland** values. That will also mean that the set of local economic impacts will be incomplete and unbalanced. Anne Huebner's paper in the following section underlines one of the (correctable) ways in which this will be true. Only marketable commodities currently influence the size of the federal payments to county governments. **Non-**marketed goods and services associated with wilderness contribute little or nothing. This gives local governments far more interest in commodity development that in **wildland** preservation. But this is just one way in which the generation of economic value and the flow of economic impacts diverge. Because there is no cash flow through their businesses matching the non-market values associated with preserved wildlands, some members of the local business community may be far more supportive of commercial tourist developments in wildlands than in protecting the wilderness qualities.

Wildland economic preservation values and the local economic impact of such preservation **are** related, but in complex and not very well understood ways that do not **fit** very well into the rubric of the professional economist's national efficiency analysis. For this reason, it is important, while insiiting upon the legitimacy and importance of accurately measured **non-**market economic values, to also separately focus on good local economic impact analysis. Even that is easier said than done.

"Good" economic impact analysis would avoid all of the following pitfalls:

i. It would focus specifically upon the economic well-being of the existing population of the area and would not uncritically accept as measures of local economic well-being the familiar total employment and income, population, dollar volume of business, unemployment, and per capita income measures.

ii. It would critically evaluate the economic reality of the opportunity costs associated with restricted economic activities in protected wildlands rather than accepting estimates of potential physical quantities that might be lost due to **wildland** preservation.

iii. It would not focus exclusively on tourism/visitors when evaluating the way preservation enhances certain types of economic activities. The importance of wildlands to existing residents and to locational choices would also be considered. In addition, the way in which various levels of protection affects recreation and other preservation values would be analyzed.

iv. The impact of **wildland** preservation on both restricted and enhanced economic activities would be put in the context of the total economy and the trends that are transforming it. This helps avoid a "rear-view-mirror" approach to economic impact analysis.

Most current economic impact analysis does not even address, not to suggest meet, these criteria. To underline how far we have to go, each of these is discussed briefly in turn below.

THE CONCEPTUAL INADEQUACY OF CONTEMPORARY LOCAL ECONOMIC IMPACT ANALYSIS

I begin with the assumption that the focus of any analysis of local economic impact should be on the economic well-being of existing residents and how that may change as a result of different public policies. Although that may appear to be a relatively non-controversial statement, the standard tools of local economic impact analysis do **not** focus on that. Instead, much broader quantitative measures are assumed to be closely associated with the economic well-being of existing residents, and the analysis then proceeds to focus **almost** exclusively on those quantitative features of the local economy. Those usually include total employment, total income, gross dollar volume of business, total population, per capita income, and unemployment rates. Some of these (e.g., total population and gross dollar volume of business) are not even plausibly related to the well-being of existing residents., total income, total employment, and unemployment rates) do not distinguish between the well-being of existing residents and that of potential new-comers.

Finally, measures such as **per** capita income and unemployment rates may be perversely misinterpreted in a mobile society where people "vote with their feet" as they pursue living environments which they find attractive. Attractive living environments, for instance, may well become areas with low real per capita incomes, high unemployment rates, and high costs of living simply because these are the costs that residents are willing to pay to gain access to non-marketed qualities of the natural and social environment (Power, **1990a** and **1988a,** Chapter 8).

The point is that the standard tools of local economic impact analysis are conceptually flawed or are used in a conceptually flawed manner. This should not be surprising. Professional economists have, in general, avoided dealing with local economic well-being. This has been considered a rather parochial field of little professional or national significance. It has been left, instead, to local Chambers of Commerce and economic development organizations. They, not surprisingly, have given this type of analysis a decidedly **"boosterist"** flavor: anything that "boosts" the dollar volume of business in the local community. This explains the commitment to uncritically using various quantitative measures or misinterpreting the quantitative measures that are used (Power, **1988a,** Chapter 1).

Before local economic impact analysis can be of much use in answering questions about the impact of public policy on local well-being, economists are going to have to develop the conceptual tools that allow us to use and interpret the market-orientated data that is readily available. They are also going to have to guide the collection of data that allows us to deal with the fact that local economic well-being depends upon both marketed and non-marketed goods and services (Power, 1984). Until that is done, local economic analysis may add as much confusion as it does clarification.

LINKING **WILDLAND** PRESERVATION AND CONSTRAINED ECONOMIC USE

The economic costs associated with preserving wildlands are the value of the opportunities forgone when use of the area is restricted to protect its "wild" characteristics. This may involve restricting timber harvests, mining, hydroelectric development, resort development, **roaded** recreation, etc. It is easy to imaeine almost unlimited activities that might have taken place in the area had it not been managed to protect its **wildland** character. These, then, can simply be asserted to be the economic costs. But clearly that is not sufficient. The physical possibility of something does not give it a positive economic value nor does it make it a certain or even a likely result in the absence of restrictions aimed at protecting **wildland** values.

This may seem obvious, but physical possibilities rather than economic reality often dominate estimates of the economic sacrifice associated with **wildland** preservation. For instance, in Southern Utah, the existence of coal, uranium, other energy, and precious metal deposits has been used as the basis for calculating biions of dollars of wilderness "costs" (Learning, 1990, and Power, 1991b).

On the Rocky Mountain Front, the possibility of finding natural gas fields has been the basis for calculating high opportunity costs for wilderness. In most U.S. Forest Service plans, the loss of opportunities for **roaded** recreation is used to offset the value of dispersed **wildland** recreation (Power, 1987 and 1990b).

Clearly, critical economic analysis can be useful in these types of situations to constrain the claimed economic costs of **wildland** preservation to those with some conceptual support in economics. Economic value is not established by taking an estimated physical quantity and multiplying by an average value when the good or service is delivered to a market. The cost of obtaining access to the resource, the cost of processing it, and the cost of delivering it to the market all have to be taken into account. So, too, does the existence of substitutes: if a resource is readily available from a

variety of different sources of similar quality, all of which will not be developed, the cost of not developing any one of those sources may be close to zero (Power, 1990b). This primarily involves the application of the concept of site rental value to the mineral deposit, a basic but underutilized concept, usually ignored in the attack on preservation.

Similarly, a possibility is not the same as a certainty. The possibility of discovering oil or gas or commercially feasible deposits of some other mineral does not have the same economic import as a known deposit. At the very least, the probability of a discovery of a certain size and with certain cost characteristics has to be taken into account in some type of expected value calculation. For very uncertain mineral explorations, this can turn billion dollar "resources" into almost non-existent resources (Power, 1990b and 1987).

One of the most important contributions economics can make in evaluating local economic impacts is to critically develop the information available on the alternative commercial uses of wildlands and place it in the appropriate economic context of supply, demand, and substitutes.

LINKING **WILDLAND** PRESERVATION AND ENHANCED ECONOMIC ACTIVITY

Because people do value wild landscapes, the protection of such landscapes is likely to enhance those economic activities that support visitation to and use of those wildlands. Accurate estimation of these local impacts certainly is important in developing a complete picture of how preservation affects local well-being.

But this, too, is a more complicated issue than might be assumed. Linking various types of landscape protection to visitor preferences and visitor visitation rates and expenditures requires a type of data collection that is rarely pursued. Moisey and Yuan and Yuan and Christiansen, in the papers that follow, for instance, correctly link fishing and wildlife observation that take place outside of protected wildlands but that are supported by **wildland** watersheds and habitat to the supporting **wildland** base. This is an important and appropriate step away from only counting recreation that takes place within designated wildlands. But this still leaves open the question of what level of protection or what level of degradation could be allowed within the wilderness with little change in the value of this related recreation. That is, although we may suspect that the impact of protecting these landscapes on these off-site activities is positive, we do not know how marginal or modest or drastic changes to the status of these lands would affect those values.

It is also important not to focus exclusively upon visitors in conducting this type of economic analysis (Power, 1989b). As mentioned above, residents' economic well-being is the result both of the real money income they have access to and the flow of **non-**marketed qualities associated with the natural and social environment. Protected wildlands cannot be valuable only to visitors. They are likely to be valuable to the existing population, too. They may also play an important role in attracting both businesses and population to a particular area. In that sense, a significant part of the non-tourist economic activity may be tied to protecting these landscapes, too (Power 1991a). And in measuring local economic impacts, the direct value of these wildlands to the existing population also needs to be taken into account (Power, 1983).

PUTTING ECONOMIC CHANGE INTO AN INFORMED CONTEXT: AVOIDING THE REAR-VIEW MIRROR APPROACH

Local economic impact analysis has been crippled by the use of a very primitive economic base model of the local economy. That primitive model is also shared by most of the local population and decision-makers. It is a model taught to the general population in primary grade school and reinforced by the mass media after that. That primitive economic base model identities the local economy with its dominant export: people live in Pittsburgh because of steel, in Detroit because of automobile production, in Milwaukee because of beer, in western Montana and north Idaho because of forestry, etc. (Power, **1988a,** Chapter 7, and 3989a).

Although there is an element of truth to this encapsulation of the local economy, it is both distracting and distorting. Most importantly, it ignores the fact that economic development primarily involves escaping from the dominance of the local economy by one or a few such export-oriented industries. An economy that is developing is being systematically transformed in a way that reduces the importance a few primary or secondary economic activities. What most of these depictions of the local economy do is focus on what was important or dominant in the past and then use that as an indication of what will be important sources of employment and income in the future. In most cases, this will be seriously misleading (Power, 1991a and **1989c).**

What the economic analyst needs to do is to provide an overview of the way in which the local economy has been changing and the forces that are driving that change. Before the public and local decision-makers can put the impacts of **wildland** preservation in a useful context, they need to know just where the local

economy is now and where it is going. Knowing only where it was thirty or fifty years ago is not usually going to be useful information.

Ray Rasker's paper in the following group of papers is a good example of the type of context that needs to be established before one can adequately evaluate the local economic impact of **wildland** preservation. To assert that protecting landscapes will limit timber harvest and mineral extraction in an area dominated by this type of activity can create considerable insecurity on the part of the local citizenry. To say the same things while pointing out that these sectors are small and declining sources of employment, while **"landscape-**related" employment in, say, recreation is large and growing, may have a quite different meaning. Given that economic insecurity is one of the most powerful forces mitigating against environmental protection, it is extremely important to help the local population to accurately understand the size and character of the risk they face as a result of **wildland** protection.

CONCLUSION

Critical analysis of the local economic impact of **wildland** preservation is central to the political process of protecting these natural areas. Yet this is a relatively underdeveloped field of professional economic analysis that has been neglected because of its small town and rural focus and because of its association with the "boosterism" of the local business community. The result has been that economists have been developing ever more sophisticated tools with which to measure the economic value of various **wildland** qualities and have used those non-market economic values to document the national and international importance of **wildland** preservation. But these empirical economic results have had limited impact in actually protecting these natural areas because the more widely used "folk" economic concepts have been telling a contradictory story: **wildland** protecting is unreasonably costly and destructive of local communities and economic health.

Economists interested in seeing that a more balanced view of the "economics of **wildland** preservation" is developed and shared with both citizens and **decision-**makers need to reallocate some of their energy away from the nearly exclusive focus on estimating **non-**market economic values. Local economic impact analysis will continue to play a central role in preservation decisions, and we need much more sophisticated and critical analyses than we now typically have available.

REFERENCES

Leaming, George F. 1990. The adverse economic impacts of wilderness land withdrawals in Utah. Marana, AR: Western Economic Analysis Center.

Power, Thomas M. 1991a. Ecosystem preservation and the economy of the greater Yellowstone area. Conservation Biology. **5(3),** September, 1991.

Power, Thomas M. 1991b. **Wildland** preservation and the economy of Utah. Summer, 1991, Utah 2000 Project. State of Utah, reprinted in Southern Utah Wilderness Alliance Newsletter.

Power, Thomas M. 1990a. Real measures of nonmetropolitan local economic well-being: Adjusting per capita income for local cost of living and amenities. Proceedings, 24th Pacific Northwest Economic Conference, April, 1990.

Power, Thomas M. 1990b. Comparing wilderness values to oil and gas values along the Rocky Mountain Front: A net economic value approach. Forestry on the Frontier, 1990, American Society of Foresters.

Power, Thomas M. 1989a. Broader vision, narrower focus in local economic development. Forum for Applied Research and Public Policy. Fall, 1989, 40-49 **pp.**

Power, Thomas M. 1989b. Avoiding the passive/ helpless approach to economic development. Forest Watch. October, 1989, 15-18 pp.

Power, Thomas M. **1989c.** The economic base model and local economic development policy. Proceedings, 23rd Annual Pacific Northwest Economic Conference, April, 1989.

Power, Thomas M. 1988a. The economic pursuit of quality. New York: M.E. Sharpe Publishers.

Power, Thomas M. 1988b. Per capita income as an index of local economic well-being: A critique of an important 'folk' economic principle. Proceedings, 22nd Pacific Northwest Economic Conference. April, 1988, 65-70 pp.

Power, Thomas M. 1987. To be or not to be: The economics of wilderness classification on the Rocky Mountain Front. Western Wildlands. Fall, 1987.

Power, Thomas M. 1983. Another dimension of community stability: Local quality of life. Western Wildland. Winter, 1983. **8(4):28-32.**

ECONOMIC SIGNIFICANCE AND CHARACTERISTICS OF SELECT WILDLAND-ATTRACTED VISITORS TO MONTANA

Neil Moisey and Michael S. Yuan*

ABSTRACT

Wildland-based recreation may be an important component of a state's economic base. The economic effects of expenditures by non-resident visitors to Montana engaging in wildland-based activities were estimated using an input-output economic model (IMPLAN). Expenditure data werecollected from the Montana Travel Survey. Results indicate that non-resident spending by wildland-attracted visitors stimulates considerable growth in economic activity in Montana.

INTRODUCTION

While the aesthetic and natural resource values of wildlands are acknowledged by both opponents and proponents of wilderness, **wildland** preservation is often debated in terms of economics. Recently there have been attempts to justify wilderness by linking it to the travel and tourism industry in Western states. Wilderness-based tourism represents a substantial amount of the tourism activity in this region. For example, in Montana, which contains about ten percent of the wilderness acreage in the U.S. outside of Alaska, wilderness use constitutes almost 700,000 recreation visitor days (USDA Forest Service, 1991). While these use figures are substantial, the amount of use that can be attributed to wilderness-induced **wildland** use outside of wilderness is probably many times more. Wilderness areas can provide the natural backdrop (dramatic scenery, wildlife, high quality streams, etc.) that attracts visitors to **wildland** areas outside of wilderness.

In linking **wildland** use to tourism and thus to economic development, we are beginning to understand its importance to a state's economy. Montana's travel and tourism industry is becoming one of the fastest growing industries in the state. In 1990, over 5 million travelers visited Montana, spending over $750 million. This resulted in over $1.5 billion of total economic impact, $428 million in income, and supported almost **27,000** Montana jobs (Yuan and Moisey, 1991). Over 50 percent of these travelers were attracted to Montana because of the state's scenic quality.

The connection between **wildland** use and tourism and economic development is important to the state's economy. However, many people do not understand this linkage or the components that make up the relationship. This paper discusses one of these components: the economic significance of the activities that constitute much of the **wildland** involvement, namely backpacking, angling, and nature study. We examined the economic significance of these activities and then compared them to the remainder of the travel market in Montana.

It is important to examine particular activities for several reasons. First, activities form market segments that can be specifically identified and targeted; second, people understand and relate to activity descriptors; and third, data on activities are readily available (Moisey and others, 1990). Studies of activity involvement are very popular in the recreation and wilderness literature, but they generally concentrate on describing activities. While there is a trend toward examining behavioral components of **wildland** involvement, management decisions are more often based on what people do, namely their activities. One aspect of activity involvement is not often addressed - the economic significance of wildland-based activities.

BACKGROUND CONCEPTS

While traveling to Montana, non-residents buy goods and services from local businesses. These outside, or exogenous, dollars are distributed throughout the economy, producing a multiplier effect on the original expenditure. The introduction of visitors' exogenous dollars stimulates economic growth in the state.

There are three types of effects that exogenous dollars can have on a region's economy - direct, indirect, and

*Research Assistant, Institute for Tourism and Recreation Research, School of Forestry, University of Montana, Missoula, MT 59812 and Assistant Professor, Institute for Tourism and Recreation Research, School of Forestry, University of Montana, Missoula, MT 59812.

induced. Direct effects result from the initial purchase of goods and services by travelers. Businesses that provide these goods and services must purchase inputs (e.g., raw materials and labor) from their suppliers; these purchases result in indirect effects - that is, suppliers are indirectly affected by the travelers' expenditure. For example, restaurants must purchase food items from their suppliers to provide meals for travelers. Induced effects result from the increased spending of persons employed in the directly and indirectly affected businesses. This chain of buying and selling continues until the original expenditure totally leaks out of the region in the form of purchases, interest, profits, rents, and taxes paid outside the region. The sum of the indirect and induced impacts are defined as total secondary impacts (Walsh, 1986).

The ratio of the direct impact to the sum of direct and secondary impacts is called a multiplier. Multipliers give an indication of how much "leakage" occurs from a region as a result of spending on outside goods and services. The more leakage an industry has, the lower the multiplier. In addition, the smaller the secondary effects are relative to the direct effects, the smaller the multiplier. The multiplier for a region with a diversity of businesses will be larger because regional demand may be satisfied from within the region, rather than through imports.

Multipliers can be calculated for numerous economic indicators. Just as additional employment earnings are generated as a result of **direct** expenditures, additional employee compensation is produced from secondary spending. The ratio of **direct** employee income to direct and secondary employee income is called a personal income multiplier (USDA Forest Service, 1989). Employment is generated by each level of impact, producing an employment multiplier, which is defined as the ratio of direct employment to direct and secondary employment.

METHODOLOGY

Data Collection

The primary expenditure data used in this analysis were obtained from the Montana Travel Survey of non-resident travelers (Moisey and **Yuan,** 1990). From April 1988 through March 1989 and May **1990** through September 1990, a sample of non-resident visitors were contacted at the state's six major airports and the thirteen primary highways used to enter Montana. Each location was surveyed in proportion to the number of non-resident visitors entering Montana by that entrance. On-site interviewers questioned visitors about their trip purpose, length of stay, and state of residence. Mail-back trip questionnaires distributed to these visitors asked them to record the type, amount, and location of each expenditure made during two days of their trip in Montana. The questionnaires allowed respondents to record 14 types of expenditures that represented the most common visitor expenditure categories. Other questions asked respondents to record their recreation activity patterns while in Montana and to provide socio-demographic information. Approximately 15,000 travel groups were interviewed, resulting in about 7,500 returned questionnaires.

Identification of Wildland-Based Activities

For this study, wildland-based activities were defined as backpacking or backcountry camping, nature study or wildlife viewing, and angling. These activities are influenced by the **wildland** character of Montana's natural areas, which attract visitors to the state.

Respondents who indicated on the mail-back questionnaire that they had engaged in one of these wildland-based activities were identified and grouped into an activity type. The wildland-based activity groupings were analyzed independently and then compared with the non-wildland-based activity visitors to Montana.

Limitations

Each activity group's economic effect may include impacts from other wildland-based activities because these groups actually represent activity clusters. For example, many backpackers may have **fished** and studied nature. The total economic effect of the three wildland-based activities were calculated separately. To eliminate this overlap in activity participation, the three activity groups were then combined to estimate the total economic effects of the three wildland-based activities.

The economic effects estimated from **wildland-based** visitors may include expenditures made while engaging in non-w&hand-based activities. For example, visitors may have backpacked in Montana for several days and then spent several days shopping. Therefore, the economic effects for wildland-based visitors include all the expenditures they made in Montana.

Total Group Expenditures

To estimate total trip expenditures, the mean for each expenditure category was calculated and combined with

average trip length for each travel group. Total trip costs were then multiplied by the estimated number of groups for each activity type to estimate total gross expenditures for each activity type. The gross expenditures were then used to estimate the economic impacts for each activity type.

Economic Analysis

This study uses the IMPLAN input-output economic model developed by the U.S. Forest Service. The IMPLAN data base contains county-level economic data, derived from the national input-output model and the 1982 Census of Business (Alward and Lofting, 1985). The model allows the user to define an economic region based on single or multiple counties. IMPLAN estimates economic impacts in terms of changes in **final** demand within these defined economic regions. Spending by non-resident visitors introduces exogenous dollars into the state economy and can be treated as changes in **final** demand. The direct, indirect, and induced effects of these changes in **final** demand were estimated by IMPLAN. These important secondary effects are then used to derive total industry output, employee compensation, and employment multipliers.

Allocation of Trip Expenditures to Economic Sectors

Two steps were taken to prepare the Montana Travel Survey (MTS) gross expenditure data for economic impact analysis. During the first step, the **14** MTS expenditure categories were "bridged," or distributed to the appropriate economic sectors contained within the IMPLAN data base. The allocation scheme used is based on methods developed by various researchers and used in numerous impact studies (Probst, 1985; Alward and Lofting, 1985; Watson and Bratcher, 1987; Bergstrom and others, 1989; USDA Forest Service, 1989; Moisey and Yuan, 1990; Cordell and others, 1990). The scheme used production function data provided by the U.S. Department of Commerce (Bureau of Economic Analysis, 1989).

Once this allocation was made, each sector was deflated from 1990 to 1982 prices, based on producer price indices. The IMPLAN county-level data base is derived from the 1982 Census of Business. To make the 1990 Montana Travel Survey (MTS) allocation data consistent with this data base, they must be converted to 1982 prices for IMPLAN analysis. Once IMPLAN estimated the regional impacts, they were inflated to reflect 1990 prices.

RESULTS

The three wildland-based activity groups from the MTS produced the sample sizes shown in Table 1. These were used to estimate the total number of non-resident visitors engaging in each activity. Backpackers represented the smallest of the three groups, while the nature study group comprised about 70 percent of the wildland-based activity respondents. Anglers comprised about 25 percent of the wildland-based activity respondents.

Each of the wildland-based activity groups exhibited different socio-demographic and trip characteristics. Table 2 compares each activity group with the **non-**wildland-based activity group. Table 3 displays each group's average daily expenditure profiles. Backpackers came predominantly from the more populated West Coast states. Eighty-seven percent had visited Montana previously and had returned to enjoy the backcountry. Backpackers were the youngest and the second most affluent of the wildland-based activity groups. They stayed twice as long in Montana and spent about $22 per day more than the non-wildland **group.**

Non-resident anglers, attracted by Montana's blue ribbon trout streams, came mainly from California and the surrounding Rocky Mountain states. Most had experienced Montana's fishing waters before, displaying the highest repeat visitation of any group (92 percent). Anglers were the most affluent and the second oldest group. They stayed in Montana longer than any other group and spent almost twice as **much** per day as the non-wildland group.

Montana attracted thousands of nature and wildlife enthusiasts. These visitors primarily came from the West Coast states and Canada. Many had never visited Montana before (28 percent). While these visitors exhibited income and expenditure levels similar to the non-wildland-based group, they were younger and stayed over two days longer in Montana.

Economic Impact

The direct, indirect, induced, and total economic effects of visitors engaging in **wildland** and non-wildland-based activities on Montana's economy are presented in Table 4. Total gross output (TGO) is a measure of the total industry output of a region and is synonymous with gross state product. For this example, TGO is the amount of additional sales activity within the state that results from each activity group's expenditures. Employee compensation is the sum of wages and salaries paid to employees of the affected firms within

the state. Employment refers to the number of jobs that are generated by the visitor expenditures within Montana (Palmer and Siverts, 1985).

Wildland-based activities stimulate **significant** economic activity in Montana's economy. Angling by non-residents produced the greatest economic effect, generating almost $450 million in additional sales activity. This supported over 3,900 jobs directly and an additional 3,200 jobs through secondary impacts, for a total of 7,100 jobs. Nature study supported over 6,000 jobs and $97 million in labor income, from the industry output of over $390 million. Backpacking accounted for over 1,200 jobs and $19 million in Montana wages and salaries, generated by $76 million in industry output.

The economic impact of the three **wildland-based** activities comprised a major portion of Montana's non-resident travel industry. Wildland-based activities accounted for **almost** half of the 26,750 jobs **within** the travel industry, generated by over $736 million in industry output. These activities supported over $187 million in direct and secondary wages and salaries. In each case, the secondary output and income effects were larger than the initial direct effects. This relationship is due to the strong linkages that exist between the directly and indirectly affected firms. Any increase in the wildland-based travel market will flow through the economy and produce an even greater overall effect. Secondary employment effects were less than the direct effects, illustrating the more seasonal and part time nature of Montana's travel related jobs.

This flow-through effect is summarized by the regional economic multipliers for wildland-based and **non-**wildland-based activities, as shown in Table 5. For example, the employment multiplier for backpacking expenditures is 1.80. This means that for every 10 jobs created **within** the directly affected firms, an additional 8 jobs will be generated within the economy through the direct and secondary effects. The magnitude of the multipliers in Table **5** suggest that spending by non-resident travelers can have significant flow-through effects in Montana's economy. These multipliers are consistent with those found in similar recreation impact studies (Walsh, 1986; Bergstrom and others, 1989).

DISCUSSION

The economic impacts estimated by IMPLAN suggest that non-residents who engage in wildland-based activities constitute a substantial proportion of the economic impact of non-resident travel in Montana. The wildland-based activity groups tended to **be** younger, more affluent, stayed longer, and spent more than the non-wildland activity groups. These travel patterns mean that each wildland-based activity group has the potential to provide a greater economic effect than the non-wildland group. This information can be an important consideration for some communities and states; it indicates they will not necessarily have to attract more visitors. Attracting visitors who engage in **wildland-based** activities may provide more economic impact than attracting non-w&hand-based visitors. This study found that, in Montana, only about **one-**quarter of the number of non-resident visitors engaged in wildland-based activities, but accounted for **almost** one half of the economic impact of non-resident travel.

Current regional economic development strategies in Montana stress the more efficient utilization of regional resources. One approach involves the diversification of the region's economic base. Diversification can reduce a community's or region's dependence on industries affected by market conditions outside of the area. Montana has traditionally relied on the extractive industries, such as timber and mining, to support the state's economic base. Tourism, and especially wildland-based tourism, can provide the opportunity for the state to diversify its economic base, which can lead to a more viable and stable regional economy.

Understanding the significance and magnitude of economic impacts for various wildland-based activities may provide decision makers with the information necessary for management of wilderness and **near-**wilderness areas. Managers can use these **wildland** activity types as market segments, for marketing plans to attract a preferred type of visitor. These visitors may never enter the wilderness, but the wilderness quality projected through these activities may provide the attractant for other visitors. The benefits from these wildland-induced visitors are difficult to measure, but may represent the largest proportion of economic impacts, and these visitors may provide a broader base of support for **wildland** and wilderness preservation.

REFERENCES

Alward, G.S.; Lofting, E.M. 1985. Opportunities for Analyzing the economic impacts of recreation and tourism expenditures using IMPLAN. Contributed paper. Philadelphia, PA: Annual meeting of the Regional Science Association.

Bergstrom, John C.; Cordell, H. Ken; Ashley, Gregory A.; English, Donald B.K.; Watson, Alan E. 1989. Rural economic development impacts of outdoor recreation in Georgia. Res. Rep. 567. Athens, GA: The Georgia Agricultural Experiment Stations, College of Agriculture, University of Georgia.

Bureau of Economic Analysis. February-May 1989. A survey of current business. Washington, DC: U.S. Department of Commerce.

Cordell, H. Ken; Bergstrom, John C.; Ashley, Gregory A.; Karish, John. 1990. Economic effects of river recreation on local economies. Water Resources Bulletin. V26, No 1.

IMPLAN News. St. Paul, MN: Department of Agriculture and Applied Economics. University of Minnesota.

Moisey, Neil; **Yuan,** M.S. 1990. Estimates of economic impact of non-resident travelers to Montana. Research Report 11. Missoula, MT. Institute for Tourism and Recreation Research, School of Forestry, University of Montana.

Moisey, Neil, McCool, S.F.; Yuan, M.S. 1990. Montana's non-resident market segments. Research Report 12. Missoula, MT: Institute for Tourism and Recreation Research, School of Forestry, University of Montana.

Palmer, C.; Siverts, E. 1985. IMPLAN analysis guide. Fort Collins, CO: Land Management Planning Systems Section, USDA Forest Service.

Probst, D. 1985. Use of IMPLAN with the public area recreation visitor survey pretest data: Findings and recommendations. East Lansing, MI: Michigan State University, November 1985.

USDA Forest Service. 1991. Washington D.C.

USDA Forest Service, 1989. Micro IMPLAN Software Manual. Rocky Mountain Experiment Station, Fort **Collins,** co.

Walsh, Richard G. 1986. Recreation economic decision:
Comparing benefits and costs. State College, PA: Venture Publishing, Inc.

Watson, A.E.; Bratcher, L. 1987. Public area recreation visitor study: Phase III reporting. Athens, GA: Final Cooperative Research Agreement Report to the Southeastern Forest Experiment Station.

Watson, A.E.; Cordell, Ken; Bergstrom, John C.; Ashley, Gregory A.; English, **Donal** B.K. 1988. Estimates of economic importance and impacts from public area recreation visitor study data analysis: State of Georgia.

Yuan, M.S.; Moisey, Neil. 1991. 1990 non-resident travel in Montana: An economic report. Res. Rep. 7, Missoula, MT: Institute for Tourism and Recreation Research, School of Forestry, University of Montana.

Yuan, M.S.; McCool, S. 1989. Montana travel survey, summer quarter 1988, characteristics of the sample. Int. Res. Rep. 89-4. Missoula, MT: Institute for Tourism and Recreation Research, School of Forestry, University of Montana.

Table 1. Sample Sizes and Estimated Visitation to Montana For Select **Wildland** and Non-Wildland-Based Activities

	Sample Size (groups)	Estimated Visitation 1990 (groups)
Backpacking	94	**46,300**
Angling	371	182,900
Nature Study	721	355,400
Wildiand-Based*	1,031	508,300
Non-Wildland-Based	3,550	**1,749,800**

*Backpacking, angling, and nature study do not total to wildland-based as some overlap exists between activity types.

Table 2. Comparison of Socio-Demographic Characteristics For Select **Wildland** and Non-Wildland-Based Activities

	Backpacking	Angling	Nature Study	Non-Wildland Based
State of Origin				
California	16%	20%	9%	9%
Washington	24%	9%	16%	18%
Idaho	6%	5%	5%	6%
Colorado	4%	6%	3%	6%
Minnesota	9%	4%	6%	4%
Canada	4%	5%	11%	11%
Repeat Visitation to Montana	87%	92%	72%	82%
Percent Income over $60,000	26%	27%	15%	15%
Average Age	43	49	46	51
Number of Days in Montana	8.22	10.82	5.99	3.66

Table 3. Average Daily Group Expenditures For Select **Wildland** and Non-Wildlaud-Based Activities

	Backpacking	**Angling**	Nature Study	Non-Wildland Based
Gasoline	13.87	**14.89**	13.80	12.12
Groceries	11.40	12.82	7.90	4.54
Restaurant/Bar	**14.28**	17.18	16.33	13.59
Lodging	12.46	13.13	17.18	14.18
Campground	2.09	2.37	2.34	1.48
Auto/RV Rental	1.81	2.18	1.68	0.83
Auto/RV Repair	2.80	2.82	2.04	1.60
Transportation	0.06	1.11	0.62	0.49
Licenses/Admission	2.40	6.14	1.87	0.64
Recreation Equipment	4.46	6.09	2.01	0.70
Outfitter/Guide	1.97	5.36	0.91	0.19
Retail	25.00	17.35	16.35	16.08
TOTAL	92.61	101.44	83.03	66.44

Table 4. Economic Impacts of Recreation Spending - 1990 By Select **Wildland** and Non-Wildland-Based Activities

	Total Gross Output	Employee Compensation	Employment
BACKPACKING			
Direct Effects	35067,941	**8,476,226**	678
Indirect Effects	**16,140,435**	3308,194	**130**
Induced Effects	**28,171,719**	**7,598,314**	414
TOTAL Effects	**76,380,095**	**19,382,734**	1,222
NATURE STUDY			
Direct Effects	**161,941,526**	**40,483,427**	3,239
Indirect Effects	**86,034,258**	**17,615,111**	683
Induced Effects	**145,119,892**	**39,140,843**	2,135
TOTAL Effects	**393,095,676**	**97,239,381**	6,057
ANGLING			
Direct Effects	**187,123,200**	**49,626,342**	3,970
Indirect Effects	**95,515,887**	**19,640,262**	775
Induced Effects	**166,732,477**	**44,970,094**	2,435
TOTAL Effects	**449,371,564**	**114,236,698**	7,180
ALL WILDLAND-BASED*			
Direct Effects	**306,556,537**	**81,315,578**	6,505
Indirect Effects	**156,432,416**	**32,164,266**	1,279
Induced Effects	**273,043,683**	**73,643,612**	4,017
TOTAL Effects	**736,032,635**	**187,123,456**	11,801
NON-WILDLAND-BASED			
Direct Effects	**380,593,602**	**102,903,615**	8,233
Indirect Effects	**190,473,989**	**39,862,559**	1,499
Induced Effects	**364,265,136**	**98,247,224**	5,221
TOTAL Effects	**935,332,728**	**241,013,398**	14,953
TOTAL NON-RESIDENT TRAVEL			
Direct Effects	**687,149,847**	**184,219,193**	14,738
Indirect Effects	346906,405	**72,026,825**	5,762
Induced Effects	**637,308,819**	**171,890,836**	13,751
TOTAL Effects	**1,671,365,071**	**428,136,855**	34,251

***Backpacking, angling, and** nature study do not total to wildlaud-based as some overlap exists between activity types.

Table 5. Regional Economic Multipliers for Recreation Expenditures By Select **Wildland** and **Non-Wildland-Based** Activities

	Total Gross Output	Employee Compensation	Employment
Backpacking	2.38	2.29	1.80
Angling	2.40	2.31	1.81
Nature Study	2.43	2.40	1.87
All Wildland-Based	2.40	2.30	1.81
Non-Wildland-Based	2.46	2.34	1.82

WILDERNESS-INFLUENCED ECONOMIC IMPACTS ON PORTAL COMMUNITIES: THE CASE OF MISSOULA, MONTANA

Michael S Yuan and Neal A. Christensen*

ABSTRACT

This paper examines the wildland-influenced economic impacts of non-resident travel on portal communities next to wildland areas. The portal community used in this study is Missoula, Montana. Data for this study came from the Montana Travel Survey. Visitors who were attracted by fishing hunting, camping or viewing scenery and wildlife were defined as the wildland-influenced group (n = 271). The non-wildland-influenced group were those people not attracted by the above activities (n = 110) The results suggest that the economic impact of wildland-related travel on Missoula's economy is as great or greater than non-wildland-related travel. Wildland users and non-wildland users had similar length of stay in Missoula and near equal daily expenditures, although about 60 percent of all non-residents were attracted to Montana by wildland-based qualities. This study suggests that portal communities such as Missoula should encourage the retention of the area's wildland qualities because they will attract more visitors and the type of people who will have potential high economic impact.

INTRODUCTION

The benefits of wildlands have long been debated. While many people champion the social and health benefits of wildlands, the major focus of **wildland** preservation and development continues to be on economic impacts (Hunt, 1990). Both proponents and opponents of wildlands often use the issue of economic impacts to support their stance. Opponents state that **wildland** protection restricts traditional basic industries, such as wood products and mining, and replaces them with industries which have lower economic value. Proponents, on the other hand, point out that wildlands are the prime attractions for a growing travel and tourism industry. Many regions' travel related benefits are closely tied to their natural resource or **wildland** qualities. States like Montana have encouraged tourism development to reduce their dependency on traditional industries and to diversify their economy. The travel industry may affect a region's economy to a greater degree than the traditional industries which compete with it.

This paper examines the **wildland-influenced** economic impacts of non-resident travel on portal communities next to **wildland** areas. A major objective is to examine the proportion of **wildland-related** economic impacts to non-wildland-related impacts. In this paper, wildlands are not defined as designated Wilderness Areas, but areas which have a natural or wilderness character. The **wildland** quality of a region is often the reason why people come to visit it; wildlands **define** the character and the aura that forms the backdrop for recreation. People do not have to physically enter the **wildland** to receive benefits or to have a **wildland**-related impact on the region. Just the presence, or even the knowledge, of the nearby **wildland** may influence travelers to visit an area. In this study, wildland-related impacts are those associated with people attracted to Montana for the purposes of viewing scenery and wildlife, **fishing,** hunting and camping. Non-w&hand-related impacts are those not associated with the above.

The portal community used in this study is Missoula, Montana. Missoula is the center for a community of approximately 70,000 people located in the heart of the Rocky Mountains in western Montana. This community is just three miles from the Rattlesnake Wilderness Area and is surrounded by national forests containing many of the most famous and popular wilderness areas in the U.S., including the Bob Marshall, Selway-Bitterroot, and areas around Glacier National Park. Missoula is known as a major hub for wildland-related activities and is often mentioned in national outdoor publications because of the variety of nearby **wildland-based** recreation opportunities. Because of Missoula's popularity as a recreational destination for non-resident visitors, the community benefits greatly from these visitors' expenditures, which enhance its economic **stability** and vitality **(Yuan,** Moisey, and **McCool,** 1991).

*Assistant Professor and Research Specialist, respectively, Institute for Tourism and Recreation Research, School of Forestry, University of Montana, Missoula, MT, 59812.

When the economic contributions of wildlands are examined, the traditional approach is to look at backpackers and hikers; but wildlands attract people for a variety of other reasons. For example, people may come to communities next to wildlands because the natural setting serves as the backdrop for other activities such as special events, sight-seeing, or driving for pleasure - all of which can be influenced by the surrounding wildlands. These people spend time and money in the portal community, purchasing retail goods, services, and lodging, and thus affect local economic structure. Wildlands are important in their own right, but their impact on portal communities' economic and social stability, through travel expenditures, has become more than just an important by-product (Yuan, 1990).

City and recreation planners often determine what types of tourism developments are best for communities adjacent to **wildland** areas. Should these travel attractions be related to the **wildland** character of the area, or should large-scale developments unrelated to the **wildland** environment be encouraged? These developments, and the subsequent economic impacts, are especially important for portal communities around **wildland** areas. Many portal communities have catered to wildland-related travelers and are now inextricably linked together with travel and tourism (Yuan, 1990). To determine the type of developments to focus on, these portal communities need to know how much of their travel-related economy is based on wildland-induced impacts.

METHODS

Data for this study came from the Montana Travel Survey, which collected primary expenditure information in 1990 (Yuan, Moisey, and McCool, 1991). Non-resident visitors to Montana were contacted at the 19 major highway entry points to the state, accounting for over 85 percent of all traffic. Mail-back questionnaires were distributed at these sites. Visitors were asked to record the specific type, amount, and location of each expenditure made during the next two days of their trip in Montana. Space was provided to record expenditures for 14 of the most popular expenditure categories.

These procedures produced a sample of approximately 2,300 travel groups, representing non-resident summer travel in Montana. For this report, only those people who stayed overnight in Missoula were selected for the analysis. Selecting only overnighters reduced the impact of people who were just passing through Missoula to other destinations. This sample was then segmented into **wildland** and non-wildland-influenced travelers, according to what attracted them to Montana. Visitors who responded that they were attracted by fishing, hunting, camping, or viewing scenery and wildlife were defined as the wildland-influenced group. The **non-wildland**-influenced group were those people not attracted by the above activities. The total sample size was 271, with 161 for the **wildland** group (60 percent) and 11 for the non-wildland group (40 percent). Comparis were then made between the two groups of traveler From the 14 expenditure categories, average expenditures for five categories were calculated, **including** average daily and total trip expenditures. Sample size limitations allowed only expenditure estimates for food, lodging, gas, retail sales, and oth expenses. The sample size necessitated aggregating specific expenditure categories into the "other" category. Travel characteristics and select socio-demographics were calculated. T-tests and chi-square significance tests were used to determin differences existed between the **wildland** and the non-wildland groups. The alpha level used for both significance tests was .05.

RESULTS

The socio-demographic characteristics of **wildland** a non-wildland groups are shown in Tables 1 through For education, no significant differences were foun between the two groups, with over 50 percent of b groups having either a college degree or some coll education (Table 1). A significant difference did e between the two groups in respect to occupation. More **wildland** users were in the managerial ranks retired than non-wildland users, while more non-wildland users were students or craftsman (Ta 2). Annual household income did not differ significantly, with the majority of both groups havi incomes between $20,000 and $39,999 (Table 3).

The travel characteristics for the two user groups shown in Tables 4 through 9. Average group sizes both groups did not differ significantly; both had a 2.5 people. The average number of males for the **wildland** group was significantly larger than the non-wildiand group - 1.15 to .93 males (Table 4). group type differed significantly, with more non-wildland visitors traveling alone, and more **wildland** users traveling with friends (Table 5). O six responses asked of travelers about their reasor visiting Montana, all differed significantly between two groups, except for the reason of "visiting frien and relatives" (Table 6).

The flexibility of travel plans is shown in Table 7. There was a significant difference between the tw

groups, with **wildland** users having greater flexibiity in their travel plans and fewer stops planned in advance than **non-wildland** users. The activities engaged in are shown in Table 8. Only six of the 26 activities did not differ significantly between the two groups: horseback riding, road bicycling, waterskiing, river floating, golf, and special events. The most popular activities were the same for both group, including viewing wildlife, photography, and visiting historic sites, museums, and visitor centers.

The number of nights spent in various accommodations in Montana is shown in Table 9. Overall, there was a significant difference in the total number of nights spent in Montana, with **wildland** users spending 6.38 nights and non-wildland users spending 2.29 nights. Significant differences were identified for those wildland-related accommodations that were more traditional, such as resort, RV camp, and backcountry camp. The average total number of nights spent in Missoula did not differ significantly, with both groups spending 1.0 night. The average number of days for both groups was calculated by **adding** one to the average number of nights.

The average group expenditure characteristics for the two user groups are shown in Tables 10 through 13. Average "Day 1" group expenditures are displayed in Table 10. Significant differences were identified for food and lodging, where **wildland** users had higher expenditures. Gas and oil, retail, and "other" expenditure categories did not differ significantly for Day 1. Overall, there was a significant difference in the average total expenditure, with the **wildland** group spending about **$80** and the non-wildland group spending about $64. Average total "Day 2" expenditures did not significantly differ, at $65 for non-wildland users and $75 for **wildland** users. Specific expenditures, similar to Day 1, did differ significantly, as **wildland** users spent more than non-wildland users for food and lodging. Gas and oil, retail, and "other" expenditure categories did not differ significantly for Day 2.

Average daily group expenditures, based on two days of a visitor's trip in Montana, are shown in Table 12. These expenditures were similar to Day 2, as the overall totals did not differ significantly - $65 for non-wildland users and $78 for **wildland** users. As with Day 1 and Day 2 expenditures for specific categories, food and lodging differed significantly, while the other three categories did not.

The average total trip group expenditures in Missoula and in Montana are shown in Table **13.** Although the average daily group expenditures did not differ significantly for the two groups, the average number of nights spent in Montana did. Because of the differences in length of stay, the average trip group expenditures were very different, with about $148 per trip for non-wildland users and about $495 per trip for **wildland** users. The economic impact of both groups on Missoula was about the same because of similar lengths of stay in Missoula. **Wildland** users spent about $129 during their stay in Missoula, while non-wildland users spent about $110.

DISCUSSION

The major fmding in this study is that the economic impact of wildland-related travel on Missoula's economy is as great as or greater than **non-wildland-**related travel. Since **wildland** users and non-wildland users had similar lengths of stay in Missoula and about equal daily expenditures, visitors from either group would have similar economic impacts. Even though total trip expenditures in Missoula were about the same for both groups, 60 percent of all non-residents who stayed overnight in Missoula were attracted to Montana by wildland-based qualities. These results suggest that of the total economic effect of non-resident travel in Missoula, **60** percent can be attributed to wildland-based users. Because Missoula only receives a portion of the total economic impact of travel in the state, visitors to Missoula also greatly affected other areas outside the community. Since overall length of stay for **wildland** travelers is much higher than non-wildland travelers in the state, the overall economic impact of **wildland** users outside of Missoula is substantially higher than non-wildland users. More than half of the non-residents who stayed overnight in Missoula were attracted to Montana by wildland-related aspects, such as scenery, wildlife, fishing, and camping activities. These people, in turn, contributed substantially to the economic vitality of Missoula and other communities in the state. The traditional idea that the socio-demographics of people who are attracted by wildlands'qualities are quite different from non-wildland users was not found to be true. **Wildland** and non-wildland users were determined to have about equal amounts of education and income, although retirees made up a higher proportion of **wildland** users. The data suggests that well-educated people with high incomes are just as likely to visit Missoula as those with lesser education and income. In addition, retirees, who often have more disposable incomes, may be an important market segment to focus on.

While the demographics of **wildland** and non-wildland users had similarities, the travel characteristics of the two groups differed. Non-wildland users were often on business and tended to travel alone more frequently,

whiie **wildland** users traveled with family or friends for vacation. The reasons for visiting Montana also differed, with most **wildland** users visiting here on vacation and non-wildland users just passing through. Travelers passing through a community may not have as large an economic impact as those visiting for a specific purpose. **Wildland** users also had more flexible travel plans with fewer places planned in advance. Because of this flexibility, **wildland** users may be easier to convince to stay in the area longer or visit additional attractions, thus producing additional economic impact.

Many portal communities want increased travel and its associated economic benefits, but they are not sure whether wildland-based travel is more important than non-w&hand-based travel. Wildland-based travel is a substantial part of the economic impact of travel in Missoula. Although only about 11 percent of our **wildland** sample reported going backpacking or hiking, most **wildland** visitors stated that many of the qualities inherent to wildlands were the basis for coming to Montana. The traditional belief that **wildland** users do not spend much money is not true, as average trip expenditures in Missoula were similar.

There is a general consensus among community leaders that economic development is good. In the search for economic development, travel and tourism are often mentioned as potential solutions. If travel and tourism are to be further developed, what type of development is best, and to what extent should the natural character of the region be kept intact? This question is especially important for portal communities next to **wildland** areas. This study suggests that portal communities such as Missoula should encourage the retention of the area's **wildland** qualities because they will attract more visitors and the type of people who will have potentially greater economic impact.

Some portal communities next to wildlands and national parks have had difficulties keeping a balance between what is best for the community and what is best for the **surrounding** environment. Based on the premise that greater economic impact comes with an increase in the number of visitors, these areas have encouraged developments to bring in more people. These developments then compromised the **wildland** character of the area. Some communities have learned from these scenarios that promoting economic growth does not necessarily mean increasing visitation rates; instead, visitors could be encouraged to stay longer in the community. Increases in length of stay may not impact the **wildland** quality of the area as much as increased visitation rates because they would not necessitate more development.

Additional tourism developments are often the result of supply not meeting demand. Supply is usually held constant, but demand could vary depending on **seasonality** or day of the week. When the demand curve exceeds the supply's marginal point, two options are available. One option is to increase the supply, through additional developments, to satisfy peak demand. The second option is to reduce the variability of the demand curve to where peak demand is reduced and the supply's marginal point is reached. When increased visitation rates are encouraged, it is easier to go beyond the supply's marginal point. When visitors stay longer in an area, the **variability** in the demand curve is reduced and under-utilized supply is better utilized.

By encouraging visitors to stay longer and discouraging excessive developments, a balance, could be achieved between wildlands' retention and economic growth. This balance is often difficult to determine, as some developments are necessary to provide basic services to travelers. The problem lies not just in the amount of development, but also in the type of developments. Recognizing the importance of wildland-based travel, communities can better plan for the future and anticipate growth without reducing the natural quality of the area.

In summary, wildland-based travel and travel in general are interlinked in Missoula, Montana. Portal communities may benefit as much or more from **wildland** travelers than from non-wildland travelers. A prime attractant for travelers coming to Missoula is the atmosphere of an unspoiled and natural environment; keeping these values intact will benefit both wildlands and the economic impact to the community.

REFERENCES

Hunt, J. **1990.** Linking tourism, wildlands, and economic development. In: D. Lime, ed. Managing America's enduring wildlands resource. University of Minnesota: 570-576.

Yuan, M. 1990. Linking tourism and wildlands: The federal role. **In:** D. Lime, ed. Managing America's enduring wildlands resource. University of Minnesota: 661-665.

Yuan, M.; Moisey, N.; **McCool,** S. **1991. 1990** non-resident travel in Montana: An economic report. Res. Rep. 15. Missoula, MT: Institute for Tourism and Recreation Research, University of Montana. 12 **pp.**

Table 1 - Education, in **percent**

School	Non-Wildlands	Wildlands
Grade School	2	3
High School	36	42
Some College	39	30
College Graduate	23	24

Chi-square significance test = **.64**

Table 2 - **Occupation,** in **percent**

Occupation	Non-Wildlands	Wildlands
Professional	22	19
Manager	4	11
Craftsman	11	1
Service Workers	4	6
Student	6	1
Retired	35	48
Other	18	22

Chi-square significance test = **.01**

Table 3 - Annual Household Income, in **percent**

Category	Non-Wildlands	Wildlands
< $10,000	**5**	3
$10 - $19,999	8	**13**
$20 - $29,999	**15**	23
$30 - $39,999	36	**20**
$40 - $49,999	13	14
$50 - $59,999	12	16
$60 - $69,999	8	7
> $70,000	3	7

Chi-square significance test = **.11**

Table 4 - **Group** Size

	Non-Wildlands		**Wildlands**		
Type	Mean	S.D	**Mean**	S.D	T-Test
Males	**.93**	**.61**	1.15	1.18	**.05***
Females	**.99**	**.75**	1.15	**.93**	**.11**
Children	**.33**	**.69**	**.30**	**.75**	**.68**
Total	2.26	1.39	2.60	1.99	**.09**

Table 5 - Groun Type. in nercent

Type	Non-Wildlands	Wildlands
Alone	21	9
Family	77	80
Friends	<1	8
Family and Friends	3	3
Club or Group	C1	<1

Chi-square significance test = .01

Table 6 - Reasons for Visiting Montana. in nercent

Reason	Non-Wildlands	Wildlands	Chi-Sauare Test
Vacation	30	88	.01*
Friends/Relatives	35	34	.97
Business	12	3	.01*
Shopping	4	13	.01*
Convention	7	<1	.01*
Passing Through	56	41	.01*

Respondents could list more than one reason for visiting Montana.

Table 7 - Flexibility of Travel Plans. in nercent

Places Planned in Advance	Non-Wildlands	Wildlands
All Places	28	11
Most Places	20	28
Some Places	4	28
Few Places	20	23
No Places	28	10

Chi-square significance test = .01

1%

Table 8 - **Activity** Participation. in **percent**

Activity	Non-Wildlands	Wildlands	Chi-Sauare **Test**
Auto/RV Camping	**5**	13	.02*
Backcountry Camping	**<1**	**<2**	.01*
Naturalist Hikes	**1**	5	.04*
Day Hiking	**5**	**17**	.01*
Backpacking	2	**11**	.01*
Horseback Riding	3	4	.66
Road Bicycling	**1**	1	.99
Off-Road Bicycling	**1**	5	.04*
Stream Fishing	**<1**	**<8**	.01*
Lake Fishing	**<1**	**<6**	.01*
Swimming	2	**0**	.01*
Powerboating	1	4	.03*
Waterskiing	1	**1**	.89
Lake Canoeing	**<1**	**<1**	.01*
Sailing	**<1**	**<1**	.01*
River Floating	**2**	3	.34
Picnicking	**5**	6	.01*
Photography	**9**	31	.01*
Historic Sites/Museums	**9**	28	.01*
Visitor Centers	**8**	22	.01*
Viewing **Wildlife**	35	24	.01*
Gambling	3	10	.02*
Spectator Sports	**<1**	**<1**	.01*
Golf	3	6	.17
Special Events	5	6	.68
Other	4	**11**	.03*
Hunting	**<1**	**<1**	**N/A**
Motorbike/ATV	**<1**	**<1**	N/A
Off-Road 4WD	**<1**	**<1**	N/A
Tennis	**<1**	**<1**	N/A

Respondents could list more than one reason for visiting Montana.

Table 9 - Leneth of Stav in Various Accommodations in Montana

Accommodation in Montana	Non-Wildlands Mean	S.D	Wildlands Mean	S.D	T-Test
Hotel/Motel (nights)	1.34	1.58	1.49	1.83	.49
Resort (nights)	.01	.20	**2.15**	**13.45**	.05*
RV Camp (nights)	.25	.80	1.49	3.46	.01*
Backcountry Camp (nights)	<.01	<.01	.10	1.14	.01*
Friends/Relatives (nights)	.64	1.54	.77	2.34	.58
Condo (nights)	<.01	<.01	.01	.09	.01*
Other (nights)	.05	.23	.37	5.34	.46
Total Number of Nights Spent in Montana	2.29		6.38		.01*
Total Number of Nights Spent in Missoula	1.01		1.00		.95

Table 10 - Average Day 1 Group Expenditures in Montana, in dollars

Expenditure	Non-Wildlands Mean	S.D	Wildlands Mean	S.D	T-Test
Food	13.17	13.80	18.92	22.84	.01*
Lodging	24.02	20.87	29.63	20.27	.03*
Gas/Oil	15.84	20.80	14.56	14.48	.58
Retail	6.56	29.58	11.07	35.22	.27
Other	4.76	32.61	5.97	26.08	.75
Totals	64.36	63.18	80.15	54.01	.03*

Table 11 - Averaee Dav 2 Group Exoenditures in Montana, in dollars

Exnenditure	Non-Wildlands Mean	S.D	Wildlands Mean	S.D	T-Test
Food	**12.15**	**15.79**	**21.34**	**25.11**	.01*
Lodging	16.10	21.92	23.75	37.11	.03*
Gas/Oil	15.66	22.77	**13.20**	18.12	.34
Retail	14.33	47.06	12.20	26.13	.68
Other	6.50	27.07	4.55	14.37	.49
Totals	**64.75**	**84.29**	**75.05**	**70.82**	.29

Table 12 - Average Daily **Group** Exnenditures Based on Two Days of **Trip** in Montana, in dollars

	Non-Wildlands		Wildlands		
Expenditure	**Mean**	**S.D**	Mean	**S.D**	**T-Test**
Food	12.66	14.80	20.13	23.98	**.01***
Lodging	20.06	21.40	26.69	28.69	**.01***
Gas/Oil	15.76	21.79	13.88	16.30	**.30**
Retail	10.45	38.32	11.64	**30.68**	**.73**
Other	5.64	29.84	5.27	20.23	**.87**
Totals	64.57	73.74	77.60	62.41	**.07**

Table 13 - Average Total **Trip Group** Exnenditures. in dollars

	Non-Wildlands	Wildlands
Average daily group expenditures	$64.57	$77.60
Average number of days' spent in Montana	3.29	7.38
Average trip **group**[2] expenditures **in** Montana	$192.38	$546.00
Average number of days spent in Missoula	2.01	2.00
Average trip **group**[2] expenditures in Missoula	$109.72	$128.51

[1] Average number of days calculated by adding one to the average number of nights.
[2] Average trip group expenditure calculated by multiplying the average number of days times average daily expenditure, less the average lodging costs for one night.

DYNAMIC ECONOMY VERSUS STATIC POLICY IN THE GREATER YELLOWSTONE ECOSYSTEM

Ray Rasker*

ABSTRACT

In the Greater Yellowstone area there is a perceived controversy between conservation efforts and economic well-being. This controversy is fueled by misconceptions about the economy and the role played by public lands in the region. In this paper three commonly held myths are addressed by &scribing changes that have taken place in the economy and in view of these, a more appropriate role of public lands management is identified.

INTRODUCTION

In the Greater Yellowstone Region, as in much of the West, there is an ongoing debate concerning the economic impact associated with efforts to protect the quality of the environment. The debate centers largely on the proper management of public lands, and the appropriate mix of commercial and noncommercial uses of this land. It is often argued that in order to succeed economically we must, by necessity, rely heavily on public lands for grazing and for the extractive industries, such as mining, oil and gas development, and the logging and processing of wood products (Power, 1987). Efforts aimed at regulating where, when, and to what extent these activities take place are, therefore, seen as a threat to economic well-being. Conservation and economic development, by implication, become contradictory goals. This view is influenced by an all too common interpretation of economic development that is based on several assumptions, or myths:

(1) Agriculture and the resource extractive industries are the only "basic" industries. They are assumed to be the only ones, along with out-of-state tourism, that bring outside money to local communities. Services, transportation, retail trade, finance, and other sectors are assumed to be "secondary" and, therefore, dependent on the "basic" industries (see Polzin **[1990]**). As Goe and Shanahan (1990, p. 149) point out, there is an all too prevalent way of thinking of services as "parasitic to goods production."

(2) The backbone of the rural communities of the Greater Yellowstone area is assumed to be the jobs produced by the extractive industries in the seven National Forests that surround Yellowstone National Park. The raw materials these public lands provide for the extractive industries are assumed to play a critical role as the engine that drives the economy. Any restrictions in these activities are, therefore, assumed to be a threat to the economic well-being of the region (for examples, see U.S. Forest Service **[1986, 1985]).**

(3) Promotion of the extractive sectors is often deemed to be necessary and desirable because all that rural communities have available to them is the timber, oil, gas, and minerals found on the land. Because the economic history of the Yellowstone region is based on mining, timber, and agriculture, the future is, therefore, necessarily based on doing more of the same (for recent examples of this line of reasoning, see Corporation for Enterprise Development **[1989],** Montana Ambassadors Association **[1988]).**

The objectives of this paper are to explore the validity behind these assumptions, and to portray factually the current direction of the economy of the Yellowstone region. These assumptions are not just the straw man, set up for the sake of counter-argument. Indeed, they constitute a mind set that runs deep in many communities and often forms the basis for misguided, although well-meaning rural development projects. Further, these beliefs also influence the policy guiding the management of public lands.

For too long the debate ***over***conservation and economic development has been surrounded by misinformation and rhetoric. A necessary first step is an evaluation of what a population "does for a living." As Power (1990, **p.** 4) points out:

> One of the last things **to change is that shared collective "understanding" of what drives the local economy. In that sense, the shared conventional wisdom about the local economy is a "view through the rear-view mirror"....**

*Resource Economist for The Wilderness Society, 105 West Main, Suite E, Bozeman, Montana.

An objective of this paper, therefore, is to present an up-to-date analysis of economic activity. The lessons learned from this paper should prove to be useful to the residents of the Greater Yellowstone, as well as to the public agencies in charge of managing the bulk of the land base.

THE GREATER YELLOWSTONE ECOSYSTEM'

The economy of the Greater Yellowstone Ecosystem (Figure 1) was chosen because it is a good example of the **difficult** task of balancing the concerns over economic well-being with concern over environmental protection. The Yellowstone ecosystem has been recognized by the United Nations as an international biosphere reserve for its global importance as a representative ecosystem and for its irreplaceable genetic resources. It is the largest essentially intact ecosystem remaining in the lower 48 states - approximately **18** million acres of mountain wilderness and valleys, much of it relatively untouched by humans. The ecosystem is also one of the last remnants of wild land in the U.S. where huge herds of bison and elk roam freely and where remnant populations of grizzly bears still survive. Despite this, and despite its national and international recognition, the Yellowstone area is also one of the most threatened (see Keiter **[1989]).** These threats include commercial extraction of raw materials, heavy visitor use, construction projects, and human **conflicts** with wild animals. Many of these problems are related to promoting economic activity at the expense of preserving natural areas.

The integrity of the ecosystem is largely dependent on over 9.1 million acres of National Forest lands that surround Yellowstone National Park. It is precisely on these lands that there is tremendous pressure from a variety of commercial uses. **Hardrock** mining, oil and gas development, livestock grazing, and logging, and an ever growing business based on recreation and tourism all alter the pristine condition of the landscape in one form or another. Yet, the tradeoff between commercial uses of public land and conservation is often deemed necessary for the health of local communities.

METHODS AND DATA USED

Study Area

The focus of this study is the **20** counties adjacent to the Greater Yellowstone Ecosystem. These counties are listed in Table 1 below. From a geographical perspective, these counties form a transition zone between the mountains and the agricultural valleys (Jobes, 1990). Some lie almost entirely within the boundaries of the ecosystem, such as Park county, Wyoming. Others, like Stillwater county, Montana are on the perimeter.

Counties were chosen as the unit of analysis for two reasons. First, information available on economic factors, such as employment and income, are readily available and systematically collected by reliable sources at the county level. It is **difficult** to obtain accurate information at a **finer** level of detail. For this reason, some counties were included which may have close economic ties to the Yellowstone area, as well as regions outside the ecosystem. For example, the economy of Fremont county, Wyoming is likely to be influenced by oil and gas development activities well outside the Yellowstone area. Similarly, the county of Bonneville, Idaho is heavily influenced by the federal nuclear energy facilities of Idaho Falls, clearly outside the ecosystem. Idaho Falls, in turn, also influences the economies of Madison and Teton counties, which are closer to the heart of the ecosystem.

The second reason for choosing the counties in question is that they contain large components of federal land. Fifty eight percent of the ecosystem counties' land base is in federal land, and in four counties over 70 percent of the land is federally owned (Table 1). These counties are influenced by decisions made on public lands, such as decisions of the Forest Service to accelerate or curtail timber harvesting or the opening of a new mine.

THE ECONOMY OF THE YELLOWSTONE REGION

Jobs and Income

From Figure 2 it can be seen that in the last **20** years the growth in mining, manufacturing, and farming has been somewhat flat, yet other sectors of the economy are **growing**[2]. From 1969 to 1989 the entire workforce grew by almost 66,000 people, an overall increase of 68 percent. Over **96** percent of all new jobs and 89 percent of the growth in labor income occurred in sectors other than mining, manufacturing, and agriculture (Bureau of Economic Analysis, 1991). Although the traditional resource dependent industries still play a role in the economy, and certainly in particular communities, their relative importance is declining as the region's economy becomes more **diverse**[3].

Following Power **(1990),** mining, manufacturing, and agriculture are defined here collectively as "extractive" industries. This includes renewable industries, such as

farming, cattle grazing, and forestry, as well as the nonrenewable mining industries. The "mining" sector includes **hardrock** mining and oil and gas extraction. The manufacturing sector includes lumber and wood products manufacturing, an activity commonly perceived to be predominant in the Yellowstone ecosystem. Due to the way data are made available, it is not possible to disaggregate, over time, the lumber and wood products manufacturing from the broader category of manufacturing. However, according to state labor and employment agencies, in 1988 the lumber and wood products manufacturing sector in the ecosystem counties constituted about **13** percent of the manufacturing employment and a little over one percent of total **employment)[4].**

In **1969** the extractive industries employed almost one out of every three workers in the Yellowstone area. By 1989 this had fallen to about one out of every six workers. In terms of dollars of income earned, the extractive industries contribute half as much as they used to in **1969,** dropping from 23 percent of total personal income to a little over 12 percent of total in 1989 (Bureau of Economic Analysis, 1991).

The bulk of the increase in economic growth has been due to local service sectors. Almost 80 percent of all new jobs and over 65 percent of all increases in labor income from **1969** to 1989 has been in local service producing businesses. These are defined here as retail trade, finance, insurance and real estate, state and local government, and narrowly defined "services" (Standard Industrial Classification Codes 70 through 89). The last of these categories, "services," as defined by the Bureau of Economic Analysis, includes, among others, hospitals, legal and business services, hotels, social, and educational services. Some economists use a broader definition of services. Ginzberg and Vojta (1981, p. **48),** for example, **define** services as "all output that does not come from the four goods-producing sectors: agriculture, mining, manufacturing, and construction."

Figure 3 contrasts the growth in local services against the decline in extractive industries. The counties of the Yellowstone ecosystem saw an increase of 52,280 new service related jobs between **1969** and 1989. Personal income from service related employment has increased by **almost** 88 percent, bringing in over one-third of total personal income and over half of all labor income (Bureau of Economic Analysis, 1991).

The trend away from employment in manufacturing is not unique to rural America or to the Yellowstone region. It is a reflection of national and international trends. Increased efficiencies in production has resulted in automation and a subsequent reduced demand for manual labor. In Montana, for example, output in the wood products industry was higher in 1986 than in 1979, but the industry employed 2,400 fewer workers. The Brand-S mill in Livingston, one of the two largest mills in the Greater Yellowstone area, has been able to increase production per worker by 98 percent from 1979 to 1988 (Heffner et al., 1989). Similarly, from 1977 to 1986 Montana's farm output rose by almost 51 percent, while farm employment increased by only one percent. Mining output rose by 41 percent during the same time period while mining employment dropped by 1.2 percent (Corporation for Enterprise Development, 1989). These trends are seen throughout the country.

This does not imply that manufacturing is not important. In fact, nationally, manufacturing production has risen steadily and has remained constant in terms of its contribution to the total economy. For the last 30 years the manufacturing sector has remained between 23 to 24 percent of Gross National Product **(Drucker,** 1986). What has happened, however, is an uncoupling of manufacturing production from manufacturing employment. The effects of this are being felt in the Yellowstone region as well.

The Importance of Service Industries

A common perception is that the service sector is composed of people making hamburgers or shining shoes. In reality, services are a significant force in today's economy. In **1990** the service economy comprised 68 percent of production of real GNP and 76 percent of employment (Sinai, 1990) and according to Harvard economist Robert Reich (1991, p. 40) "ninety-one percent of the increase in the number of jobs since the 1982 recession was in services." Predictions by the U.S. Bureau of Labor and Statistics indicate that the service sector will continue to be the leading source of new jobs, creating nine out of ten new jobs between 1985 and **1995** (Bureau of Labor Statistics, 1985).

In the Greater Yellowstone region service industries can play as an important role as basic industries, although this calls for a rethinking of the old notions of what constitutes the region's economic base. Traditional definitions of "export" or basic industries include mining, agriculture, and the wood products industry. Raw materials such as gold, coal, and wood, crops, and livestock are exported from the region and, in the process, bring outside dollars into the local economy. These dollars are spent and represent locally, creating a multiplier effect.

Service industries can play much the same role. When a stockbroker or insurance agent in Bozeman, Montana, conducts business with a client in Denver, the transaction results in the sale of a product and the **influx** of outside dollars. It does not matter that the product travels via mail, telephone, or a computer modem rather than by truck or train. The products of a laser research fum, a law **firm,** a scientific institution, or a mail-order catalog store may be more difficult to measure than a flatbed of timber or a sidecar of ore. Yet, such products do bring in outside dollars and are, therefore, part of the economic base (Boyers et al., 1985; Goe and **Shanahan,** 1990).

While services play a role in earning export dollars, they also play an important role in import substitution. Some businesses serve local markets and thereby capture the sales of local residents who might otherwise go outside the region to see a doctor or to have their cars repaired. These businesses help diversify the economy and they keep money circulating in local communities, thereby sealing the economy from outside forces. Over-reliance on export-oriented business does the opposite - it places the local economy at the mercy of economic forces outside of its control. A town that is heavily dependent on mining, for example, is also at the mercy of national and international price trends. The economic diversification of the Yellowstone region has helped to minimize this danger.

Other Economic Indicators

Population Growth. Evidence of positive economic trends in the region can be found in the fact that the region's population has been growing-people are expressing their preferences by "voting with their feet." From **1969** to 1980 the population of the Greater Yellowstone increased by 32 percent; and from 1980 to 1989 by 10 percent (Figure 6). By comparison, the states of Montana, Idaho, and Wyoming gained population at a much slower rate. From 1980 to 1989 Montana grew by only 2 percent and Wyoming lost population. **Idaho** grew the fastest by 6 percent, yet slower than the growth of the ecosystem counties.

Retirement Money and Other "Non-Labor" Income. **Two sources** of income that have risen substantially in the last **20** years are from transfer payments and from dividends, interest, and rent. Transfer payments are composed primarily of payments in the form government-related retirement benefits, disability insurance payments and medical payments'. Dividends, interest, and rent are primarily income from past investments, but also represent yields from private pension programs and personal retirement **savings**[6] (Bureau of Economic Analysis, 1988).

In the counties of the Yellowstone region, transfer payments and income from past investments constitute almost 35 percent of total personal income, an amount that surpasses income from farming, manufacturing, miniig, and oil and gas extraction combined (Figure 5).

The substantial amount of income from these **"non-**labor" sources is largely representative of several national trends: (1) a growing retirement population that is currently collecting the benefits from **federally-**managed retirement and **disability** programs established by the 1935 Social Security Act and (2) rising investment income resulting from "widespread prosperity among sections of the American population" (Hirschl and Summers, 1985, p. 129).

The increase in these sources of income stimulates an increase in the derived demand for services (Deaton, 1985). There is evidence that transfer payments can more readily translate into local jobs than other industries, such as agriculture or manufacturing (Hirschl and Summers, 1982, 1985; Smith et al., 1981). According to Hirschl and Summers (1985, p. **133),** "retirement income is more likely to be spent locally than goods-producing income because the elderly are physically less mobile than employed workers." Following a review of the literature on the importance of unearned income to rural communities, **Hirschl** and Summers (1985, p. 136) conclude that, "Manufacturing, mining, agriculture, and contract construction may be important to local economies in some instances. However, their importance should not be over-estimated. When community concerns are focused on total employment, income from unearned sources may also be a factor - even a leading factor."

Entrepreneurial Activity and Small Businesses. One measure of economic health is the growth in business startups and an increase in the number of people who are self-employed. From 1980 to 1989 total employment in the Yellowstone region increased by over 10 percent. While salary and wage employees still constitute the majority of the workers (76 percent), they bring less than half of all personal income (47 percent). While in the last decade the number of wage and salary workers grew by little over 6 percent, the number of **nonfarm** self-employed grew by 39 percent. Of the 15,141 new jobs that have been created since 1980, over half have been the **nonfarm** self-employed (Bureau of Economic Analysis, 1991).

Over 1,900 new businesses have been started in the Yellowstone region from 1980 to 1988 (not including

the self-employed with no hired help) and most are relatively small; over 90 percent of these businesses hire fewer than 20 employees. The mining sector lost the highest number of establishments during the 80s. From 1980 to 1988 the number of oil and gas extraction businesses declined by over 36 percent, metal mining by over 52 percent. In contrast, the services sector (SIC 70 through 89) grew by over 48 percent, **adding** 964 new establishments. This represents almost half (49 percent) of the growth in new businesses. An additional 20 percent of the growth in new firms has been in the retail and finance, insurance, and real estate sectors (Bureau of the Census, 1990).

These state-wide and regional trends in small business growth echo a national trend. According to Birch (1987, p. 7) close to 90 percent of the 7 million companies in the U.S. employ fewer than 20 workers, and "taken together these small companies create more jobs than the giants comprising the Fortune 500 . ..." According to the Montana Department of Labor and Industry (1989) small businesses, particularly those with fewer than 100 workers, have experienced some of the largest increases in new jobs.

These trends - an increase in small business, the increase in population and **nonlabor** sources of income, and the growth of service industries - all have positive implications for the communities of the Greater Yellowstone area. Residents of the region are relying less on the traditional wage and salary sources of employment and they are creating jobs for themselves. Entrepreneurial niches exist in the communities of the ecosystem, and they are being filled either by existing residents or by new migrants.

Marketing the Quality of Life

Advances in telecommunications and the rise of the knowledge-based service **economy** has made it possible to move some business activity to areas with desirable lifestyles. Office functions, such as data processing, and work that can be conducted via modern telecommunications facilities no longer need to be located in big cities. Rural areas with a sufficient infrastructure (including telephone facilities, schools, roads) and with social and environmental amenities can attract this type of "footloose" business.

According to Swanson (1984, p. 14) most of the recent population growth in rural areas is from city migrants who are attracted "less by economic reasons than by the perception of a better quality of life." Referring to the Greater Yellowstone area, Jobes (1990, p. 14) believes that "the perceived need for the presence of nature as a condition for quality of life distinguishes residents [of the ecosystem] from most urban Americans." According to Lutz-Ritzheimer (1990, p. **16),** executive director of the Montana Entrepreneurship Center, the "highly qualified work force and a quality of life attracts talented people to [Montana]." Birch (1987, pp. 139,148) points out that "the successful, innovation-based company will, in general, settle in an environment that bright, creative people **find** attractive" and that, in order to keep workers content, the firm must provide a setting with a high "quality of life." Similar findings that offer insights into the importance of qualitative factors in rural economies can be found in **Whitelaw** and Niemi **(1989),** Knapp and Graves **(1989),** Mendelsohn and others **(1988),** Werner **(1989), Dillman (1979),** and Rudzitis and **Johansen** (1989).

The communities of the Greater Yellowstone Ecosystem are in a unique position that affords them a comparative advantage over other rural areas. They are blessed with a one-of-a-kind natural endowment; a high quality of life in a relatively unspoiled natural setting. These are qualities that are increasingly in demand for people wishing to escape the confines of our overcrowded and industrialized world. They are rare qualities and they make the communities of the ecosystem highly saleable and marketable as places to live and do business. According to **Whitelaw** and Niemi (1989, p. **36),** "the economic-development process is increasingly characterized, not by **jobs-first-**then-migration, but by the reverse." That is, a new rural development strategy can be based on capitalizing on the qualitative features of an area to attract people. The people and the setting will, in turn, attract new firms. As evidence shows, people who have made the decision to live in the Greater Yellowstone can and do create jobs for themselves.

THE ROLE OF THE FOREST SERVICE IN THE YELLOWSTONE REGION'S ECONOMY

The National Forests as a Workplace

Despite the fact that the economy has undergone a dramatic shift toward diversification, policies of the Forest Service in the Yellowstone region still support a heavy emphasis toward commodity extraction. One reason for this is a perception that commodity uses of the forest are necessary for economic well-being, even if this entails a tradeoff in terms of environmental quality.

For example, a planning document of the Shoshone National Forest admits that "timber management and associated roads can reduce visual quality and other

recreational values .... they can reduce wildlife habitat quality and contribute to the loss of important habitat components ... and they can produce conditions that decrease the productivity of soils and the quality of water." Yet, the plan indicates a concern over "maintaining a healthy forest and a healthy local economy" (U.S. Forest Service, 1986, pp. 11-91). Another example of the perceived **dependance** on National Forests is in management of the Targhee National Forest, where over half of all timber in the region is harvested. In 1960 Targhee managers deliberately set out to "begin a wood-using industry in the area," and, as a consequence, several local mills are now entirely dependent on timber from this forest. This has created a "local economic dependency on Targhee timber" and a justification and a need for harvesting timber (U.S. Forest Service, **1985a,** pp. **92-93; 1985b,** p. 111).

One way to test the importance of all commercial uses of the National Forests - grazing, recreation, timber, mining, oil and gas extraction - is to look at the number of jobs directly and indirectly tied to forest resources. According to Forest Service information compiled in a study by the Congressional Research Service **(1987),** the total number of direct, indirect, and induced jobs attributable to the forests of the Greater Yellowstone was approximately 13,671. This figure includes 4,000 jobs in the phosphate mines of the Caribou National Forest, on the outskirts of the Yellowstone ecosystem. Total employment in the region is over 156,000. Thus, the forests are directly, and indirectly (through a multiplier effect), responsible for less than 9 percent of total employment (Congressional Research Service, 1987, Bureau of Economic Analysis, 1991).

Further, over two-thirds of the **direct** jobs produced by the National Forest are recreation related activities. If the impact of the Caribou phosphate mines is not included in the calculations, the forests produce almost twice as many direct, indirect, and induced jobs in the recreation industry than in grazing, mining, oil and gas extraction, and timber harvesting combined (Congressional Research Service, 1987).

The most important conclusion from these findings is that the National Forests are not the workplace for most of the residents of the region. Rather, a more appropriate role for the Forest Service is to protect and enhance the most productive part of the economic base: the scenery, wildlife, and recreation opportunities, the free-flowing streams, and the overall quality of life associated with living adjacent to vast expanses of wild and pristine wilderness.

Forest Service Budget Priorities

A true test of the management direction of the National Forests of the ecosystem is to investigate how their budget is allocated into separate types of expenditures. Table 2 shows the 1980 and 1989 budgets for all seven National Forests of the ecosystem combined. The public land expenditures are divided into four categories, as follows:

(1) Conservation spending - outlays to protect and enhance natural resources, promote public use, and to acquire land. This includes, among others, restoration and improvement of forest lands, wildlife and **fish** habitat management, and construction of recreation facilities.

(2) Overhead - outlays to support the general administration and management of the agency.

(3) Production spending - outlays to facilitate the production of commodities such as timber, oil and gas, livestock, and minerals.

(4) Transfers - outlays to state and local governments in the form of shared receipts from the sale of federally-owned resources.

In 1989 two out of every three dollars spent by the Forest Service in the ecosystem went toward commodity production, while less than one out of six dollars went toward conservation related expenditures. Further, the total amount spent on conservation fell by 29 percent from 1980 to 1989, while expenditures on production activities rose by 9 percent during the same time period. Overhead costs have grown the most, consuming almost 17 percent of the Forest Service budget. At the same time, shared receipts to local governments have declined by 22 percent, an indication that although the amount of spending to promote resource extraction has increased, the value of production has declined.

For some of the forests of the ecosystem, the expenditures for commodity production were even higher. For example, production related spending on the Targhee National Forest in 1989 constituted over 72 percent of the budget, more than six times the expenditures on conservation related items. During the same year the Shoshone National Forest spent 70 percent of its budget on commodity extraction, which is over three and a half times the amount spent on conservation. Similarly, the Beaverhead spent four times more on production than on conservation. The Caribou and Custer National Forests spent more than three and five times, respectively, on commodity extraction than on conservation[7].

Despite the fact that the economy of the region has become less dependent on commodity extraction, the direction taken by the Forest Service in the ecosystem illustrates that they are headed in the opposite direction. Most the region's economy is not dependent (directly or indirectly) on federal land for grazing, harvesting and processing of timber, oil and gas extraction, or hard rock mining. Yet, the Forest Service continues to manage land with a priority that suggests that the National Forests of the ecosystem are the engine that drives the region's economy. This is clearly not the case. A more productive role for the Forest Service would be to protect and enhance the elements of the natural landscape that serve as attractants for people and business.

CONCLUSIONS

The objectives of this paper were to dispel some of the myths associated with the economy surrounding the Greater Yellowstone Ecosystem, and to give a more accurate portrayal of what it is that residents of the region "do for a living." An appropriate and economically more productive role of the Forest Service was explored in light of this information.

The economy of the Yellowstone region has diversified, and it has managed to attract new residents and an increase in entrepreneurial activity. Many of these new industries do not rely on extracting and exporting materials obtained from public lands. Because they are less consumptive of land resources, they also put less pressure on the land. Economic well-being can, therefore, be compatible with ecological protection, particularly if an unspoiled natural landscape is the critical element stimulating economic activity.

Communities of the Greater Yellowstone are in a unique position to market themselves as good places to live and do business. According to Deavers (1989, p. 5) rural counties that are growing are those that are " attractive to growing numbers of retirees moving out of cities and other rural areas, and to owner/managers of footloose industries with a preference for a rural location." Since 1983, nearly 85 percent of **nonmetro** population growth nationally has occurred in counties with quality "locational assets - lakes, mountains, shorelines, and so forth - that make them attractive for residence or recreation" (Deavers, 1989). The Greater Yellowstone Ecosystem abounds with these assets. The vast expanses of wilderness, breathtaking scenery, clean air, and abundant wildlife is the comparative advantage enjoyed by towns like Cody, **Rexburg,** Jackson, Dubois, and Bozeman.

One way to think of the ecosystem is as a vast reservoir - or factory - of wealth. It provides raw materials and economic opportunities and it provides important amenities and noncommercial "products," such as clean air and wildlife. The debate between economic development and **wildland** conservation needs to involve a more thorough understanding of what constitutes the true wealth of the region. In the Greater Yellowstone Ecosystem the scenery, wildlife, and wild features of the ecosystem are largely responsible for the region's growing economic diversity. The challenging task for residents and for public land managers is to **find** ways to protect the abiity of the ecosystem to continue to produce this form of wealth, for this and for future generations. This task - by necessity - must involve a better understanding of the proper role of public lands management in a modem economy.

REFERENCES

Bureau of Economic Analysis. 1988. Local area personal income: 1981-1986. Washington, DC: U.S. Department of Commerce.

Bureau of Economic Analysis. 1991. Employment, personal income by major source and earnings by major industry. Unpublished data from Regional Economic Information Service. Washington, DC: U.S. Department of Commerce.

Birch, D. 1987. Job creation in America: How the smallest companies put the most people to work. New York: Free Press. 244 pp.

Boyers, W.B.; **Alvine,** MJ.; Johnson, E.G. 1985. The service economy: Exports of services in the Central Puget Sound region. Rural Development Perspectives. **4(2):14-18.**

Bureau of the Census. 1990. County business patterns, 1988. (Issues for Montana, Wyoming and Idaho). Washington, DC: U.S. Department of Commerce.

Bureau of Labor Statistics, U.S. Department of Labor. 1985. Employment of wage and salary workers by industry 1984 and projected 1995 alternatives (moderate growth estimates). In: Revisiting the service sector. Perspectives, September 1989. Corvallis, OR: Oregon State University Extension Service.

Congressional Research Service. 1987. Greater Yellowstone Ecosystem: An analysis of data submitted by federal and state agencies. Library of

Congress. Washington, DC: U.S. Government Printing Office.

Corporation for Enterprise Development. 1989. New directions: Building an economic future for Montana's children. Washington, D.C. 39 pp.

Deaton, BJ. 1985. Strategies for strengthening the rural economy. Testimony presented to the Joint Economic Committee, U.S. Congress, (Available from the author, Columbia, Missouri: University of Missouri.)

Deavers, K. 1989. The reversal of the rural renaissance. Entrepreneurial Economy Review. September/October:15.

Dilhnan, DA. 1979. Residential preferences, quality of life, and the population turnaround. American Journal of Agricultural Economics. **61(5):960-966.**

Drucker, P.F. 1986. The changed World economy. Foreign Affairs. **64(4):768-791.**

Employment and Security Commission of Wyoming. 1990. Unpublished section **202** data on employment and income, by county and industry category. Casper, Wyoming.

Ginzberg, E.; Vojta, GJ. 1981. The service sector of the U.S. economy. Scientific American. 244(3):48-55.

Goe R.W.; Shanahan, J.L. 1990. A conceptual approach for examining service sector growth in urban economies: Issues and problems in analyzing the service economy. Economic Development Quarterly. **4(2):144-153.**

Heffner, RA.; Kirkpatrick,G.; Duckett, S. 1989. Decision by default: The Southwest Montana mill crisis. Helena, **MT:** Montana Ambassadors, Montana Department of Commerce, Small Business Development Center.

Hirschl, TA.; Summers, G.F. 1982. Cash transfers and the export base of small communities. Rural Sociology. **47(2):295-316.**

Hirschl, TA.; Summers, G.F. 1985. Shift in rural income: The implications of unearned income for rural community development. Research in Rural Sociology and Development. **2:127-141.**

Idaho State Department of Employment. 1990. Unpublished section **202** data on employment and income, by county and industry category. Boise, ID.

Jobes, P.C. 1990. The Greater Yellowstone social system. Unpublished document submitted to Conservation Biology for review. Fall, 1990.

Keiter, R.B. 1989. Taking account of the ecosystem on the public domain: Law and ecology in the Greater **Yellowstone** Region. niversity of Colorado Law Review. **60(4):923-1007.**

Knapp, TA.; Graves, P.E. 1989. On the role of amenities in models of migration and regional development. Journal of Regional Science. **29:71-87.**

Lutz-Ritzheimer, K. 1990. The university system assisting the state's business community. Montana Business Quarterly. **28(3):15-18.**

Mendelsohn R.W.; Whitelaw, E.; Niemi, E. 1988. Economic analysis of selected fish issues: **Final** report. Prepared for Northwest Power Planning council.

Montana Ambassadors Association. 1988. Partnership for progress: An economic development proposal. Helena, MT: Department of Commerce. 38 pp.

Montana State Department of Labor and Industry. 1990. Unpublished section **202** data on employment and income, by county and industry category. Helena, Montana.

North, D.C. 1955. Location theory and regional economic growth. Journal of Political Economy. **63:243-58.**

Polzin, E. Paul. 1990. The state and local outlook: 1990. Montana Business Quarterly. Spring, p.5.

Power, T.M. 1987. To be or not to be? The economics of development along the Rocky Mountain front. Western Wildlands. **Fall:20-25.**

Power, T.M. 1990. Ecosystem preservation and the economy in the Greater Yellowstone Area. Unpublished document submitted to Conservation Biology.

Quinn, J.B.; **Gagnon,** C.E. 1986. Will services follow manufacturing into decline? Harvard Business Review. **November-December:95-103.**

Reich, R.B. 1991. The real economy. The Atlantic. **267(2):35-52.**

Sinai, A. 1990. Services economic highlights. The Service Economy. Washington, DC: Coalition of Service Industries. **4(4):6.**

Smith, E.D.; Hackbart, M.M.; Van Veen, J. 1981. A modified regression base multiplier model. Growth and Change. 12:17-22.

Swanson, L.L. 1984. Moving to the country in search of a better life. Rural Development Perspectives. 1(1):14-19.

U.S. Forest Service. 1985a. Targhee National Forest Land Management Plan. 1985. St. Anthony, ID: Department of Agriculture.

U.S. Forest Service. 1985b. Targhee National Forest Final Environmental Impact Statement. St. Antohny, ID: Department of Agriculture.

U.S. Forest Service. 1986. Shoshone National Forest Land and Resource Management Plan. Cody, WY: Department of Agriculture.

Werner S. 1989. An environmental perspective of communications. Review of Business. Fall:3-20.

Whitelaw, E.W.; Niemi, E.G. 1989. Migration, economic growth, and the quality of life. In: Proceedings of the twenty-third annual Pacific Northwest regional economic conference. April 26-28:36-38.

ENDNOTES

1. It is not the intention of this study to define what an ecosystem is, or the boundaries of the Yellowstone ecosystem. Rather, the term Greater Yellowstone Ecosystem is used here to define a geographic region that is a subset of the 20 county Greater Yellowstone economic region investigated in this paper.

2. At the time of this writing, data were available from 1969 to 1989 only.

3. "All Other" income dropped beginning in 1986. This was primarily due to the completion of a natural gas processing plant in Lincoln County, Wyoming and the subsequent loss of 3,000 construction jobs.

4. Time series information on specific sectors is difficult to obtain due to confidentiality restrictions. If a county has only one mill, for example, it is illegal to disclose information on this sector. One way around this problem is to request data for several counties combined. The contribution of the lumber and wood products manufacturing sector was determined this way. Data were made available from the Idaho State Department of Employment (1990), the Employment and Security Commission of Wyoming (1990), and the Montana State Department of Labor and Industry (1990).

5. Communities where transfer payments are a large component of personal income are not necessarily "welfare havens." Unemployment benefit payments (or "welfare") represents 3.2 percent of transfer payments (less then half of a percent of total personal income) in any given region in the U.S. (Bureau of Economic Analysis, 1988).

6. Rent includes Imputed Rent, the value of owner-occupied nonfarm dwellings. It is not calculated as a cash flow. Rather, it adds to personal wealth in the same way income would, but does not affect the local economy in the same way (Power, 1990, p. 13). In any region of the U.S. rental income is approximately 2.8 percent of "dividends, interest, and rent," or half of a percent of total personal income (Bureau of Economic Analysis, 1988).

7. For details, see forthcoming report by The Wilderness Society on the economy of The Greater Yellowstone Ecosystem. Sources are the same as in Table 2.

Table 1

IDAHO	Total Acres	% Federal
Bear Lake	630,016	46
Bonneville	1,174,784	53
Caribou	1,117,376	40
Clark	1,120,512	63
Franklin	425,024	33
Fremon t	1,201,280	59
Madison	302,720	20
Teton	292,416	32
SUBTOTAL	6,264,128	49

MONTANA	Total Acres	% Federal
Carbon	1,072,247	55
Gallatin	1,606,263	38
Madison	2,292,252	46
Park	1,705,383	48
Stillwater	1,152,640	9
Sweet Grass	1,218,215	71
SUBTOTAL	9,047,000	45

WYOMING	Total Acres	% Federal
Fremon t	6,053,780	53
Hot Springs	1,294,080	44
Lincoln	2,625,280	68
Park	3,173,518	71
Sublette	3,146,240	75
Teton	2309.044	97
SUBTOTAL	18,601,942	67
TOTAL	33,913,070	58

Sources: Montana & Idaho -Soil Conservation Service, U.S.D.A. Wyoming - Dept. Administration & Fiscal Control, 1990.

Table 2

Type of Spending	1980 Spending	% of Total	1989 Spending (Current $)	1989 Spending (1980 $)	% of Total	% Change 80-89 (1980 $)
Conservation	10,714,193	27.09	11,261,529	7,634,935	16.66	-2%
Overhead	916,136	2 3 2	11,475,722	7,780,150	16.98	74%
Production	27,783,774	70.24	44,693,316	30,300,553	66.12	9%
Transfers	141,318	0.36	163,213	110,653	0.24	-22%

Source: derived from Statement of Obligations accounting report, by unit (BUDG4V-1), Fiscal and Public Safety, U.S. Forest Service, Washington D.C. 1990.

Figure 1

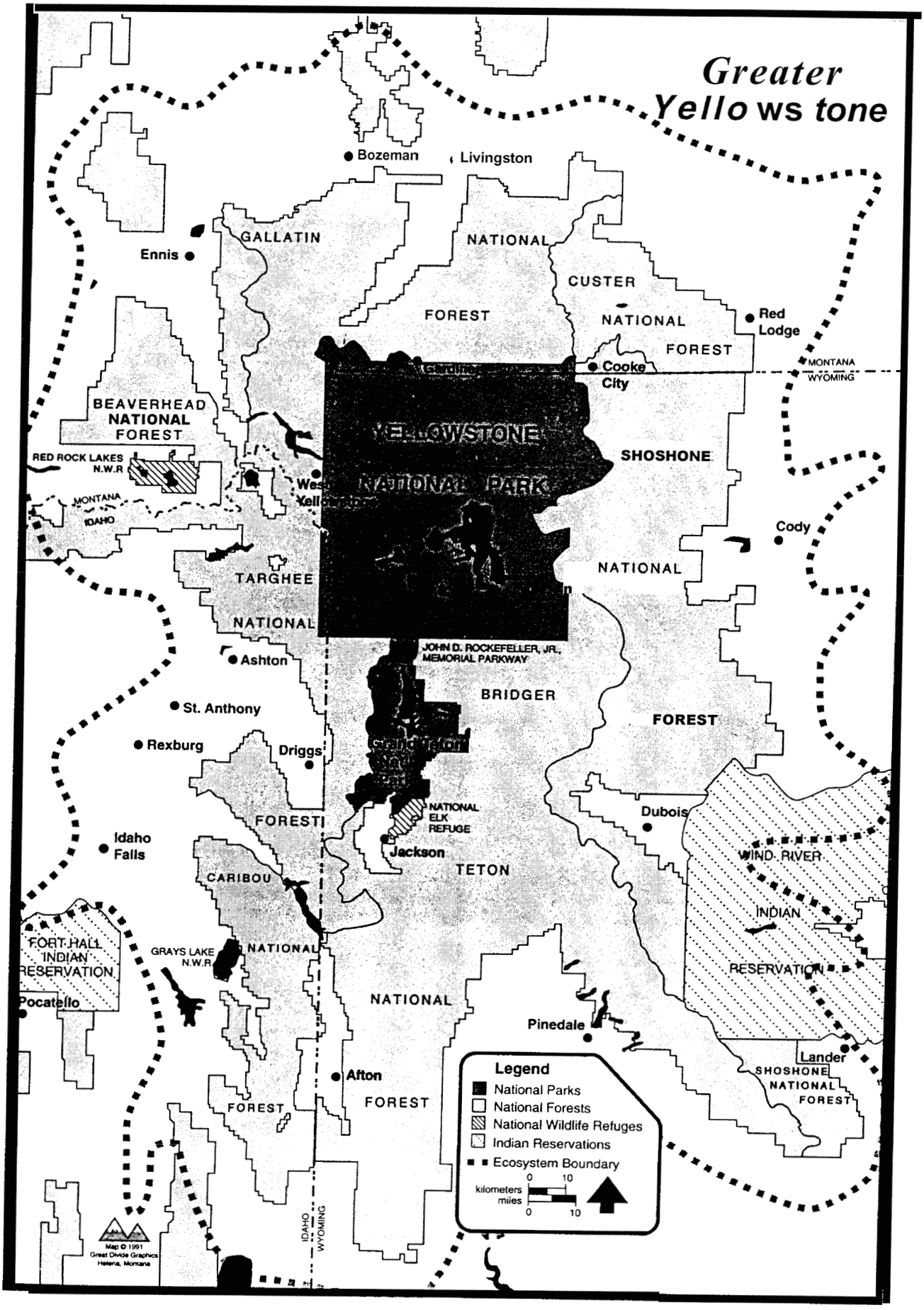
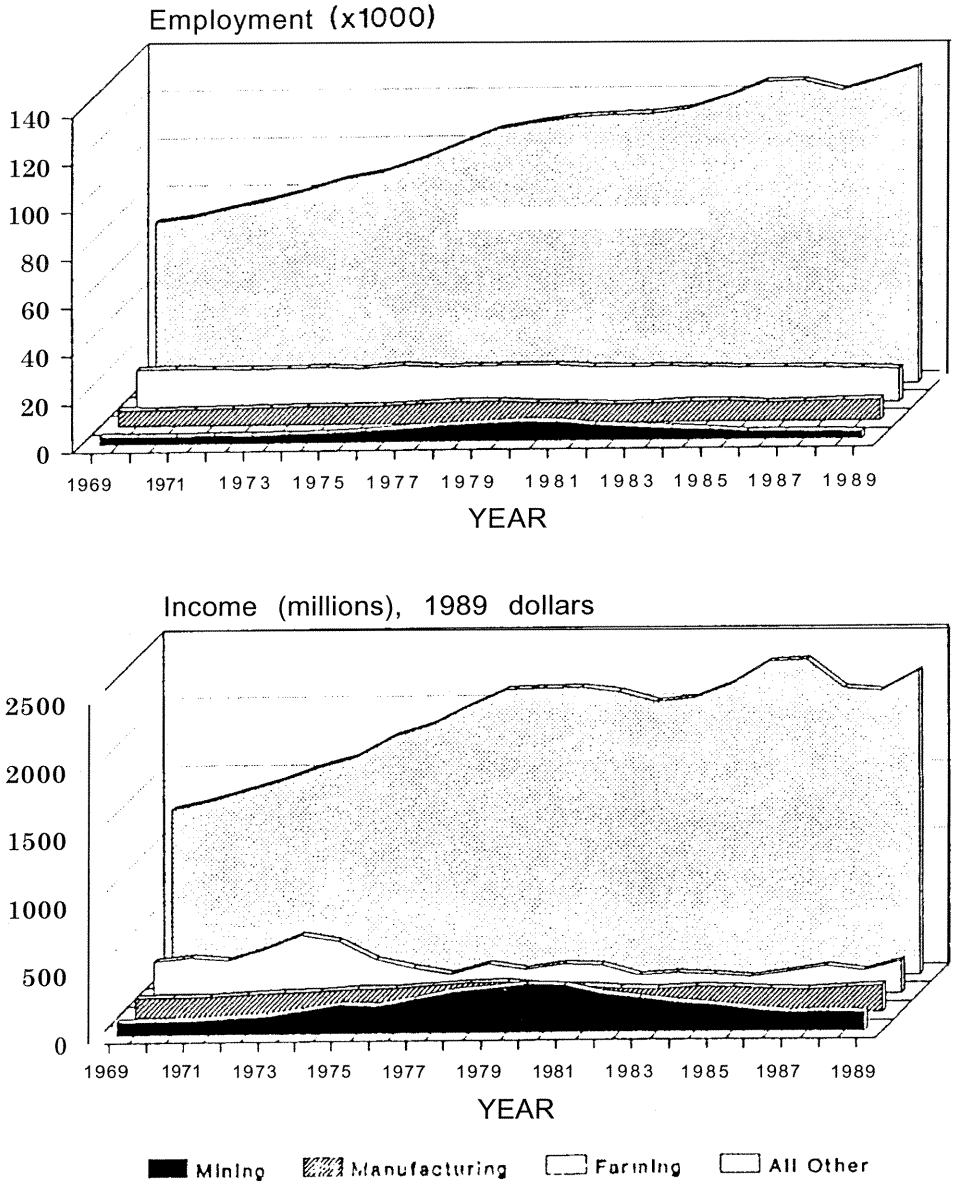

Greater Yellowstone
Bozeman
Livingston
Ennis
GALLATIN
NATIONAL
FOREST
CUSTER
NATIONAL
FOREST
Red Lodge
Cooke City
MONTANA
WYOMING
BEAVERHEAD
NATIONAL
FOREST
RED ROCK LAKES
N.W.R
MONTANA
IDAHO
YELLOWSTONE
NATIONAL PARK
SHOSHONE
NATIONAL
FOREST
Cody
TARGHEE
NATIONAL
FOREST
Ashton
JOHN D. ROCKEFELLER, JR.
MEMORIAL PARKWAY
BRIDGER
FOREST
St. Anthony
Rexburg
Driggs
NATIONAL
ELK
REFUGE
Dubois
Idaho
Falls
Jackson
TETON
CARIBOU
NATIONAL
FOREST
WIND RIVER
INDIAN
RESERVATION
FORT HALL
INDIAN
RESERVATION
GRAYS LAKE
N.W.R
Pocatello
NATIONAL
FOREST
Pinedale
Lander
SHOSHONE
NATIONAL
FOREST
Afton
FOREST
FOREST
Legend
National Parks
National Forests
National Wildlife Refuges
Indian Reservations
Ecosystem Boundary
kilometers
miles
0
10
0
10
IDAHO
WYOMING
Map © 1991
Great Divide Graphics
Helena, Montana

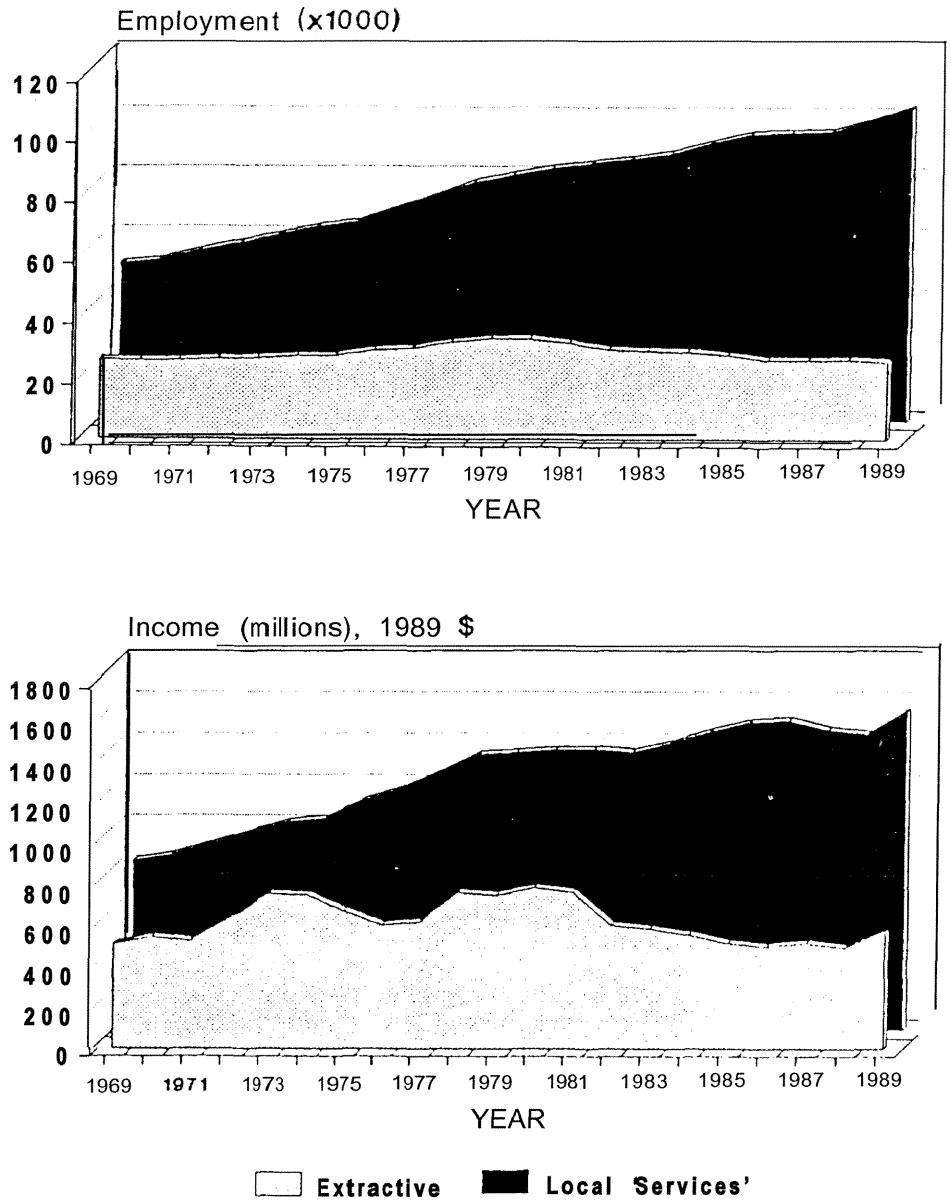
Figure 2



All Other = Conatruction, Traneportation & Public Utilities, Retell & Wholesale Trade, Finance, Inaurance & Real Estate, Services, Government

Source: Bureau of Economic Analysis
U.S. Department of Commerce 1991

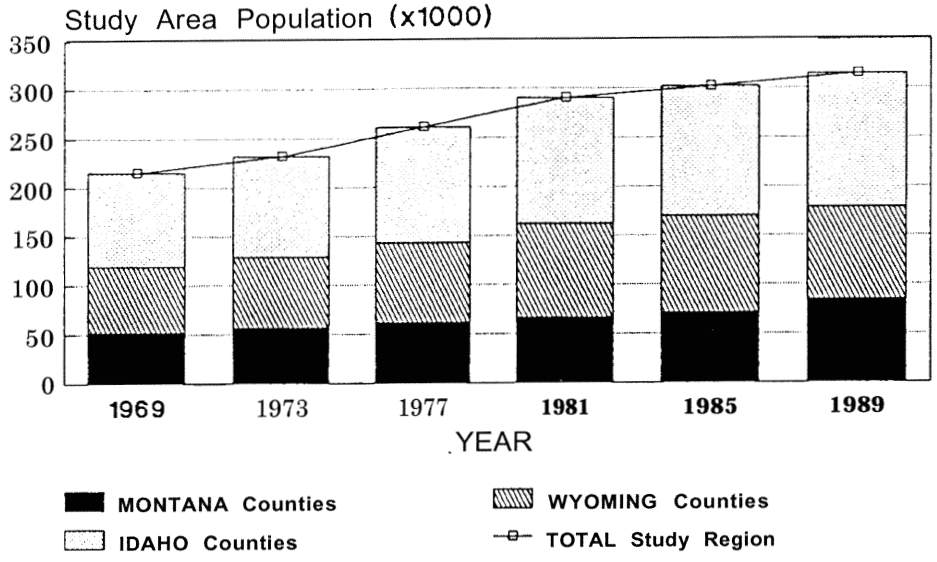
Figure 3



Extractive - Farm, Mining & Manufacturing.
Local Services' - Retail Trade, Finance, Insurance & Real Estate, "Services", State & Local Government.

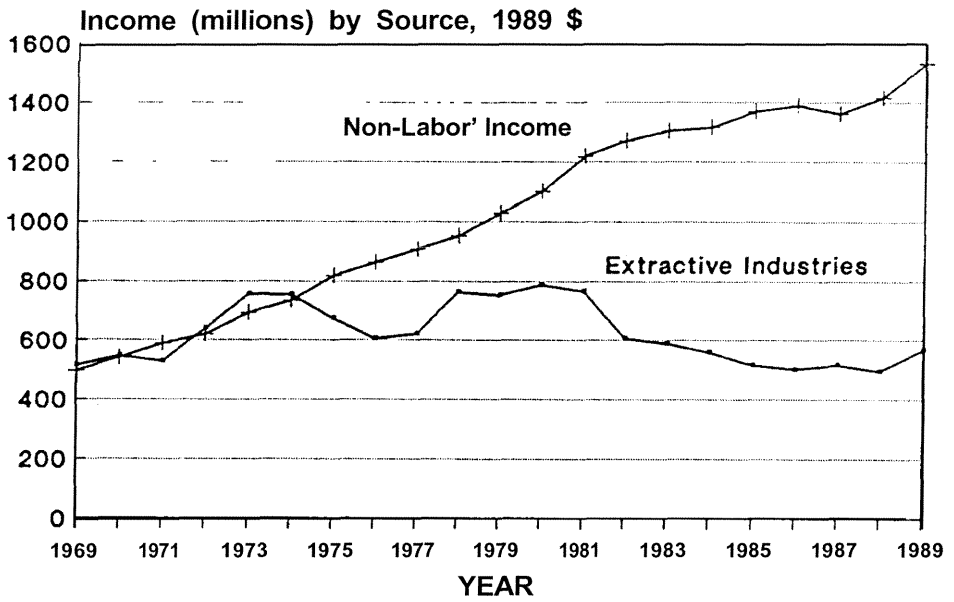
Source: Bureau of Economic Analysis
U.S. Department of Commerce 1991

Figure 4



Source: Bureau of Economic Analysis
U.S. Department of Commerce 1991

Figure 5



Source: Bureau of Economic Analysis
U.S. Department of Commerce 1991

USING MARKET AND NONMARKET VALUES OF WILDERNESS LANDS IN ALTERNATIVE REVENUE-SHARING STRATEGIES

Anne Huebner*

ABSTRACT

The United States Department of Agriculture, Forest Service, currently shares 25 percent of all moneys received by national forests with the counties origin on a per acre basis. These payments do not reflect the value of wilderness use on the national forests, for which no fee is charged nor do the payments relate to any type of tax equivalency payment which the county might receive if these lands were in private ownership.

Three alternative revenue-sharing methodologies are developed and analyzed. The methodologies include the use of nonmarket values for wilderness use, and county property values andax formulas for similar parcels of land that are in private ownership.The methodologies are applied to Congressionally-mandated wilderness areas on jive national forests in six states, which include the Bridger-Teton in Wyoming, theGila in New Mexico, theTongass in Alaska, the White Mountains in Maine and New Hampshire, and the White River in Colorado.

Counties with national forest wilderness acres would receive greater revenue-sharing payments using any of the three alternatives, compared to the existing revenue-sharing structure. Any of the three alternatives better meet the objectives of explicitly recognizing the social value of wilderness, and more equitably and predictably compensate counties containing national forest acres.

INTRODUCTION AND OBJECTIVES

Since 1908 (16 U.S.C. 500), 25 percent of all moneys received during any fiscal year, from user fees and the sale of products off of national forests (NF), are returned to the counties of origin (via states) on a per acre basis. These dollars must be used for public schools and county roads. How much for each is decided by individual state legislatures. Historically, the major portion of these revenue-sharing payments has come from the sale of Forest Service (FS) timber, especially in some of the western and southern states.

National Forest System (NFS) wilderness lands cover 33,255,498 acres in the United States, including Alaska. This figure represents 18 percent of all NFS lands, i.e., 187,946,811 acres. Currently, the Forest Service does not charge user fees for NFS wilderness areas. There are dollars shared with the counties from the sale of and/or fees collected from special use permits, e.g., outfitters and guides. The amount charged for the special use permits is most often based on some percent of the user's gross income reported from use of the permit.

In the face of an increasing population and a revitalized interest in the biosphere, there are increasing demands on public forest lands to provide goods and services that have not been traditionally exchanged in the market place. These goods and services do not contribute towards county revenue-sharing payments, under existing laws.

Many counties are, or will soon be, facing substantial reductions in payments because traditional commodity output levels are decreasing. A greater share of the public is currently demanding long-term environmentally sensitive uses of public forest land, which are also aesthetically pleasing.

Many counties facing reductions in payments are also counties with limited property tax bases to support local infrastructure, due to large percentages of Federally-owned acreages. One result is county governments pressuring the Forest Service to keep market commodities and uses at sometimes inefficiently high production levels in order to maintain the status auo of local finances. This pressure exacerbates existing conflicts between market commodity users, and endangered species habitat, wilderness and other amenity users on NF land.

*USDA Forest Service, Land Management Planning staff; Huebner was formerly with the Forest Inventory, Economics, and Recreation Research staff, USDA, Forest Service, Washington, DC 20090. The views expressed are the author's alone.

The objectives of this paper are to analyze and describe alternative revenue-sharing strategies which would jointly: 1) explicitly recognize the social values of wilderness, and 2) equitably and predictably compensate counties containing National Forest System (NFS) acreages. The three alternatives are listed below.

A. Assess wilderness acreages based on regionally-specific market clearing prices, as determined for the Resource Program and Assessment (RPA) 1990 long-term strategic plan, and national forest-specific annual wilderness usage, reported as recreation visitor days **(RVDs).** Use the existing 25 percent revenue-sharing process to share 25 percent of these nonmarket values with the counties, in addition to revenues already shared.

B. Assess wilderness acreages as if privately owned, using county-specific taxable land values and local mill levies. Revenue-sharing payments would be 100 percent of property tax-equivalent assessments.

C. Assume assessed property values (defined in alternative B) do not reflect the additional value from wilderness users. Add the capitalized RPA clearing prices to the market property values and apply county formulas to estimate tax-equivalency payments.

In addition to the alternative analyses and results, two policy questions are presented for further thought in the discussion section.

Wilderness areas are analyzed on live National Forests, each of which covers portions of several counties. Revenue sharing based on any of the three proposed alternative strategies will alleviate much of the conflict between county governments and the (growing) portion of the public who desire that wilderness areas be maintained or increased in number and size.

CURRENT SITUATION

In response to expectations of annual FS and other Federal revenue-sharing payments, state and local governments have designed their property, sales, income, and/or local mill levy tax structures around these payments. The intent of the Twenty-five Percent Fund Act of 1908 was to encourage the establishment of communities in the western U.S. and not related to any type of tax equivalency payment. In recent years, however, counties containing public lands have viewed these dollars **as in-lieu** property tax payments.

The relatively highest contributors to **FS** payments are timber sales. For example, the FY 1990 total **NF** statement of receipts shows that 79 percent of all receipts were from the sale of timber (includes green sales, salvage sales, dollars allowed for reforestation by the Knutson-Vandenberg Act (K-V), and timber purchaser road credits). In contrast, the receipts generated from recreation-special uses were 2 percent of the NF grand total. This 2 percent includes the fees received from outfitter and guide businesses using NFS wilderness areas. In terms of the 25 percent payments shared with counties, $271.4 million came from timber sales, and $6.9 million came from recreation-special use permits/fees. Timber receipts represent the market value to the purchaser and the seller (the public) of Federal timber; special use fees do not reflect the value of wilderness to visitors (see Madsen **[1990];** McAvoy and **Dustin [1989]).**

Although the first national-level intervention of forested lands began in the late **1800s,** there exist today more than 33 million acres of wilderness areas of the total 188 million acres of National Forest System land, The primary reason for a national-level government is based on the recognition that private markets may fail to allocate resources efficiently or equitably. The failure of the price system implies that market prices do not necessarily reflect social benefits and costs, and market profitability does not necessarily reflect net social benefits (Boadway, 1979). In some cases, public policy may better ensure a more equitable distribution of income or a more socially desirable long-term rate of economic growth (Musgrave and Musgrave, 1984).

Most counties affected by losses of FS revenue-sharing payments are rural counties. However, several authors have pointed out that amenity resources represent a key reason why rural people live where they do, why others come to visit, and represent the "rural capital" of the future (Niemi and Whitelaw, 1990; Siehl, 1990). It is not appropriate to solely compare economic situations between rural and urban areas. Wilderness areas and amenity resources provide rural and urban residents alike a unique opportunity for personal exploration and self-discovery (Madsen, 1990; **McAvoy** and **Dustin,** 1989).

In the case of wilderness, threatened and endangered species, and a variety of values not easily or accurately measured in the market place, the public has historically supported the intervention of the Federal government to manage these lands. This support for Federal agencies to manage national parks, national forests, and grasslands indicates that the public believes net social benefits are best maximized by Federal ownership. However, this does not necessarily indicate

that individuals recognize the equity in compensating counties containing wilderness acreages.

Problem Statement, or "Why Analyze Revenue-Sharing Strategies Using Nonmarket Values?"

This paper addresses two related issues:

1. The first issue is using both market and nonmarket values in policy decisions involving public goods; e.g., public natural resource lands, where the social benefits and costs of some uses are not and/or cannot be priced in the market place.

2. The second issue concerns the local financial impact on counties containing national forest acreages and why current revenue-sharing laws may exacerbate conflicts between commodity users and noncommodity or amenity users.

In reference to the **first** issue, volumes of literature exist which identify, analyze, and discuss various methods of **nonmarket** valuations (Peterson et al., **1990;** Kelly, 1985; Peterson and Randall, 1984; **Slovic** and **Lichtenstein,** 1983; Bishop, 1982, Brookshire et al., 1976; **Tiedman** and **Tullock,** 1976; Willig, 1976; etc.). Additionally, the USDA Forest Service Resource Programs and Assessment staff prepares a document every five years which includes market clearing prices **(MCPs)** and MCP plus consumer surplus (CP) for all nonmarket goods and services available from the existence of NFS lands.

The second issue addresses the effectiveness of current revenue-sharing laws pertaining to public resource lands. A number of studies have been done addressing the concerns that current revenue-sharing laws do not provide adequate or equitable compensation to local governments for costs incurred as a result of Federal land ownership (Huebner et al, 1985; Comptroller General, 1979; Advisory Commission on Intergovernmental Relations, 1978). However, none of the past studies have specifically considered the value of property in wilderness designations, nor have they considered the use of nonmarket values in **revenue-**sharing payments.

Federal tax immunity or non-tax equivalency payments reduce state and local government financial bases and violate the equity principle in public finance that taxpayers in equal circumstances be treated equally (Oates, **1969).** Because there has been shown to be an inverse relationship between the level of local taxes and property values (Oates, **1969),** land and real property values may be reduced in counties with large percentages of Federal acres where no grant system exists designed to promote **fiscal** equity between local authorities **(LeGrand,** 1975). The property tax accounts for approximately 80 percent of local tax collections; local governments have no better tool for generating revenues for maintaining the level of public goods and services [of their choice] (ACIR, 1981).

National Forests and Wilderness Areas in Sample, and Analysis Methodology

Five National Forests in five Forest Service regions are the sample for this analysis. These national forests were chosen based on the following criteria: 1) they represent a diversity of uses and locations across the United States; 2) specifically, the recreation-special use category contributes varying percents to total forest revenues, which include revenues from outfitter and guide special use permits used in wilderness areas; and 3) they have complete or **almost** complete wilderness areas within their boundaries, which simplified the data collection from forest and county personnel. The national forests are listed below.

1. Bridger-Teton National Forest; Wyoming; Forest Service Region 4.
   In FY 1990, recreation-special uses were 45 percent of total revenues.

2. **Gila** National Forest; New Mexico; Forest Service Region 3.
   In FY 1990, recreation-special uses were 2 percent of total revenues.

3. Tongass National Forest; Alaska; Forest Service Region 10.
   In FY 1990, recreation-special uses were **.4** percent of total revenues.

4. White Mountain National Forest; Maine and New Hampshire; **FS** Region 9.
   In FY 1990, recreation-special uses were 22 percent of total revenues.

5. White River National Forest; Colorado, Forest Service Region 2.
   In FY 1990, recreation-special uses were 81 percent of total revenues.

The names of wildernesses contained within these Forest's boundaries, and the wilderness and total national forest acreages are listed in Table 1 (see Table 1).

Four calculations are made for each national forest and are explained as follows.

1. Current revenue-sharing payment for wilderness acreages only. Using the current 25 percent revenue-sharing act, calculate the amount shared with the counties for wilderness acres only. The current payment methodology is a per acre payment. In other words, all receipts from all resources, regardless of county location, go into a pot. Counties receive an amount commensurate with the number of forest acreages in their county, regardless of which resource and which national forest acreages generated these revenues.

2. Alternative A - Wilderness nomnarket revenues shared with counties. The RPA 1990 long-term strategic plan lists region-specific market-clearing prices **(MCPs)** and **MCPs** plus consumer surplus (CS) (i.e., average **willingness-to-pay)** for wilderness recreation visitor days **(RVDs** = 12 hour days; values were adjusted from activity days = 24 hours). These values are listed in Table 2 (see Table 2). **RVDs** for eight categories of recreation activities are reported annually by National Forest. Wilderness **RVDs** are portions of some of these eight categories and are reported last as a wilderness total. To obtain the revenue-sharing payment for alternative A, multiply the MCP times the number of wilderness **RVDs;** 25 percent of this value is the payment shared with counties. This payment would be in **addition** to the 25 percent revenue-sharing payment received by a county in 1990.

3. Alternative B - Property tax equivalency payments to counties from National Forest acreages. Fair market, or actual values, and taxable, or assessed, values are determined for forest wilderness parcels. Estimated values are from county assessor personnel on counties containing the specific wilderness acreages by national forest; these values are averaged for each national forest. Mill levies are averaged in the same way. Both property values and mill levies were for large, remote, undeveloped parcels of land. Table 3 lists the fair market and taxable values per acre, and the respective mill levy applied to the taxable values (see Table 3). Payment received by counties would be 100 percent of the property tax, on a per acre average.

4. Alternative C - Property tax equivalency payments which reflect an additional value from wilderness use. Assume property values for these remote lands do not reflect an additional value from wilderness user demand. Add the capitalized RPA market clearing price to the total market property value assigned to the forest's total wilderness acres, and apply the same county formulas as in Alternative B to estimate a new tax equivalency payment which considers values of land and wilderness use. A 7 percent interest rate is used to estimate the capitalized use value.

RESULTS

The results are presented in Table 4 (see Table 4). Counties with NF wilderness acreages would receive greater revenue-sharing payments using any of the three alternatives, in place of the current process.

The Bridger-Teton NF would contribute the greatest payments to counties using Alternative A (see Table 4). The payment of **$1,393,315** would be approximately 10 times the current payment of $143,036, or an average of **$.11** per acre. Three characteristics of the Bridger-Teton may explain this large **difference** in payment values: 1) market commodity programs are small relative to three of the other forests; the counties received **$.11** per acre in 1990 from actual dollar returns to the Treasury; 2) NFS lands are assessed under the "current use" classification for timber lands of $6.25 per acre, which is not derived from market value; and 3) wilderness **RVDs** per wilderness acres is the third highest - one wilderness RVD **(WRVD)** per three wilderness acres (WA) in 1990.

The **Gila** NF would return more dollars using Alternative C, which includes the MCP in the property tax formula (see Table 4). Alternative C payment is approximately 25 times greater than the current payment of $68,498 (an average of **$.09** per acre). The **Catron** County assessor's office provided me with a **$300/acre** market value for miscellaneous nonresident, nonagricultural land. Small ranches of approximately 300 acres, surrounded by forested or wilderness lands, are currently selling for $3,000 per acre. Another property value, which could be used is from a sale estimate of the 500,000 acre Gray Ranch in Hildago County, recently purchased by the Nature Conservancy. The exact purchase price has not been disclosed; however, the range is thought to be from $50 to $100 per acre. The **Gila** National Forest had a ratio of one wilderness RVD to six wilderness acres in 1990.

The Tongass NF wilderness acreages are the most difficult to estimate because 97 percent of Alaskan lands are in state, Federal, or native corporation ownership. Therefore, the property tax base is

extremely small; property taxes might be reduced if the taxable land base increased. Any of the three alternatives would return more dollars to the boroughs, with Alternative C producing the highest payment. Under the current property taxation process (Alternative B), Tongass Wilderness areas would contribute approximately 15 times more dollars to southeast Alaska boroughs, $44,172,775, compared to the current payment, $2,944,852 (average of 5.54 per acre). The property value used is the lowest value for wetlands and the mill levy is for **unroaded** areas. At this time, the wilderness RVD to wilderness acres ratio is the lowest of the **five** Forests; 1 WRVD to 7 **WAs.**

The highest returns to counties with White Mountain NF wilderness areas would result from Alternative A (see Table 4). These wilderness areas have the highest RVD to wilderness acres ratio; 1.1 to 1. The counties currently receive the highest average per acre payment, **$.70** per acre (total 1990 payments of $80,452) from any of the live Forests. However, the counties receive the most dollars from Alternative A - $609,525, which is approximately eight times greater than the current 1990 payment. Alternatives B and C are also greater, 2.8 and 4.3 times the current payment. This is **significant** because the property value used is a weighted average "current use" value for timberlands of $42.50 per acre, as opposed to $500 per acre assessed value if not in "current use" status.

The White River NF also would return the highest payment to counties under Alternative A. The amount is **$1,017,676,** compared to the actual 1990 payment of $319,030 or **$.49** per acre. The White River has the second highest ratio of **WRVDs** to **WAs,** 1 to 2, in 1990. The tax equivalency methods, Alternatives B and C, also return 2.5 and 3 times more than the 1990 payment. Wilderness land assessed values are based on a Forest "current use" assessed value of $21 per acre (recently passed by the Colorado State Legislature). In comparison, old mining claim lands on wilderness areas are currently selling for $2,500 an acre, for an assessed value of $825.

Discussion

All counties receive greater payments when revenue-sharing payments are based on values other than, or in addition to, market revenues received from the sale of goods or services off national forest lands. Any of the alternatives reflect an increased public recognition of the net societal benefits of having wilderness areas by utilizing nonmarket values in policy decisions, e.g., Federal payments to counties. The alternatives are more equitable because the counties are compensated by how much of their tax base is eliminated due to Federal ownership rather than market revenues, which vary greatly between forests. Alternatives B and C are more predictable because they are based on county property assessment procedures, which are most often re-evaluated every five to 10 years, rather than **annual** revenues. Annual revenues from sales of goods and services off the national forests fluctuate greatly and are influenced by many factors; some factors are outside of the Forest Service's and local government's control.

If Alternative B or C were chosen, no doubt the addition of thousands of acres to county property tax bases would affect market property values, assessed property values, and/or mill levies. Alaska property values and mill levies could most be expected to change, based on the current 3 percent land base in private ownership.

Implementation of these alternatives, especially Alternatives B and C, involving property assessments, would require a lot of effort and cooperation on the part of the Forest Service, and states and counties. Implementation of any of these alternatives would also require that Congress be willing to appropriate additional funds to cover these payments, in the likely case that actual dollar returns to the Forest Service (Treasury) would be insufficient.

Some resource economists have argued for charging user fees based on similar goods or services provided through private markets. Additionally, one of two key characteristics of a "pure public good" is nonexcludability. It is reasonable to assume that the 5 million acres of southeast Alaskan wilderness, with thousands of miles of shoreline, is nonexcludable to anyone wanting access. To reiterate an earlier point, the very existence of nationally-owned resource lands implies the public has already decided there is an additional net benefit to society not realized through the price system and private ownership. Therefore, exclusion is not physically feasible and society does not wish to deny access based on the ability to pay a user fee.

All alternatives presented in this paper are "use" oriented; non-use values, such as bequest, existence, or option values, are not included in the revenue-sharing calculations. Because these public lands represent or produce public goods, the non-use values in revenue-sharing payments would reduce incentives for local governments to lobby for solely commercial activities resulting from actual use, whether it be timber production or wildlife viewing.

The two issues, described in the problem statement and analysis results, inspire two questions for further thought.

1. The first issue leads us to the question of: Why are the public, their Congressional representatives, and Federal land managers, generally unwilling to use these nonmarket values in policy and legislative decision-makmg, when, by the very nature of being in Federal-ownership and management, there are net social benefits which are not captured in the private price system?

2. The second issue leads us to the question: "Based on the extensive literature on the dependence of local governments on property taxes, why have the Forest Service and Congress been historically unwilling to provide equal circumstances, e.g., compensation based on locally comparable property taxes applied to Federal acreages within counties and school districts? (Note: The exception is three counties in Minnesota containing the Boundary Waters Canoe Area, which currently receive payments based on property tax equivalency as legislated in the Act of June 22, 1948, 16 u.s.c 577 g-l.)

In many counties, an unprecedented level of conflict exists between interest groups and between individuals over the management of nationally-owned natural resource lands. Perhaps American society has not yet "come to terms" with the fact that "net social benefits" implies some level of social costs, as well as benefits (except in the case where a true Pareto optimum exists). American public behavior reflects (via the Congressional budget process and individual spending/saving patterns) the beliefs of a "free lunch" and "having your cake and eating it, too" by simultaneously demanding increased economic growth and accumulation of material wealth, and demanding clean air, clean water, biodiversity, and pristine natural resource lands. In the current world of an ever-increasing population, wide-spread abject poverty, and continued belief by many people that "more (material wealth) is better," trade-off decisions affecting the quality and quantity of natural resource lands are continuously being made, intentionally or otherwise.

SUMMARY

Three alternative revenue-sharing strategies for wilderness areas on five national forests are described and analyzed. Results show that counties and local governments benefit more from any of the three strategies, compared to current revenue-sharing based on actual dollar returns to the Treasury. Any of the three alternatives better meet the objectives of explicitly recognizing the social value of wilderness, and more equitably and predictably compensating counties containing NFS acreages. An efficient allocation of these resource lands would not likely be achieved through the market price system, which would also be acceptable to society.

REFERENCES

Advisory Commission on Intergovernmental Relations. The adequacy of Federal compensation to local governments for tax exempt Federal lands. Commission Report A-68. Washington, DC: Government Printing Office. 1978. 203 pp.

Bishop, R.C. 1982. Option value: An exposition and extension. Land Economics. 1-15.

Boadway, R.W. Public Sector Economics. Cambridge, MA: Winthrop Publishers, Inc. 465 pp.

Brookshire, D.S.; Ives, B.C.; Schulze, W.D. 1976. The valuation of aesthetic preferences. Journal of Environmental Economics and Management. 3:325-346.

Comptroller General: Alternatives for achieving greater equities in Federal land payment programs. Washington, DC: General Accounting Office Report to Congress PAD 7964, 1979. 59 pp.

Huebner, A.E.; Hickman, CA.; Kaiser, H.F. 1985. A tax equivalency study on National Forest System lands in the United States. USDA Forest Service, FS-3%. 50 pp.

Kelly, J.R. Investment theory: Long-term benefits. Proceedings, National wilderness research conference; 1985; Fort Collins, CO; 393-397.

LeGrand, J. 1975. Fiscal equity and central government grants to local authorities. The Economic Journal. 85:531-547.

Madsen, C. 1990. The wilderness within. Nature Conservancy. 40(6):20-21.

McAvoy, L.H.; Dustin, D.L. 1989. Resurrecting the frontier. Washington, DC: U.S. Department of Interior, National Park Service, TRENDS, 40-42.

Musgrave, R.A.; Musgrave, P.B. 1984. Public finance in theory and practice. McGraw-Hill Book Co. 822 pp.

Niemi, E.G.; Whitelaw, W.E. 1989. Looking beyond the owls and the logs: The relationships between Oregon's forests and its economy. Eugene, OR: University of Oregon, Economic Policy Institute Northwest. 14 pp.

Oates, W.E. 1969. The effects of property taxes and local public spending on property values: An empirical study of tax capitalization and the Tiebout hypothesis. Journal of Political Economics. 77:957-971.

Peterson, G.L.; Driver, B.L.; Brown, PJ. 1990. The benefits and costs of recreation: Dollars and sense. In: Johnson, R.L.; Johnson, G.V., eds. Economic valuation of natural resources. Boulder, CO: Westview Press, Inc: 7-23.

Peterson, G.L., Randall, A. 1984. Valuation of wildland resource benefits. Boulder, CO: Westview Press. 258 pp.

Siehl, G.H. 1990. Amenity resources and rural economic growth: Report on a national policy symposium. Washington, DC: The Library of Congress, Congressional Research Service, 90-380 EM. 91 pp.

Slovic, P.; Lichtenstein, S. 1983. Preference reversal: A broader perspective. American Economic Review. 596-603.

Tideman, T.N.; Tullock, G. A new and superior process of making public choices. Journal of Political Economics 84:1145-1159.

United States Department of Agriculture, Forest Service. The Forest Service program for forest and rangeland resources: A long-term strategic plan. Washington, DC, Resource Program and Assessment Staff, 1990 RPA program. 63 pp.

United States Department of Agriculture, Forest Service. The Principal Laws Relating to Forest Service Activities. Washington, DC: Government Printing Office, Agriculture Handbook No. 453, revised, 1983.

Willig, R.D. 1976. Consumer surplus without apology. American Economic Review. 66:587-597.

TABLE 1. Uilderness Areas and Recreation Visitor Days (RVDs) on Five National Forests (1990 data)

State	National Forest	National Forest Acres	Wilderness Areas	Wilderness Acres	Percent of Uilderness Area on this NF	RVDs for all Uilderness on this NF
Wyoming*	Bridger-Teton	3,399,768		1,300,325		410,100
			Bridger	428,087	100	
			Gros Ventre	287,000	100	
			Teton	585,238	100	
New Mexico	Gila	2,704,773		761,089	100	128,400
			Aldo Leopold	202,016	100	
			Blue Range	1,200	4	
			Gila	557,873	100	
Alaska	Tongass	16,748,460		5,453,429	100	781,800
			Coronation Island	19,232	100	
			Endicott River	98,729	100	
			Kootznoouoo	937,459	100	
			Maurelle Islands	4,937	100	
			Misty Fiords	2,142,243	100	
			Petersburg Creek-Duncan Salt Chuck	46,777	100	
			Russell Fiord	348,701	100	
			South Baranof	319,568	100	
			South Prince of Wales	90,996	100	
			Stikine-Leconte	448,841	100	
			Tebenkof Bay	66,839	100	
			Tracy Arm-Fords Terror	653,179	100	
			Uarren Island	11,181	100	
			Uest Chichagof-Yakobi	264,747	100	
Maine/New Hampshire	Uhite Mountain	768,947		114,932	100	116,100
			Caribou-Speckled Mtn.	12,000	100	
			Great Gulf	5,552	100	
			Pemigeuasset	45,000	100	
			Pres. Range-Dry River	27,380	100	
			Sandwich Range	25,000	100	

TABLE 1. Uilderness Areas and Recreation Visitor Days (RVDs) on Five National Forests (1990 data) (continued)

State	National Forest	National Forest Acres	Uilderness Areas	Uilderness Acres	Percent of Wilderness Area on this NF	RVDs for all Wilderness on this NF
Colorado	White River	1,960,242		651,081	100	320,528
			Collegiate Peaks	35,700	21	
			Eagles Nest	50,582	38	
			Flat Tops	196,300	83	
			Holy Cross	113,800	92	
			Hunter-Frying Pan	74,399	100	
			Maroon Bells-Snowmass	163,500	89	
			Raggeds	16,800	28	

TABLE 2. Market Clearing Prices for Wilderness Recreation Visitor Days (RVDs) in the 1990 RPA Program (1989 dollars)

Forest Service Region	State	National Forest	Market Clearing Price
4	Wyoming	Bridger-Teton	13.60
3	New Mexico	Gi La	16.50
10	Alaska	Tongass	17.75
9	Maine, New Hampshire	Uhite Mountain	21 .oo
2	Colorado	White River	12.70

TABLE 3. Market Values, Taxable Values, and Mill Levies for Wilderness Land (dollars per acre)

	Market Value	Taxable Value	Mill Levy
Bridger-Teton	65.80	6.25	63.4
Gi la	300.00	99.00	20.0
Tongass	1500.00	1500.00	5.4
Uhite Mountain	500.00	42.50'	44.0
Uhite River	600.00	21.00[1]	58.0

[1] "Current use" value for forest land. A current use value is not related to market or normal taxable values and is usually determined by a State Legislature. Many Western states have various "current use" classifications and values for grazing and agricultural uses. Many Eastern and Southern states have "current use" values for forest land.

Sources of data: The market and taxable value estimates and mill levies were obtained from County Assessors offices in Teton and Sublette Counties, Uyoming; Catron and Grant Counties, New Mexico; Juneau and Ketchikan Boroughs, Alaska; Coos and Grafton Counties, New Hampshire; and Eagle and Pitkin Counties, Colorado.

TABLE 4. Current and Alternative Revenue-Sharing Payments from Wilderness Areas, by National Forest

(dollars)

National Forest	Current Payments 25% of NFS Revenues, based on the average per acre payment for this NF	Alternative A[1] Additional 25% Payment, based on RPA wilderness market-clearing prices and RVDs	Alternative B[1] State/County Property Tax Equivalency Payment	Alternative C[1] Property tax equivalency and market-clearing prices capitalized using county tax formulas
Bridger-Teton	143,036	1,393,315	515,254	996,349
Gila	68,498	527,403	1,506,956	1,706,710
Tongass	2,944,852	3,475,101	44,172,775	45,243,283
White Mountain	80,452	609,525	214,923	345,350
White River	319,030	1,017,676	793,017	911,363

[1] Alternative "A": payment would be added to "Current Payments" to get a total revenue-sharing payment for the national forest. Alternatives B and C could be added to "Current Payments" or a similar methodology could be applied to all national forest acres to obtain a total payment.

Part VI. Economic Value in Decision-Making

ECONOMIC VALUE IN WILDERNESS DECISION-MAKING: SOME REFLECTIONS ON APPLICATIONS

Lloyd C. **Irland***

ABSTRACT

Economic research on wilderness is becoming more extensive, more rigorous, and better validated. The range of problems being addressed is increasingly complex, ranging from in-lieu-of-tax problems to land swaps to the traditional issues of land allocation. The issues needing attention, however, have been shifting and the focus of applied economic research needs to shift as well. More work on the application of our growing knowledge is needed, and attention needs to be paid to emerging issues such as biodiversity, cost recovery from users, option values of future resource supplies, and the costs of wilderness management.

Wilderness land allocation and management have always raised economic questions. The traditional commodity versus amenity questions familiar from allocation controversies remain with us. These questions are taking new forms, however, as the examples of visibility retention and protection of the spotted owl indicate. Research has raised our confidence in our ability to measure consumer willingness to pay for various forms of wilderness recreation. Beyond this, we are gaining confidence in contingent valuation methodology (CVM) techniques for estimating consumer value for existence and bequest values of wildlands.

In the conference session, we have seen applications of economics to a variety of these questions. The land ownership history of the West left vexing problem of working out fair value-for-value exchanges with inholders in federal wilderness areas. The concern over local tax revenues as affected by resource extraction on federal lands endures. Continuing allocation controversies, involving large areas of BLM lands, display wide ranges in acreages between agency suggestions and interest group demands. They also display disingenuous if not downright fraudulent misuse of economic information on in place resource values and the implications for local communities. It is not clear that either side has a full monopoly on objectivity.

Finally, there is uncertainty as to how extensively or effectively economics has been used in decisions about wilderness allocation and management and fire protection policy. Forest Service speakers offered differing perspectives on this question. The papers in this session and the balance of the conference lead to a number of questions that may provide a useful review of where we stand from the standpoint of decisionmaking. Of course, there are other reasons for doing economics than to aid decisionmakers.

HOW ARE **WILDLAND** VALUES AFFECTED BY WILDERNESS DESIGNATION?

As pointed out by Bruce Godfrey, wilderness values need to be examined on a with-without basis. Since most previously established recreational uses usually continue, all the economic value of these uses may not be attributable to wilderness designation as such. This point is highlighted by the prominence of day use in most wilderness areas, consisting of activities where solitude and close contact with nature may not be the primary attractions for visitors. For these users, nonwilderness lands may offer suitable substitutes. Surely many wilderness values are preserved by designation, but it is undeniable that at least some of these values would continue to be realized under multiple-use management or simply under deferral of any decisions.

We have measures of existence values for wildlands and for a variety of individual components of wildlands, including John Duffield's case on re-introducing the timberwolf into the Greater Yellowstone Ecosystem. It may not yet be clear, however, whether all of these existence values fall completely to zero if present roadless areas are used - or kept available for use - for nonwilderness purposes.

WHAT DO MEASURED EXISTENCE VALUES TELL US?

At this conference, one speaker wondered aloud whether decisionmakers are comfortable relying on these measured existence values. John Loomis asked,

* Lloyd C. Irland, President, The Irland Group, 7 North Chesnut Street, Augusta, Maine 04330.

"Do you folks believe this stuff?" A strong sense emerged that many administrators don't. Given that fact, it is worth asking if additional research of this sort is a high priority. Decisionmakers already have an abundance of polling evidence that shows citizens supporting wilderness and environmental protection, and that they are willing to pay "more" to have these benefits.

IS OUR VALUATION PARADIGM FALLING BEHIND?

The measured existence values have shown us one important thing - that existence values for wilderness exceed direct user benefits. This is hardly surprising considering how few people ever visit wilderness, and how few of those who do are really seeking backcountry solitude. What is increasingly at stake is the legal and policy concern for biodiversity, wildness, existence values of wild lands, and the survival of individual species. It seems that the more we know about recreation benefits, the less important they appear in the social rationale for wilderness designations. Likewise, measured existence values for wilderness in general may or may not well cover the other important concerns.

Indeed, there is something of a contradiction in trying to value species survival - a fundamentally nonutilitarian matter - with a economic paradigm based on individual utilitarian valuations. There is a point at which truly collective modes of forming preferences and making decisions become more intellectually defensible and more realistic. There is no danger whatever that the fate of the spotted owl will be decided on the basis of a CVM analysis.

If we agree that placing a dollar value on biodiversity in general is reaching a bit far, then how should we suggest to decisionmakers that they weigh this consideration against other competing ones? In Bob Moore's summary of **BLM's** Colorado wilderness proposal, he notes that the proposal will increase ecosystem representation in Colorado protected areas significantly. Probably this point will not be challenged. But if it proves to conflict with some other important value, how can we as economists help analyze the situation?

DO FUTURE RESOURCE SUPPLIES HAVE AN EXISTENCE VALUE?

My friend Hugh **Canham** observes that lumber has consumer surplus, too, though we often don't make comparisons on an apples-to-apples basis in this business. It is also worth asking whether future resource supplies have some sort of option or existence value. Is a future renewable raw material supply important? Looking at a world whose forests are shrii and whose wood supplies are in for dramatic shifts, is there option value in the opportunity to harvest in the future on lands that are presently submarginal? Does a regulated forest have a value? Personally, I don't think it's an argument in favor of rape and plunder to suggest that there may be something here. We are often all too willing to argue that if an acre isn't worth harvesting now, it ought instantly to go into wilderness. Why should option preservation only work in one direction? Wii the market conditions of the last three years last for the next **300?**

Notice that during the years that we've been expanding our wilderness areas, we've also been expanding our reliance on Canadian softwood lumber. This readily accessible, low cost supply has muted the severity of our choices between **wildland** values and raw material supplies. Now British Columbia, as Terje Vold has shown us, is evaluating its own wilderness future.

WHAT SHOULD USERS PAY?

We are now satisfied that we can show the reality of large consumer willingness to pay for both existence and use values of wilderness areas. It is interesting that there was no mention during this program of how that willingness to pay could be tapped to cover appropriate costs of wilderness recreation management. The general level of this discussion could benefit from some careful economic thinking. The National Park Service got a ten-spot out of me to let me into the Grand Teton and Yellowstone Parks - for about four hours. It was a bargain.

WHAT ARE THE COSTS OF WILDERNESS MANAGEMENT?

There are real cash costs associated with providing wilderness recreation. We are only beginning to realize just how complex quality wilderness management is. We are finding significant unfunded backlogs and deteriorating conditions in more and more areas. Too many people are coming to see and fondle. We need more research on what these management costs are, what the priorities are, and how best to manage cost recovery if we are to meet our responsibilities.

Better cost analysis and assessment of alternatives could contribute a great deal to more responsible long

term budgeting and to improved decisions in wilderness management plans. In the Society of American Foresters (SAF) Task Force Report on Wilderness Management, for example, many of the issues and recommendations discussed had to be treated with little or no information on costs. And cynics have observed that functions that bring in some cash often get more attention at budget time from senior managers and legislators.

WHAT ARE THE EFFECTS OF WILDERNESS DESIGNATION AND RESOURCE DEVELOPMENT ON NEARBY COMMUNITIES?

How Should This Information Affect Decisions?

Several papers at this conference emphasize important facts about local resource-dependent economies. Local dependence on resource-based industries is smaller than one might think, even in areas as rural as the Greater Yellowstone Region and Southern Utah. Cultural images and myths endure, not surprisingly, long after facts have changed. Yet it is clear that resource dependence is a complicated story, involving much more than counts of jobs. And the specific implications of low levels of employment dependence for wilderness decisions are less than clear from a more long-term perspective. Interestingly, there was little emphasis at this conference on local benefits of **wildland** recreation uses. Indeed, data for Montana showed a surprisingly small spending impact by **out-of-**state backpackers. In contrast, significant spending impacts have been asserted for certain portal communities associated with river rafting.

A need still exists for the research community to bridge gaps of factual **understanding,** perception, and group interests in this important area. I think The Wilderness Society's work on the Yellowstone region is a good beginning for one particular area, though a few qualifications and quibbles might arise on detailed review. On the other side of the coin, we have plenty of good evidence that common forms of Western resource development can impose severe financial, environmental, and social costs on nearby communities. Yet the dream of the Big Strike continues to hold sway on Main Street, affecting wilderness proposals around the West. Killing a dream is hard to do.

How to develop and present clear and useful ideas about these situations remains fuzzy around the edges, and needs more attention from applied economists. Unfortunately, a lot of the recent general literature about "community stability" is conceptually weak and one-sided, if not actual propaganda. Perhaps moving from abstractions to the facts of particular areas will help. Further, we need to get beyond cliches about just how this knowledge ought to affect decisionmaking.

IN CONCLUSION

As I've noted elsewhere, we are getting into the rising leg of the cost curve in our decisions about wilderness management and allocation. The level of complexity is rising. America has a vast empire of some 100 million acres of wilderness. Large **roadless** areas remain in dispute. But we know more and more about less and less important aspects of the future allocation and management of this incredible natural heritage. Some of our speakers suggest that economic information has played a modest role in these choices in the past. If true, isn't this largely our own fault?

WILDERNESS RESOURCE PROTECTION AND ECONOMIC RESOURCE PRODUCTION AS A CONTINUUM - A LAND MANAGERS PERSPECTIVE

Bob Moore and Eric Finstick*

ABSTRACT

The *conventional view of wilderness preservation emphasizes the conflict between resource protection and economic development. Viewed in a broader context, however, these two goals of protection and production are really a part of the continuum of uses which is the heart of the concept of multiple use. Viewed as such, they are not mutually exclusive. Wilderness management generates economic value, while even mining need not result in permanent loss of natural values. In between are a multitude of possible resource use mires which allow various degrees of resource protection and production. The goal of the land manager is to manage this continuum in a manner that, in a sense, maximizes these competing but not incompatible uses.*

This paper will examine this concept of the continuum of resource production and resource protection and illustrate with actual resource management planning decisions made by Colorado Bureau of Land Management managers. Examples will include wilderness recommendation decisions which (1) emphasize natural resource protection for unique or representative natural systems, while allowing compatible activities generating economic production; (2) emphasize resource production for areas with especially valuable commodities, while retaining or restoring natural values insofar as the development activity allows; and (3) emphasize a range of production/protection uses as appropriate for the resource values present in each case.

What I would like to do is provide some practical perspectives on wilderness decision-making from the viewpoint of a public land manager. I have actively participated in the wilderness recommendations for the Bureau of Land Management (BLM) in Colorado, and I will address those recommendations more **specifically.**

First, I would like to provide a context or a framework within which it may be useful to view wilderness decisions, again from the perspective of the public land manager. As I do that, I will attempt to characterize the role of economic values in that process as we viewed it in Colorado.

It seems that conventional wilderness rhetoric, especially in the political arena, tends to emphasize the conflict between wilderness designation as a "lock-up" of resources versus the potential economic values of resource production. This results in a very polarized and controversial political process. Viewed in a larger context, however, these two goals of resource protection and economic production are really contained within the continuum of uses, which is the heart of the concept of multiple-use. Viewed as such, they are not mutually exclusive. As a part of the continuum of multiple-use management, wilderness management produces economic value in a number of ways, through grazing, hunting, tourism, eco-tourism, and often increased land values on adjacent private lands, to name a few. On the other hand, oil and gas development, for example, need not result in long-term loss of natural values. In between are a multitude of possible resource mixes which allow various degrees of resource protection and production.

The concept of **wildland** protection as a part of a continuum of multiple uses has in some ways been more prevalent internationally than here in the United States. Although there are no formal wilderness designation systems in Europe equivalent to ours, there is a very high level of public interest and support for protection of relatively wild landscapes, and these are very much a part of the culture, as well as the economy, of the European nations. For different reasons, a similar result occurs in many third world countries where the need for sustainable development is a virtual survival issue. In both situations, the population and economic pressures result in a movement toward the center of the multiple-use continuum, normally allowing a greater degree of resource production to occur in a protected **wildland** area than would be permissible in our wilderness system. On the other hand, wilderness in New Zealand does not provide for any forms of livestock grazing or even for hiking trails to provide for public use.

*State Director, Colorado Bureau of Land Management, and Wilderness Program Leader, Colorado Bureau of Land Management, Lakewood, CO.

Viewed in this context, it is more productive for the land manager to examine resource values on a site-specific and resource-specific basis rather than get caught up in the rhetoric of "lock-up" versus production. Clearly, it is our job to make decisions based on actual resource values on an individual case-by-case and resource-by-resource basis.

It may be useful, then, to think of wilderness designation as one of many land management tools available to the manager. Ideally, the manager would analyze the geographic area within his or her jurisdiction and consider the multiple values found within that area, and would form management objectives and prescriptions tailored to the individual values found on each site. Only then would the manager attempt to determine which of these objectives and prescriptions were best met by wilderness designation and what sites best tit into other multiple-use management schemes.

For Colorado BLM, completing our wilderness review process through our normal resource management planning process (Resource Area-by-Resource Area) enabled us to approach our recommendations from this "tool-box" perspective. Using this approach helped us to develop our proposals in a relatively objective manner within the context of the continuum of resource protection versus resource production.

I'd like to summarize the results of our evaluation to illustrate how this thought process or context, if you will, helped result in actual objective wilderness proposals.

BLM in Colorado manages about 8 million acres of surface lands. These were inventoried, and about 10 percent or 770,000 acres were found to be roadless and to contain at least minimum wilderness characteristics. These were studied through eight individual resource management plans and environmental impact statements. The result was about 430,000 acres recommended for wilderness designation[1]. This is about 55 percent of what we studied and 5 percent of the BLM public lands in Colorado. The remaining 340,000 acres were recommended for other multiple-use management.

These recommendations considered four major factors. The degree of natural values was, of course, a primary factor. The areas with the greatest, most unique, or most pristine natural values and the largest areas are proposed for wilderness designation. The degree of conflict with other high value uses was the second critical factor. This was particularly true of energy/minerals potential. I'll address that in more detail later. Public comment was, of course, weighed carefully. Throughout the study process, we received over a thousand letters containing over 5,000 wilderness study area-specific comments. While the large majority of the comments (about 88 percent) favored wilderness designation generally, nearly all of the opposition to wilderness was from local residents nearest the study areas. Finally, we put a lot of energy into consideration of manageability. Areas with significant, valid existing rights, such as pre-FLPMA (Federal Land Policy and Management Act) oil and gas leases and areas with the greatest private inholdmgs, were generally not recommended. In addition, boundaries were drawn to make sure they will be identifiable and manageable.

The recommended areas are made up of 16 new wilderness designations and additions to four existing Forest Service-designated wilderness areas. These areas represent some of the most outstanding natural public lands in Colorado. They include parts of the most spectacular canyons on the major river systems in Colorado - the Dolores River Canyon, Ruby Canyon on the Colorado River, Cross Mountain on the Yampa River, the Gunnison Gorge, and Browns Canyon on the Arkansas River. They represent ecosystems and landforms ranging from the alpine Cannibal Plateau and Powderhorn Lakes to three 14,000-foot peaks; alpine lakes in the Red Cloud Peak and Handies Peak WSAs[2], Colorado Plateau canyons like Dominguez Canyon, with riparian systems, waterfalls, and endangered cactus; and Tabeguache Canyon on the opposite side of the Uncompahgre Plateau.

They represent remote, pristine mesa tops with colorful history, such as Sewemup Mesa and isolated badlands like Bull Canyon and Skull Creek, and even more remote and isolated back country in Diamond Breaks, flanking historic Browns Park. In contrast, the truly pristine maze of Black Ridge Canyons contains a collection of a dozen arches, and an overhang cave the size of two football fields, and the area is literally within view of I-70 and Grand Junction, the largest city on the west slope; while the little known canyons and cascades of Beaver Creek are within 15 miles of Colorado Springs on the front range. Opportunities for back country recreation and for real exploration, adventure, and discovery are virtually unlimited on these often as yet little known areas.

The areas recommended nonsuitable include all of the high potential energy/mineral resource areas, including the controversial Oil Springs Mountain and Little Bookcliffs, the latter of which also contains a thriving, wild horse herd.

Other areas, such as Troublesome, are not recommended because of conflicts with inholdings, and

two areas, Upper and Lower Grape Creek, are judged not manageable because an upstream water company has complete control of the streamflow. The natural values on many of these areas will continue to be protected through other forms of administrative management restrictions. For example, much of the Palisade is designated an outstanding natural area **(ONA)** to protect the scenic values, as well as habitat for the endangered Great Basin Silverspot butterfly.

Three areas, Cross Canyon, Squaw Papoose Canyon, and Cahone Canyon, have significant Anasazi ruins, are within the Anasazi area of critical environmental concern (ACEC), and are also high potential oil and gas areas. In these, the cultural sites will be protected by no surface occupancy and off-highway vehicle closures in the canyons, while allowing leasing and production to potentially occur from the canyon rims.

Other areas were judged to have natural values of lesser significance, although they do not have major competing resource values. These include **McKenna** Peak, Weber Mountain, **McIntire** Hills, Adobe Badlands, Camelback, Castle Peak, and several others.

One area, San Luis Hills, has limited outstanding natural values except that it would represent a unique ecosystem type (Rocky Mountain fescue/mountain **muhly** prairie) within the national wilderness system, and is not represented by any other study areas. It will be designated an ACEC upon completion of the San Luis Valley resource management plan (RMP).

On a statewide basis, this recommendation provides a balance of multiple uses and protection of natural values. On areas not recommended for wilderness designation, it allows for development of the energy and mineral resources within wilderness study areas with the highest oil and gas potential. It provides for other forms of natural value protection for areas that can best be managed as **ACECs, ONAs,** or other special management designations, and it proposes for designation and protection as wilderness those areas that would make the most outstanding contributions to the National Wilderness Preservation System.

Many areas are not recommended for wilderness because the resources contained within them are more appropriately managed in other ways. This management does not necessarily sacrifice the natural values found within them, however. Where a value warrants protection, the proposed management is tailored to the actual values found and recognizes and provides for some means of appropriate protection. The three **WSAs** with significant Anasazi sites - Cross Canyon, Squaw Papoose Canyon, and Cahone Canyon - are excellent examples of this approach. The canyons where the concentration of sites exists will be protected by no surface occupancy and off-highway vehicle closures, and are within a designated ACEC. In recognition of the high potential oil and gas values, the areas would also remain open to oil and gas leasing utilizing directional drilling from the canyon rims. Leasing would not be allowed, even with no surface occupancy, if the areas were designated wilderness. Consequently, it was our decision that wilderness designation would not result in the most appropriate management of the resources found in these specific areas.

This is but one example of management objectives, other than wilderness, which were tailored to specific resource situations. Approximately 100,000 acres of the 340,000 acres not recommended for wilderness will receive some form of protective management specific to the resources on those sites. Many of those areas will be designated **ACECs** or **ONAs,** not as a substitute for wilderness, but to allow more appropriate management prescriptions considering all the resources found in those areas.

Of the remaining study acreage not proposed for wilderness, about 175,000 acres will be managed under more general multiple-use management, and no activity is expected to substantially change the character of the areas. About 65,000 acres are expected to be more intensively developed for oil and gas, resulting in some loss of natural values, largely due to road construction.

As previously mentioned, minerals potential was a major factor in the decisions. The US Geological Survey (USGS) and Bureau of Mines (BOM) have provided information on mineral potentials and values for all of the areas studied. Of the 430,000 acres proposed for wilderness designation, only about 30,000 acres were identified by USGS and BOM as high potential for any valuable mineral occurrence. Of this, most is high potential for locatable precious metals in the high elevation country.

On the other hand, of the **340,000** acres not recommended, about 200,000 acres were identified as high potential, much of that for oil and gas. In addition, while there are no pre-FLPMA leases on the proposed areas, there are some 116 such valid existing rights covering 43,000 acres of the areas not recommended.

Among the natural values considered, ecosystem representation within the wilderness system was evaluated. BLM is using the Bailey-Kuchler ecosystem representation as a basis for this analysis. Within Colorado, there are currently seven ecosystems represented in Forest Service and National Park

Service designated wilderness. Our proposal would nearly double that by adding six additional ecosystems within Colorado. While none of these are unique nationally, several are only minimally represented.

In summary, we have proposed for wilderness designation some 430,000 acres representing the most outstanding natural values found on the BLM public lands in Colorado. On those lands, wilderness management is clearly the most appropriate form of protection of the natural values. Some multiple uses, such as recreation, livestock grazing, and wildlife management, will continue on these lands insofar as protection of the wilderness values permits.

The remaining 340,000 acres are proposed for other forms of multiple-use management, designed and tailored for each specific site, to protect the most significant natural values while allowing for resource production activities, such as oil and gas development, to occur where the potential for such development is highest. The Colorado BLM wilderness recommendations as described provide an illustration of the necessity and desirability of assessing the values of each site individually, designing appropriate management guidelines, and determining when those guidelines are consistent with wilderness or other special management designations. When viewed from a statewide perspective, the management proposed illustrates the continuum of natural value protection, including wilderness, ACEC, **ONA,** or other designation, general multiple-use lands, and lands allocated to energy/mineral development.

While certainly not everyone will agree with these recommendations, and they will be and are controversial in many respects, the site-specific analysis and study through which they were developed will provide an objective and factual basis for the eventual wilderness designation process. The recommendations are clear examples of the continuum of natural resource protection and resource production as discussed in this paper. They illustrate that natural values can be protected in areas not designated wilderness, and that some multiple uses will continue in areas which are designated.

ENDNOTES

1. The Secretary of Interior's final recommendation to the President, signed in October 1991, did not propose Red Cloud Peak and **Handies** Peak for wilderness designation. As a result, the Department's **final** recommendation for Colorado Bureau of Land Management lands proposes a total of **396,000** acres for wilderness designation and 376,000 acres for release to other forms of multiple use.

2. As indicated in **endnote** 1, Red Cloud Peak and **Handies** Peak were not included in the Secretary of Interior's **final** recommendation for wilderness designation.

USE OF WILDERNESS VALUES IN FOREST SERVICE POLICY AND PLANNING

Linda L. **Langner***

ABSTRACT

Resource economists have made considerable advances in estimating both use and nonuse values of wilderness. Use values are more available, but the limited evidence suggests that nonuse values are equally or more important in total. Wilderness values seem to have played a limited role in past wilderness decisions. Increasing conflicts over wilderness designation and management may enlarge the role of values and economics in general. Although economic information is only one of many factors that enter the decision process, it can contribute in a more substantial fashion than it has in the past.

INTRODUCTION

Economic values of wilderness can contribute to decision-making by illustrating the trade-offs from resource allocation choices. The first section of this paper traces the change in economic approach to wilderness, and the current status of wilderness economic values. The second section examines the role of wilderness values in Congressional wilderness designations. The third section treats the role of values in Forest Service recommendations on wilderness designation and wilderness management. The final section summarizes the current use of economics and values in wilderness decisions.

ECONOMIC BASIS FOR WILDERNESS VALUES

Economics and wilderness are often seen as mutually exclusive topics. The common perception of economics **being** "pro-development" was generally correct thirty years ago. The traditional view of wilderness was of unproductive land that only had value after being modified and developed by humans. This assumption of zero value was partly attributable to a perception of abundant undisturbed natural areas, so that the marginal cost of converting these areas was zero.

Resource economists have made great advances in treating amenity resources, including wilderness, since that time. Krutilla's classic article **(1967)** set the stage for a change in the economic approach to natural environments, while Krutilla and Fisher (1975) further developed and expanded this rationale. They argued that several factors made the traditional approach to natural environments increasingly questionable. The growth in recreation participation in the **50s** and 60s resulted in a large group of citizens with an interest in preserving these environments. The new science of ecology was providing evidence that these areas had many values in addition to user values. Finally, natural environments were becoming relatively scarce.

A convincing argument was made that modification of natural environments imposed opportunity costs on society that should be considered in decisions. These costs were not limited to foregone benefits from wilderness use. The concepts of irreversibility, option value, existence value, and bequest value seemed to be particularly relevant to environmental amenities (Krutilla nd Fisher, 1975).

Estimating Wilderness Values

Economists specializing in forestry, mining, and agriculture already had economic tool kits at their fingertips for estimating values when nonmarket estimation techniques got their start. The travel-cost method developed by **Clawson** (1959) received the bulk of attention in the first few decades of nonmarket value estimation, with its emphasis on estimating recreation values associated with particular sites. However, the travel-cost method is limited to use values. The contingent valuation method was also originally developed for recreation values (Davis, **1963),** but the method's flexibility allows more scope for estimating **nonuse** values as well.

Estimates of recreation values still dominate available wilderness values. In the case studies in Krutilla and Fisher **(1975),** the quantification of preservation benefits was limited to recreation benefits. A recent wilderness research conference's economic papers dealt almost totally with recreation and analysis of user behavior (Lucas, 1986, and Lucas, 1987). A similar

* Staff Economist, Resources Program and Assessment Staff, USDA Forest Service, Washington, D.C.

pattern is found in the proceedings of the wilderness benchmark colloquium (Freilich, 1989). **Nonuse** values were addressed primarily by non-economists.

However, the number of economic studies addressing **nonuse** values of wilderness is increasing. These studies show that the methods are available to address the question of total value of wilderness. An early study (Walsh and others, 1984) focused on the allocation question of how much wilderness was optimal in Colorado, another on the optimal allocation of wild and scenic rivers (Walsh and others, **1986),** while a third estimated the total value of an existing wilderness (Barrick, 1986). In all three studies, the sum of **nonuse** values (option value, bequest value, existence value) and values associated with maintaining environmental quality were consistently higher than recreation values. The lesson is clear: the sole use of recreation values severely underestimates the total value of wilderness.

The current situation can be summarized as follows: a strong conceptual framework exists for wilderness use and **nonuse** values. The tools exist to estimate these values. Currently available estimates are primarily wilderness recreation values. Study results suggest that **nonuse** values are equally or more important than use values, and although there are limited examples of **nonuse** values at the present time, current research efforts are focusing on this area.

WILDERNESS LEGISLATION: ROLE OF ECONOMICS

The Wilderness Act of 1964 (P.L. 88-577) resulted from the same changing social values and perceptions about scarcity of undisturbed natural areas that affected the economics literature. The Act lists the public purposes of wilderness areas as recreational, scenic, scientific, educational, conservation, and historical. Also recognized is the uniqueness of these areas, and the need to protect some portion of remaining areas from development.

The language of the Act casts the decision as one of "economic' development versus preservation. The economic interest is narrowly construed as concerned solely with private profits. In this light, economics is only seen as marshalling arguments against preservation. This characterization of economics also is used as an argument why economics has no role in wilderness decisions, that wilderness is somehow "above" economics. As mentioned previously, this perception of economics was accurate in the past, including the time when the Wilderness Act was passed. Today, the argument is better cast as one of comparing the benefits of preservation and the benefits of development. The fact that many of the preservation benefits cannot be monetarily quantified does not make them any less real or important, just more difficult to account for.

Since the original Wilderness Act, numerous bii have been passed by Congress designating additions to the National Wilderness Preservation System. The role of economics in two bills that designated wilderness on National Forest System lands is discussed below.

Public Law %-560 was passed in 1980, designating wilderness on National Forest System lands in Colorado, South Dakota, Missouri, South Carolina, and Louisiana, The House of Representatives report on a House version of the bill concerning designations in Colorado provides justification for designations and omissions of wilderness study areas (House of Representatives, 1979). Recreation opportunities, wildlife habitat protection, and production of high quality water were the three primary justifications for overall designation. A variety of factors were used to justify designation of particular areas: accessibility to populations for recreation, high quality wildlife habitat, scenic quality, and unique terrain. No quantification (monetary or otherwise) of these benefits is included in the report, or any consideration of how non-designation would affect these values.

The reasons for omitting portions of areas from wilderness designation included high mineral potential, interference with motorized access, providing an adequate supply of timber for local mills, and interference with local grazing operations. Again, no quantification of these effects is included, although more involved analysis may exist. The trade-offs are fairly clear, but it appears the deciding factor was political feasibility.

The Oregon Wilderness Act of 1984 (P.L. 98-328) seemed to generate more controversy. A report from the House of Representatives on one version of the bill contained both supporting and dissenting views (House of Representatives, 1983). The supporters argued that the impact on harvestable timber was insignificant, and that the timber affected was marginal and would require a subsidy for removal. Further, they argued that there would be positive impacts on jobs and revenues from a growing recreation industry that, in the long run, would contribute to the state's economy more than harvesting from marginal lands with fragile soils. They also point out the Forest Service has shown that the fishery values exceed timber values in **roadless** areas; but, at current funding levels, those values would not be protected. The dissenters argued that too much land was designated, and the loss of jobs and revenues

was too great an impact to justify. The report also included technical **analysis of timber** harvest impacts, and impacts on returns to Treasury.

The language **describing** reasons for designation in the Oregon bill is very similar to Public Law **96-560.** For example, some areas were deleted from consideration because of impending timber sales. However, much more analysis was contained in the Oregon bii report. The **fishery** values associated with wilderness designation were obviously an important factor in the decision. In both bii the basic logic of trade-offs appeared in justifying designations and omission; but it also appeared that the greater the **conflicts** involved, the more **significant** the role economic analysis plays.

FOREST SERVICE PUNNING

The Forest Service is responsible for making recommendations on wilderness designations, as well as managing designated wilderness. The Forest Service RPA Program reflects the national direction for wilderness, while the Forest Plans provide wilderness recommendations and management guidelines.

The 1990 RPA Program

The RPA Program is the Forest Service's strategic plan for the future, the most current version being the 1990 RPA Program (USDA, 1990). During the development of the 1990 Program, various management strategies were considered that contained a different mix of program emphases. These strategies ranged from high commodity production to high amenity emphasis, which included varying scenarios for the number of wilderness acres on National Forest System lands. A present net value was calculated for each of the potential strategies. The economic analysis indicated that the marginal benefits from amenity outputs generally exceeded the marginal benefits from commodity production. This result was generated even though only use values were available for the amenity outputs. The **final** strategy selected for the 1990 Recommended Program reflects a long-run change on National Forest System lands toward a more balanced mix of commodity and amenity outputs, with **sizeable** increases in amenity resource programs. In this case, the economic analysis contributed to justifying a change that appears to be in **line** with changing social values and demands on the public lands.

Forest Land and Resource Management Plans

The Forest Service is required to develop a Land and Resource Management Plan (Forest Plan) for each National Forest. In the planning process, wilderness must be considered on equal footing with the other multiple use resources. The Forest Plans must contain an evaluation of **roadless** areas for potential wilderness recommendations to Congress and establish general management direction for designated wilderness **(Wilkinson** and Anderson, 1987).

The specific direction for wilderness in Forest planning is found in the Land and Resource Management Planning Regulations (36 CFR 219). The regulations require that **roadless** areas be evaluated and considered for recommendation for wilderness designation. Several factors are to be considered in the evaluation: wilderness values of the area; values foregone and effects on management of adjacent lands if the area is designated a wilderness; feasibility of managing the area as wilderness; proximity to other designated wilderness and contribution to the National Wilderness Preservation System; and the long-term impacts on species diversity (36 CFR 219.17).

The regulations also require the Forest Plan to include direction on management of existing wilderness areas. Specifically, the plans must address management of visitor use to prevent damage to the wilderness resource, and evaluate the need for wildlife, insect, and disease control (36 CFR **219.18).**

Forest Plans and Wilderness Recommendations. I reviewed a sample of final Forest Plans for their wilderness recommendations. The language of the recommendations is reminiscent of that found in the reports on Congressional bills. Recommended areas were cited as having high wilderness values, fish and wildlife values, recreation values, and, in some cases, of having little effect on market outputs. Reasons for not designating usually included high timber values, high mineral values, and impacts on motorized recreation. There was often mention of the degree of public support for the proposal. The lack of analysis supporting designation led me to conclude that in this sample the areas recommended created little controversy, or were chosen to minimize controversy.

A study by Loomis (1987) indicated that when economic efficiency analyses were performed on wilderness study areas, there were substantial technical errors in the calculations. For example, potential recreation capacity rather than actual recreation use was valued, which generally favored non-designation because of capacity constraints in wilderness. A second

error was classifying and valuing all recreation uses on wilderness as "wilderness recreation," even though activities such as fishing and hunting (which are not precluded by wilderness designation) have higher values than general wilderness recreation. These errors generally resulted in biases against wilderness designations. However, the author also concluded that there was no correlation between the recommendations for wilderness designations and the results of the efficiency analysis.

There is little evidence to indicate that economic analysis played a substantial role in developing recommendations on wilderness designation in Forest Plans. To the extent that designation is noncontroversial, economic analysis may be unnecessary. Certainly, economic analysis is not the only factor to consider in designation. However, the basic economic trade-off approach can clarify the benefits and costs of designation. The full range of wilderness values need to be explicitly recognized in this process. Obviously, some education is also required to insure correct analysis. The burden of responsibility for improving the use of values and economic analysis in general lies with economists. We need to provide information to decision-makers in a clear and useful manner.

Forest Plans and Wilderness Management. A great deal of attention has focused on allocation of wilderness: how much and where. Management of designated areas has received less attention, even though management is critical to protecting those unique properties that justified designation in the **first** place. The Forest Plans provide some direction on wilderness management, but often lack detail.

A study comparing Forest Service and Bureau of Land Management wilderness plans on six areas concluded that these plans rarely address the unique values of the areas, and instead focus primarily on recreation. No values are usually defined or measured apart from recreation visitor days. The Forest Service sometimes covers wilderness under the Forest Plan, rather than through a separate wilderness plan. The Plans run the gamut from generic prescriptions to detailed plans that address management problems (Kelly, 1989). Directions in the Forest Plans reviewed above primarily dealt with recreation, roads, **fire** control, and administration.

One example of a wilderness plan that goes beyond generic prescriptions and recreation is the Anaconda-Pmtler Wilderness Plan (which was jointly developed by four National Forests that share management responsibilities). The Plan addresses recreation as a problem, stating that past management was geared to users' convenience rather than use as wilderness. Recreation was seen as the most significant threat to the wilderness. The plan calls for restricting recreation use if it jeopardizes wilderness values. Areas of emphasis in the plan include maintaining native fish and wildlife species, and native plants, and plans to encourage research to increase ecological knowledge, as well as plans to monitor water quality within the wilderness.

Economists have tended to focus on wilderness values versus nonwilderness values. In the management arena, there may be **conflicting** wilderness values, with recreation being the most notable example. Economic analysis can provide useful information in defining trade-offs among competing wilderness values, an area that has received little attention to date.

SUMMARY AND CONCLUSIONS

The conceptual framework for wilderness values is well developed. Techniques to estimate those values are constantly improving. Most economic research on wilderness has focused on recreation values of wilderness, which limits our ability to use wilderness values in policy and planning applications. The support for research on **nonuse** value has not been great, but there appears to be more effort dedicated to this area now than in the past.

From the admittedly small sample of activities I reviewed, from legislation to Forest Service plans, it appears that values have played a fairly minor role in wilderness decisions. The limited number of estimates available is not the only reason. A primary reason is other factors that enter the decision process, primarily political factors. Economic information is only one piece of the puzzle for decision-makers.

As the stakes on designation get higher (i.e., generate more controversy because the numbers of **winners** and losers increase) and management conflicts in wilderness areas increase, I believe economists have the potential to play a bigger role than in the past. The technical information and methods are far more advanced than our ability to communicate that information effectively to decision-makers. The challenge to economists is to prove their information is useful in making decisions, and can be presented in terms that make sense to noneconomists.

REFERENCES

36 CFR 219. 1982. National Forest System land and resource management planning. Federal Register 47 (190):43026-43052.

Barrick, Kenneth A. 1986. Option value in relation to distance effects and selected user characteristics for the Washakie Wilderness, Northwest Wyoming. In: Lucas, Robert C., **comp.** Proceedings of the national wilderness research conference: Current research. Gen. Tech. Rep. INT-212. USDA Forest Service.

Clawson, Marion. 1959. Methods of measuring demands for and **value** of outdoor recreation. Reprint No. 10. Washington, DC: Resources for the Future.

Davis, R.K. **1963.** The **value** of outdoor recreation. Cambridge, **MA:** Harvard University. Thesis.

Freilich, Helen R., compiler. 1989. Wilderness benchmark 1988: Proceedings of the national wilderness **colloquium.** Gen. Tech. Rep. SE-51. USDA Forest Service.

Kelly, Joyce M. 1989. Compatible and incompatible interactions between recreational and **non-**recreational use of wilderness. In: Freilich, Helen R., **comp.** Wilderness benchmark 1988: Proceedings of the national wilderness colloquium. Gen Tech. Rep. SE-51.

Krutilla, John V. **1967.** Conservation reconsidered. American Economic Review. **(September):777-786.**

Krutilla, John V.; Fisher, Anthony C. 1975. The economics of natural environments: Studies in the valuation of commodity and amenity resources. Baltimore, MD: The John Hopkins University Press.

Loomis, John B. 1987. Economic efficiency analysis, bureaucrats, and budgets: A test of hypotheses. Western Journal of Agricultural Economics. **12(1):27-34.**

Lucas, Robert C., **comp.** 1987. Proceedings of the national wilderness research conference: Issues, state-of knowledge, future directions. Gen. Tech. Rep. **INT-220.** USDA Forest Service.

Lucas, Robert C., **comp.** 1986. Proceedings of the national wilderness research conference: Current research. Gen. Tech. Rep. **INT-220.** USDA Forest Service.

Public Law 98-328. 1984. Oregon Wilderness Act of 1984. 98 STAT. 272-279.

Public Law %-560. 1980. 94 STAT. 3265-3274.

Public Law 88-577. 1964. The Wilderness Act.

United States Department of Agriculture. 1990. The Forest Service Program for forest and rangeland resources: A long-term strategic plan. USDA Forest Service, Washington D.C.

U.S. House of Representatives. 1983. Designating certain National Forest System and other lands in the State of Oregon for inclusion in the National Wilderness Preservation System, and for other purposes. House Report 98-13.

U.S. House of Representatives. 1979. Designating certain National Forest System lands in the National Wilderness Preservation System, and for other purposes. House Report %-617.

Walsh, Richard G.; Loomis, John B.; **Gillman,** Richard A. 1984. **Valuing** option, existence, and bequest demands for wilderness. Land Economics. 60(1):14-29.

Wilkinson, Charles F.; Anderson, H. Michael. 1987. Land and resource planning in the National Forests. Washington, DC: Island Press.

THE USE AND ABUSE OF ECONOMICS IN UTAH'S WILDERNESS DEBATE

Ken **Rait***

ABSTRACT

In an effort to fight off federal wilderness designation, some of the West's rural counties argue that such designation will jeopardize their potential for economic development. To back up their contentions, these counties have hired an Arizona-based consultant to quantify the opportunity costs of wilderness designation. This presentation reviews the ongoing debate over economics and wilderness in Utah. The methodology used to quantify the losses in Utah is critiqued and an alternative approach is reviewed.

INTRODUCTION

Wilderness designation is amongst the most contentious of issues in Utah. It has pitted the urban versus the rural, the cowboys and miners versus the recreators and wildlife enthusiasts, and entrenched values against emerging values.

To give you some idea of the polarization generated by this issue, I would like to read you a poem printed as a letter to the editor in the Richfield Reaper, a small central Utah newspaper.

> Environmentalists are here, marching in bands to **drive us off our public lands. They want to stop timber and mining and grazing; the whole idea is quite hair raising.** Don't spray mosquitos and endanger **these guests; they need those bugs for some pristine wilderness.** How **can it be without farming and mining? They better wake up, and stop all this whining. Still they push boldly like robots and vow not to shirk; they will not quit the harping until we are all out of work. When they stop all our jobs, it'll be too late to lament, for we can't all work for the government.'**

As one of Utah's greatest myth-makers, the wilderness issue has obviously roused a great deal of creativity. There are those who believe that wilderness excludes people, is bad for wildlife, and will cause watershed degradation. Ranchers argue, despite the language in the 1964 Wilderness Act and implementing regulations, that grazing is not permitted in wilderness? Miners argue that wilderness will "lock up" the best untapped mineral resources. Perhaps the greatest "Chicken Little-ism" of all is that wilderness designation will cause economic ruin in southern Utah, and, indirectly, throughout the rest of the state.

Utah and Wilderness

The Wilderness Act was passed by Congress in 1964. The Bureau of Land Management received its timetable to begin the wilderness review process with the passage of the Federal Land Policy and Management Act (FLPMA) in 1976. In 1980, the wilderness review process was completed in Utah. Through this inventory process, BLM, spurred by citizen appeals, identified 3.2 million acres of wilderness study areas. Wilderness study areas are currently being managed, pursuant to FLPMA, to protect their wilderness qualities, pending Congressional resolution of the issue.

This inventory, which set aside the 3.2 million acres, generated outrage from environmental groups who felt their interests got the short shrift in this process. Environmentalists complained about the BLM's use of helicopters to survey some areas for their "opportunities for solitude." Similarly, environmentalists argued that numerous outstanding areas were dropped from the inventory because of BLM's cozy relationship with the mining industry and grazing interests. Even former BLM employees admit to the agency's awful performance during Utah's wilderness inventory? While the inventory history is a separate story in itself, it does highlight the fact that abuse of information has been a constant theme in Utah's wilderness designation process.

---

* Issues Coordinator for the Southern Utah Wilderness Alliance. Ken Rait formerly held a faculty position with the Department of Agricultural Economics at the University of Arizona as a Research Associate. The author appreciates the input, advice, and good humor of associate Paula Raines, who helped edit drafts of this document. For more information about the Southern Utah Wilderness Alliance, contact their office at 1471 South 1100 East, Salt Lake City, Utah, 841052423, (801)486-3161.

There are two wilderness designation bills now pending before Congress. HR 1500, the conservationists' proposal, introduced by Utah Congressman Wayne Owens, would set aside 5.4 million acres as wilderness in Utah. Utah Congressman Jim Hansen has introduced HR **1501,** which would set aside no more than 1.4 million acres. At the Southern Utah Wilderness Alliance, we view our role as an interim protector for the more than 2 million acres of lands not currently protected as de facto wilderness (e.g., the difference between H.R. 1500 and **BLM's WSAs).**

Abusive Economics

The Southern Utah Wilderness Alliance plays a role in educating the public, which entails a great deal of work in trying to de-mystify all the myths that have been engendered about wilderness in Utah. This brings us to the issue of abusive economics and the role of its illusions in the Utah wilderness debate. In 1990, a report, contracted by the Utah Association of Counties, was released by the Western Economic Analysis Center. George **Leaming,** author of the study entitled, "The Adverse Economic Impacts of Wilderness Land Withdrawals in Utah," concocts some thoroughly outrageous predictions about the impacts of wilderness proposals on Utah's **economy.**[4] I am going to review some of those predictions here, and briefly discuss his methodology and some of the faux pas, which we and others view as tragic flaws.

Learning breaks the losses into three categories. The first is recreation. The assumption **Leaming** uses in this part of the analysis is simple; there is no recreational use in wilderness. Interestingly, he examines recreational use days in the wilderness study areas as the basis for determining losses, and proceeds to assume that once these areas become designated as wilderness, no one will ever visit them again. That is very bold, and quite untrue. Wilderness is, in fact, highly valued for its recreational values? Of course, these recreational, or use, values are just one of the many reasons for which wilderness is designated. Other ignored purposes include bequest value, option value, and existence values, to name a few. Wilderness, **Leaming** claims, is an economic liability to recreation.

The second area of losses George **Leaming** calculates is in the public land grazing sector. Despite language in the 1964 Wilderness Act which clearly states that grazing is allowed in wilderness, we constantly hear cries, in Utah, that grazing will be excluded. Learning responds to these cries with numbers.

In contrast to Learning's basic premise that no grazing occurs in wilderness, when the wilderness study areas were set aside to be protected as de facto wilderness, agriculture accounted for 1.3 percent of the earning income in Utah. Ten years later, agriculture increased its percentage to 1.4 **percent.**[6] While we are not so bold as to say that agriculture is enhanced by wilderness, we can say with confidence that Utah's agricultural economy has been unaffected by the management of 3.2 million acres as wilderness. There is a forthcoming article written by Mitch **McClarren** of the University of Arizona in the Journal of Range Management which will show that in designated wilderness in Arizona, animal unit months **(AUMs)** have actually increased. The underlying basis for Learning's quantification in this area, that there is no grazing in wilderness, is fatally flawed.

Learning's third area of quantified losses is in the mining sector, which he predicts will bear **99.5** percent of the economic losses from wilderness designation in Utah. To quantify these losses, Learning devises a methodology that almost entirely contradicts the **BLM's** process of utilizing favorability and certainty rankings to determine potential foregone losses from wilderness designation. Basically, Learning's assumption is that anything that is or is not there **will** be developed in the next 25 years at no cost.

In certain instances, Learning simply makes up minerals which do not exist. For all minerals, including oil and gas, he applies unrealistic probabilities that they will be developed. He does not discount; there is no estimation of the cost of developing or extracting the resource; he does not consider whether the mineral is physically or economically recoverable; he does not consider the fact that Utah is a marginal competitor amongst energy producers world-wide; he employs gross double and triple counting; and he uses unrealistic multipliers.

What we find is that the losses to the mining sector, as calculated by Learning over 25 years, are 8 times the total income earned by all Utahns. The losses are overstated by 70 to 250 times, and the losses predicted are 26 times the total annual earnings from mining, forestry, agriculture, and fisheries in the state. In southern Utah's Garfield County, Learning actually predicts losses on an order of magnitude higher than the total personal income in the county. Learning calculates that the statewide impacts from wilderness designation would total $13.2 billion annually.

Learning grossly misapplied basic economic theory to fuel an already polarized debate. Obviously, this type of propaganda has further fanned the flames between the pro and anti-wilderness forces. We believe that

this report was done in disrespect of good science, and that it is nothing more than 422 pages of voodoo economics. Leaming has also completed similar types of economic studies in Arizona and Nevada, which have also been sharply criticized.'

Use of Economics

Our use of economics at the Southern Utah Wilderness Alliance is quite different. To demonstrate how we discuss wilderness in an economic context, I will begin by examining Utah's employment by industry. The mining sector, where Leaming predicts 99.5 percent of the losses from wilderness would occur, currently employs only about 1 percent of Utah's work force. The Utah Office of Planning and Budget predicts employment will remain at 1 percent throughout the early part of the next century.[8] During the same period, the service sector is projected to increase from 17 percent to 23 percent of the state's work force.' In the past ten years, the percentage of earned income from mining has dropped, state-wide, from 5 percent to 2 percent.[10] One of the reasons for this drop is the fluctuating nature of the global energy market, to which Utah is highly sensitive. Figure 1 shows that Utah's mining industry is highly sensitive to diminutive drops in prices for coal, uranium, and oil."

The reasons for this are simple. With regard to oil, Utah has the second highest drilling cost per barrel of any state containing significant oil and gas reserves. This high cost is a result of difficult access and complex geology. For this same reason, Utah's uranium is unlikely to gain a competitive advantage against foreign producers. Utah's demonstrated coal base is significantly smaller than that of Montana, Wyoming, Colorado, and even North Dakota. The marginal costs of increased coal production have proven to be lower in states with more expansive coal bases. Additionally, significant advances of longwall mining technologies have increased productivity in Utah's underground coal mines, thereby decreasing the size of coal mining work forces. Although state-level productivity is at its highest in history, employment has decreased steadily throughout the past decade.[12]

San Juan County provides a notable example of how these market fluctuations affect employment trends in rural Utah. In 1980, the minmg sector employed 36 percent of the county's residents, while the service sector accounted for only 10 percent. By 1988, mining employment dropped to less than one-half of 1 percent, during which time employment in the service sector nearly doubled.[13] The sociological ramifications of this boom-bust type economy, symptomatic of marginal mining subject to global economic fluctuation, present significant challenges to community stability and sustainability.

Kane County (Figure 2) and Garfield County (Figure 3) encompass two regions within which wilderness advocates are proposing significant acreages for designation as wilderness. County commissioners from both these counties vehemently argue against wilderness, in defense of their mining industries.

These graphs clearly demonstrate that mining employs very few people in both these counties. When mining employment fell off as a result of the decline in energy prices in the early 80s (see Figure 1), total and per capita personal income, discounted to 1988 dollars, rebounded through tremendous growth in the service sector.[14] The service sector employs a significant percentage of both counties' work forces.

"But," county commissioners argue, "the service sector provides only low paying jobs, and cannot be depended upon to sustain community growth." Data from Washington County (Figure 4) effectively refute this resounding statement. In fact, the data from Washington County, Utah's fastest growing county, demonstrate that total and per capita personal income is rising in the region as a direct result of growth in the service sector, despite weak performance in the mining sector." We generally view the service sector as more "wilderness friendly" than the mining sector. Wilderness protects the values which generate strong service sectors.

Research by Gundars Rudzitis of the University of Idaho and by Thomas Powers of the University of Montana has shown that the amenity values of pristine places act as a tremendous draw for both visitation and population growth.[16] This growth is translated into dollars so long as those communities protect these important renewable resources. Washington County data provide a solid Utah example which supports the work of Rudzitis and Powers.

Another pertinent point demonstrated by the graphs for Kane and Garfield counties is that setting aside 3.2 million acres by the BLM as wilderness study areas did not devastate the counties' economies, as Leaming predicted. Growth that occurred in each of these counties through the 1960s and 1970s continued through the 1980s, with WSAs set aside, despite the deflection caused by the drop in energy prices. Thus, if the proof is in the pudding, history has already shown that even with 3.2 million acres of de facto wilderness, rural economies have not collapsed.

Although we don't argue that wilderness and the resulting growth in the service sector will cure southern

Utah's economic woes, its values should be seen as an asset rather than as a **liability.** If there is a solution for southern Utah's rural communities, wilderness will be a part of it.

CONCLUSION

We need to get to the facts in Utah. A disproportionate share of Utah's wilderness debate has focused on unrealistic economic impact projections. These impacts have been prophesized as being solely adverse, and not even slightly beneficial. While substitutes exist for the commodity values found in some areas **being** proposed as wilderness in Utah, there are no substitutes for wilderness resources. The sandstone arches, **redrock** canyons, towering peaks, havens of biodiversity, and abundant Anasazi and Fremont archeological resources are globally unparalleled. The scarcity value of such resources only increases with time. We believe that economists have an important role to play in this public policy issue, by introducing reality into the economics component of this debate.

ENDNOTES

1. Richfield Reaper, May 8, 1991, p. 3A.

2. 43 C.F.R. § 8560.4-1, et seq.

3. Frank Gregg, former Director of the Bureau of Land Management under President Carter, personal interview, 1990.

4. Western Economic Analysis Center, Marana, AZ.

5. See broadly, USDA, Prenarine to Manage Wilderness is the 21st Century, Gen Tech. Report SE-66, Athens, GA, April 4-6, 1990; Resource Development Coordinating Committee, Wilderness Subcommittee Report to Gov. Norm Banearter on BLM's Wilderness DEIS, July 22, 1986, Utah Statewide Final EIS, Nov, 1990.

6. State of Utah, Economic Report to the Governor, 1991.

7. High Desert Advocate, "Wilderness Study Gets "F" From University of Nevada at Reno Economics Chair," April 12, 1989.

8. Ibid.

9. Ibid.

10. Ibid.

11. Utah Energy Office, Utah Natural Resources, Utah Energy Office Statistical Abstract, 1990.

12. State of Utah, Economic Report of the Governor, 1991.

13. Bureau of Economics and Business Research, 1990 Statistical Abstract, Salt Lake City, January 1990.

14. Ibid.

15. Ibid.

16. Power, T.M., 1989, "Comparing wilderness values to oil and gas values along the Rocky Mountain front: A net economic value approach," Proceedings from American Society of Foresters Convention, Spokane, WA, Power, T.M., 1987, "To be or not to be: The economics of development along the Rocky Mountain front," Western Wildlands , Fall, 1987; Rudzitis and Johanson, 1989, "Migration into western wilderness counties: causes and consequences." Western Wildlands, Spring, pp. 19-23; Rudzitis and Johanson, 1989, Amenities, Migration, and Non-metropolitan Regional Development, Report to the National Sciences Foundation, University of Idaho, 195 pp.

WILDERNESS PLANNING IN BRITISH COLUMBIA, CANADA

Teje Vold*

ABSTRACT

This paper first describes British Columbia (BC) and its resources. Recent changes in wilderness legislation and policy and a province-wide inventory of wilderness-related resources are discussed. A major planning initiative by BC Parks and the BC Forest Service entitled Parks and Wilderness for the 90's is described. The paper also provides some economic perspectives on the wilderness issue in BC.

The BC Forest Service and BC Parks both have responsibilities for managing the province's wilderness resources. Approximately 5 million ha (12 million acres), or 5 percent of BC, have already been formally protected as wilderness. In addition, 54 million ha (133 million acres) or 57 percent of BC remain roadless.

Current planning initiatives by both agencies include over 100 wilderness or large park proposed study areas covering over 7 million ha (17 million acres) of unprotected roadless areas. The proposed wilderness study areas were based on a preliminary evaluation of numerous public and agency proposals. The proposed study areas have been presented to the public at over 100 meetings for comment throughout BC. Over 11,000 people attended these meetings and approximately 3,000 written comments have been received. After reviewing all public comments, additional wilderness study areas may be added and some deleted. For all approved study areas, a detailed planning process will be initiated which more carefully examines all resource values. Wilderness designation decisions will be based on the outcome of these studies.

INTRODUCTION

BC is Canada's Pacific coast province and its third largest at 952,263 km^2 (367,658 sq. miles). This represents an area slightly larger than the combined area of California, Oregon, and Washington.

BC's surface is:

57% forestland
10% arable and grazing land
2% fresh water
31% other (e.g., alpine, icefields, rock)

Natural resource industries currently account for 20 percent of BC's Gross Domestic Product and 13 percent of provincial employment. On average, over 80 percent of total provincial merchandise exports are natural resource products (BC Ministry of Finance and Corporate Relations, 1991).

BC's population of 3.1 million is expected to increase by over 50 percent in the next 25 years. Metropolitan Vancouver and Victoria alone account for 57 percent of that population.

BC's environment is the most diverse in Canada. BC contains more wildlife species than any other province, and many of its birds and mammals occur nowhere else in the country (BC Ministry of Environment, 1987). Sixty percent of the world's mountain goats and 25 percent of the world's bald eagles and grizzly bears occur in BC.

Land ownership in BC is 94 percent public and only 6 percent private. Crown (that is, public) lands designated as "provincial forests" total 81 million ha (200 million acres), or 85 percent of the province's total area. This is slightly larger than the entire US National Forest System.

The BC Forest Service is responsible for managing timber, range, recreation, and wilderness on these provincial forests, and for integrating with other agencies responsible for resources such as fish, wildlife, water, energy, mines, and petroleum resources.

WILDERNESS LEGISLATION

The wilderness issue in BC was brought into focus by the Wilderness Advisory Committee that was appointed in 1985 to review and make recommendations on decision-making for wilderness in general, and for 24 contentious areas in particular.

*Wilderness management forester, British Columbia Forest Service, Victoria, British Columbia, Canada.

The committee's recommendations in their 1986 report, The Wilderness Mosaic, were approved in principle by Government, and included the following:

- that a mosaic of natural area designations be created in legislation, including wilderness in provincial parks and provincial forests; and
- that legislation be introduced **modelled** by the principles underlying the US Wilderness Act **1964.**

After considering these recommendations, the Forest Act was amended in 1987 to enable government to designate wilderness areas in provincial forests. Wilderness areas are to be managed by the BC Forest Service.

The Park Act is the other legislation in BC which enables wilderness to be protected, in provincial parks and recreation areas. In addition, wilderness may also be protected in national parks.

A major difference in these wilderness categories is with respect to subsurface resource uses since no commercial logging is allowed in any category. Subsurface activities are not allowed in provincial park wilderness, but are **specifically** not prohibited in provincial forest wilderness areas. For wilderness areas, the BC Forest Service's authority is limited to "how" rather than "whether" subsurface resource use may occur in order to minimize impacts on wilderness values.

Approximately 5 million ha (12 million acres), or five percent of British Columbia, has already been formally protected as wilderness in national and provincial parks. The BC Forest Service currently manages three wilderness areas totalling 110,000 ha (270,080 acres).

WILDERNESS POLICY

After the Forest Act was amended in 1987, the BC Forest Service prepared a public discussion paper in **1988,** outlining how it proposed to inventory, plan for, and manage wilderness resources. After considering the comments received, the BC Forest Service (1989a) prepared its wilderness policy, entitled **Managing** Wilderness in Provincial Forests: A **Policy** Framework.

The policy framework covers a number of special issues, including management of fire, insect and disease, public and commercial recreation use, and fish and wildliie resources. For example, in wilderness areas, hunting, fishing, trapping, and guiding are allowed, subject to the regulations established by the Ministry of Environment.

Habitat may be manipulated when it is necessary to correct conditions resulting from human influence. For example, prescribed fire may be permitted to emulate natural processes where **wildfires** have been suppressed.

BC Parks policy for areas which are zoned for their wilderness values are described in Striking the Balance (BC Parks, **1990a).**

WILDERNESS PRESERVATION GOALS

Needless to say, there is a lot of interest in wilderness preservation. A 1989 poll funded by Forestry Canada asked Canadians: What is the most important use of Canada's forests? Twenty-seven percent responded wildlife protection, 25 percent said wilderness preservation, **11** percent said logging, and 8 percent indicated tourism/recreation. The poll noted no significant difference across Canada, and observed that forest sector employees held quite similar views.

The Brundtland Commission's UN report, **Our** Common Future, called for a substantive increase in the Earth's protected areas from 4 percent to at least **12** percent, representing the diversity of ecosystems globally.

The Endangered Spaces campaign by non-government organizations in Canada and British Columbia have promoted a Canadian Wilderness Charter which seeks at least 12 percent of Canada and British Columbia as park or wilderness representing each distinctive ecosystem.

Canada's long-term goal, as expressed in its Green **Plan** is to set aside as protected space 12 percent of the country (Government of Canada, 1990). If adopted in British Columbia, this would represent 11.5 million ha (28 million acres) of the province.

BC Parks has two conservation goals (representative landscapes and special features) and four recreation goals (tourism travel routes, outdoor recreation holiday destinations, backcountry, and local recreation), which are described in their various Parks Plan '90 documents (BC Parks 1990 b-e).

The BC Forest Service's (1990) general goal for wilderness preservation is to protect wilderness where it is the best use of land. In doing this, the BC Forest Service wilderness program, in conjunction with other protected area programs (such as parks) aims to:

- preserve representative examples of the province's diverse natural landscapes;

- protect special or unique features;
- maintain biological diversity; and
- provide opportunities for a wilderness experience.

Dedicating public lands as park or wilderness foregoes opportunities for logging, and in the case of parks, also prohibits all subsurface resource uses and grazing. For many resource based communities, therefore, there is considerable concern about the potential impact of additional protected areas on the local economy. Offsetting this concern, somewhat, is the growing interest in wilderness tourism. Both the benefits and costs of wilderness preservation, therefore, need to be carefully weighed.

WILDERNESS INVENTORY

The BC Forest Service has developed a provincial inventory of information relevant to the wilderness issue. A geographic information system (GIS) has been used to digitize the following information:

- existing large parks or wilderness areas
- remaining **roadless** tracts of land
- areas that contribute to the allowable **annual** cut
- mineral potential
- tourism resource capability
- ecoregions and ecosections
- administrative units such as forest regions/districts, and timber supply areas
- **100** mile radius from major centres

These distinctive layers in the GIS system have enabled the BC Forest Service to initially assess the status of the wilderness resource in British Columbia (Vold, **1992).** Some of the results of thii assessment are described below.

"Roadless areas" include non-designated lands that are considered primitive or semiprimitive using the Recreation Opportunity Spectrum (ROS) and are shown along with designated park and wilderness areas on Figure 1. Nearly two-thirds of BC is **roadless** when designated wilderness lands are included, as shown below.

	British Columbia, **1988**	
	MM ha	%
Designated wilderness	5	6
Roadless areas	**54**	**57**
Roaded areas	**35**	**37**
Total	94	**100**

In **1988,** the BC Forest Service mapped **roadless** areas that contribute to the allowable annual cut **(AAC).** It was found that approximately 60 percent, or 32 million ha of **roadless** areas, do not contain timber of commercial value (Figure 2).

The Ministry of Energy, Mines, and Petroleum Resources updated a generalized mineral potential map for BC. This map shows areas of high, moderate, low, or unknown mineral potential. The following summarizes the amount of **roadless** lands by mineral potential.

Mineral Potential	**Roadless** Area	
	MM ha	%
High	3	6
Moderate	**22**	**26**
Low	**15**	**41**
Unknown		**27**
Total	**54**	**100**

Roadless areas with no commercial timber and low mineral potential represent approximately **12** million ha (30 million acres), or **13** percent of BC (Figure 3).

BC has a variety of distinctive ecological units which can be described in a number of ways. Three common systems used are the BC Forest Service's **(1988)** biogeoclimatic system, BC Park's **(1990c)** landscapes, and the BC Ministry of Environment's (Demarchi, **1988)** ecoregion system.

The ecoregion system divides the province into unique physiographic and **climatic** units. This system operates on a five-tier classification; the lowest tiers represent ecoprovinces, ecoregions, and ecosections. This system has been digitized, and some of the results are presented below.

Biogeoclimatic zones are altitudinally differentiated regional climates, based on vegetation, soil, and climate. These zones are being digitized and will be added to this GIS data base.

Ecoprovince	Roadless Area	Designated Park or Wilderness
Georgia Depression	2%	9%
Southern Interior	7%	2%
Central Interior	32%	7%
Southern Interior Mtn	32%	13%
Boreal Plains	46%	0%
Sub-Boreal Interior	62%	2%
Coast and Mountains	65%	6%
North Boreal Mountains	85%	9%
Taiga Plains	93%	0%

At the ecosection level, nearly one-half (33 of the 73) have no formally protected wilderness at present. About one-sixth of all ecosections (12) have at least 12 percent protected wilderness.

Designated Park or Wilderness	# of Ecosections
0%	33
1 - 4%	14
5 - 11%	14
12+%	12

Although approximately half of British Columbia is currently roadless, this varies greatly between ecosections. For example, less than 5 percent of the land area in 12 ecosections and less than 20 percent of the land area in 22 ecosections are currently unroaded.

Roadless Area	Ecosections
o- 4%	12
5 - 20%	10
21 - 50%	20
51+%	31

Opportunities for a wilderness experience vary between the major centres of the province. The percentages below are for the total BC land area within 160 km (100 miles) radius of each major centre:

Maior Centre	Roadless Areas (% area within 160 km)	Designated Park or Wilderness
Vancouver	37%	11%
Victoria	4%	3%
Kamloops	16%	3%
Prince George	33%	3%
Nelson	21%	5%
Smithers	56%	4%
Prince Rupert	70%	29%

The information for Victoria excludes mainland areas, and the Vancouver results exclude Vancouver Island.

Another important dimension in the wilderness debate is the notion of protecting intact (undeveloped) watersheds (Lertzman and Kremsates, in prep). Moore (1991) is completing an inventory of watersheds in the coastal temperate forests of BC. The BC Forest Service has also completed a first approximation inventory of large (5,000+ ha) undeveloped watersheds throughout the province (BC Forest Service, 1992).

The BC Forest Service has completed an inventory of undeveloped watersheds on Vancouver Island to 5,000 ha (Hall and McLellan, 1990) and to 1,000 ha in size (Wiison, 1990). The results are summarized below:

Vancouver Island Watersheds

	1,000 - 5,000 ha	5,000+ ha	Total
Primary (to tide water)	(# of watersheds)		
West coast			
D	67	54	121
U,NP	13	6	19
U,P	5	1	6
East coast			
D	20	29	49
U,NP	3	1	4
U,P	0	0	0
Secondary and other			
West coast			
U,NP	7	3	10
U,P	1	2	3
East coast			
U,NP	4	0	4
U,P	6	6	12

D = developed (>2% human disturbance in watershed)
U = undeveloped (< 2% human disturbance)
P = protected (entire watershed in protected area)
NP = not protected (entire watershed not in protected area)

WILDERNESS STUDY AREAS

British Columbia still has many outstanding wilderness resources that have not yet been formally protected. The BC Forest Service and BC Parks, therefore, are undertaking a major initiative to help determine which additional areas should be considered for wilderness protection. This initiative is called Parks and Wilderness for the 90s.

The Wilderness for the 90s initiative by the BC Forest Service (1990) has identified 59 proposed wilderness study areas (**figure** 4). BC Parks **(1990b)** has also identified 42 proposed large park study areas in its Parks Plan 90 initiative. These two initiatives are proposing study areas covering over 7 million ha (17 million acres) of unprotected **roadless** areas.

The proposed wilderness study areas were identified based on a preliminary evaluation of numerous public/agency submissions for wilderness study. This included a general assessment of wilderness values and other resource values (timber, minerals) using wilderness ranking guidelines (BC Forest Service, 1989b).

The BC Forest Service and BC Parks have been seeking public/industry/agency comments on the proposed wilderness and park study areas. Over 100 public meetings and open houses have been jointly held by both agencies to obtain feedback. The purpose of the meetings, in part, was to determine what important areas have been overlooked, and what areas, if any, should be deleted.

Over 11,000 people have attended these meetings, and approximately 3,000 written comments have already been received. A report is being prepared by BC Parks and the BC Forest Service which summarizes public comments. A general impact assessment of timber, mineral, and wilderness values is also taking place.

After analyzing all comments received, and the impact assessment, direction will be sought from Cabinet for approved wilderness and park study areas.

For approved wilderness study areas, the BC Forest Service will be initiating a detailed planning process, involving other agencies and the public, to determine and compare all resource values. The outcome of this process will lead to recommendations concerning wilderness designation.

If an area is designated as a wilderness area by government, a wilderness management plan will be prepared by the BC Forest Service to ensure the wilderness resource is protected and sustained for future generations.

This wilderness planning initiative is the **first** comprehensive opportunity for the public and industry to shape the future of parks and wilderness in British Columbia. Land use is increasingly a major issue confronting the public and land managers alike. This initiative is aimed to provide greater direction on the protected area issue - a major component of the land use debate in British Columbia.

Parks and Wilderness for the 90s is, however, only one of many government initiatives currently addressing important land use issues affecting all British Columbians. Other initiatives include the Forest Resources Commission **(1991),** the B.C. Round Table on the Environment and the Economy **(1991),** and the Old Growth Strategy (1992). Government has or will be receiving reports and recommendations from these other initiatives over the next few months.

Any decisions about parks and wilderness should be consistent with all of the various government initiatives on land use and based on the widest possible range of public views.

ECONOMIC PERSPECTIVES

In 1977, the government of BC produced standard Guidelines for Benefit-Cost Analysis (Environment and Land Use Committee, 1977). These guidelines provide for contingent valuation ('willingness-to-pay') methods for non-market public resource goods such as recreation and wildlife.

Using these guidelines, there have been some economic studies concerning the value of non-timber resources in British Columbia; for example, for **wildlife** (Reid, **1985a, 1985b,** and Reid et al, 1986) and fisheries (Stone, 1988). These surveys include assessments of use, expenditures and economic value. Economic values were estimated by asking residents to state the maximum amount they would be willing to pay, over and above expenditures, for a day spent hunting, fishing, or in direct non-hunting wildlife activities. The non-use preservation values of wildlife were also estimated by Reid et al (1986).

The BC Forest Service (1991) has recently conducted an Outdoor Recreation Survey 1989/90. For provincial forests only (i.e., not parks), the following results were estimated for BC residents per year:

- 41 million recreation use days (19 days per person);
- $1.6 billion annual expenditures ($1,435 per household);
- $114 million annual preservation values of recreation resources ($53.62 per adult).

The economic value (consumer surplus) of engaging in various outdoor recreation activities has also been estimated in this survey. The survey also indicates the

amount of use in **roaded** and **roadless** areas of provincial forest by various activities.

The BC Ministry of Tourism's (1990) recent Visitor $9 survey estimates 43.7 million person-nights of non-resident use and $2.4 billion in gross expenditures. The survey found the main purpose of the trip to BC for 2 percent of the respondents was wilderness travel.

These surveys provide some insights on the value of wilderness, but none have directly addressed this issue. The value of wilderness preservation involves use values, and non-use (option, existence, bequest) preservation values (Walsh and Loomis, 1989) that are often unrelated to recreation. Existence values associated with maintaining biological diversity and natural biological systems have been frequently mentioned in BC as some of the more important reasons for preserving wilderness.

There have also been studies in BC on the opportunity cost of foregoing resource values such as timber due to wilderness preservation (e.g., BC Forest Service, 1983). The BC Ministry of Lands, Parks, and Housing (1987) has prepared guidelines in this regard for ecological reserves. The Old Growth Project has recently tested a "multiple account" benefit-cost evaluation framework (Shaffer & Assoc., 1991).

Simon Fraser University (1990) studied the economic effects on the forest industry if **BC's** designated wilderness lands rose from 6 percent to 13 percent, as has been proposed by a number of environmental groups (Valhalla Wilderness Society, 1988). They concluded the proposed additions in wilderness protection would affect the rate of harvest by 4 percent and would have a direct impact on 2,600 forest sector jobs.

Various planning committees have been formed in BC to help resolve **difficult** land use issues, often involving wilderness, through a negotiative and **consensus-**building process. Economic analysis can play an important role in helping to resolve wilderness issues. Other information, such as environmental implications, public opinion, agency support, and community stability, must also be considered. The role of economic analysis and comprehension of non-market valuation techniques are often poorly understood. As a consequence, economic perspectives, such as **benefit-**cost analysis, have not always been provided.

CONCLUSION

Provincial and national parks have protected wilderness values in BC for many years. "Wilderness areas" in provincial forests is a relatively new concept and was created to provide for a mosaic of wilderness categories. Wilderness policy for wilderness areas has been prepared through public and inter-agency consultation. The BC Forest Service and BC Parks are currently identifying wilderness and park study areas where detailed studies will be undertaken. Through these studies, recommendations concerning wilderness or park designation will be forwarded to Cabinet. To support thii effort, the BC Forest Service has embarked on a province-wide GIS inventory of resources related to the wilderness issue.

Economic surveys are needed in BC to help determine the value of wilderness and to aid the decision-making process. These surveys need to address both use and non-use preservation values. To be used, resource managers and decision-makers need to be better apprised of non-market valuation techniques and the perspectives they are intended to provide.

REFERENCES

BC Forest Service. 1983. Report of the Tahsish Task Force. Campbell River, BC

BC Forest Service. 1988. Biogeoclimatic zones of British Columbia. **1:2,000,000** scale map. Victoria, BC

BC Forest Service. 1989a. Managing wilderness in provincial forests: A policy framework. Victoria, BC

BC Forest Service. 1989b. Wilderness ranking guidelines. Victoria, BC

BC Forest Service. 1990. Wilderness for the **90's.** Victoria, BC

BC Forest Service, Recreation Branch. 1991. Outdoor Recreation Survey, 1989-1990. Victoria, BC

BC Forest Recreation Branch. 1992. An inventory of undeveloped watersheds in BC. Victoria, BC

BC Ministry of Environment. 1987. Wildlife in British Columbia. Victoria, BC

BC Ministry of Finance and Corporate Relations. 1991. The structure of the BC economy: A land use perspective. Victoria, BC

BC Ministry of Lands, Parks and Housing. 1987. Approach to calculating opportunity costs of forest industrial values in ecological reserves. Victoria, BC

BC Ministry of Tourism. 1990. Visitor 89: A travel survey of-visitors to British Columbia. Victoria, BC

BC Parks. 1990a. Striking the balance: BC parks policy. Victoria, BC

BC Parks. 1990b. Parks plan '90: Draft working map - Areas of interest to BC Parks. Victoria, BC

BC Parks. 199Oc. Landscapes for BC parks. Victoria, BC

BC Parks. 1990d. Special features for BC parks. Victoria, BC

BC Parks. 1990e. Recreation goals for BC parks. Victoria, BC

BC Round Table on the Environment and the Economy. 1991. Sustainable land and water use. Victoria, BC

Demarchi, D. 1988. Ecoregions of British Columbia. 1:2,000,000 scale map. Victoria, BC: BC Ministry of Environment.

Environment and Land Use Committee. 1977. Guidelines for benefit-cost analysis. Victoria, BC

Forest Resources Commission. 1991. The future of our forests. Victoria, BC

Government of Canada. 1990. Canada's green plan. Ottawa, Ontario.

Hall, B.M.; McLellan, J.F. 1990. Alphabetical lists of unlogged watersheds on Vancouver Island BC Forest Service. Victoria, BC

Lertzman, K.; Kremsater, L. in prep. Why watersheds? Prepared for Old Growth Strategy Project. Victoria, BC: BC Forest Service.

Moore, K. 1991. An inventory of watersheds in the coastal temperate forests of BC. Vancouver, BC: Earthliie Canada Foundation.

Reid, R. 1985a. The value and characteristics of resident hunting. Victoria, BC: BC Ministry of Environment.

Reid, R. 198% The value and characteristics of non-resident hunting. Victoria, BC: BC Ministry of Environment.

Reid, R.; Stone, M.; Rothman, F. 1986. Report on the British Columbia survey of non-hunting and other wildlife activities for 1983. Victoria, BC: BC Ministry of Environment.

Shaffer & Associates. 1991. Socio-economic evaluation of old growth conservation strategies. Prepared for Old Growth Strategy Project. Victoria, BC: BC Forest Service.

Simon Fraser University. 1990. Wilderness and forestry: Assessing the cost of comprehensive wilderness protection in British Columbia. Burnaby, BC: Natural Resource Management Program.

Stone, M. 1988. Economic values and impact of freshwater sport fishing in British Columbia. Victoria, BC: BC Ministry of Environment.

Valhalla Wilderness Society. 1988. BC's endangered wilderness. 1:2,000,000 scale map.

Vold, T. 1992. The status of wilderness in British Columbia: A gap analysis. Victoria, BC: BC Forest Service, Recreation Branch.

Walsh, R.G.; Loomis, J.B. 1989. The non-traditional public valuation (option, bequest, and existence) of wilderness. Gen. Tech. Rep. SE 51. In: Wilderness Benchmark, 1988: Proceedings of the national wilderness colloquim. USDA Forest Service: 181-192.

Wilderness Advisory Committee. 1986. The wilderness mosaic. Vancouver, BC

Wilkinson, J.F. 1990. Undeveloped watersheds on Vancouver Island larger than 1000 ha. Victoria, BC: BC Forest Service.

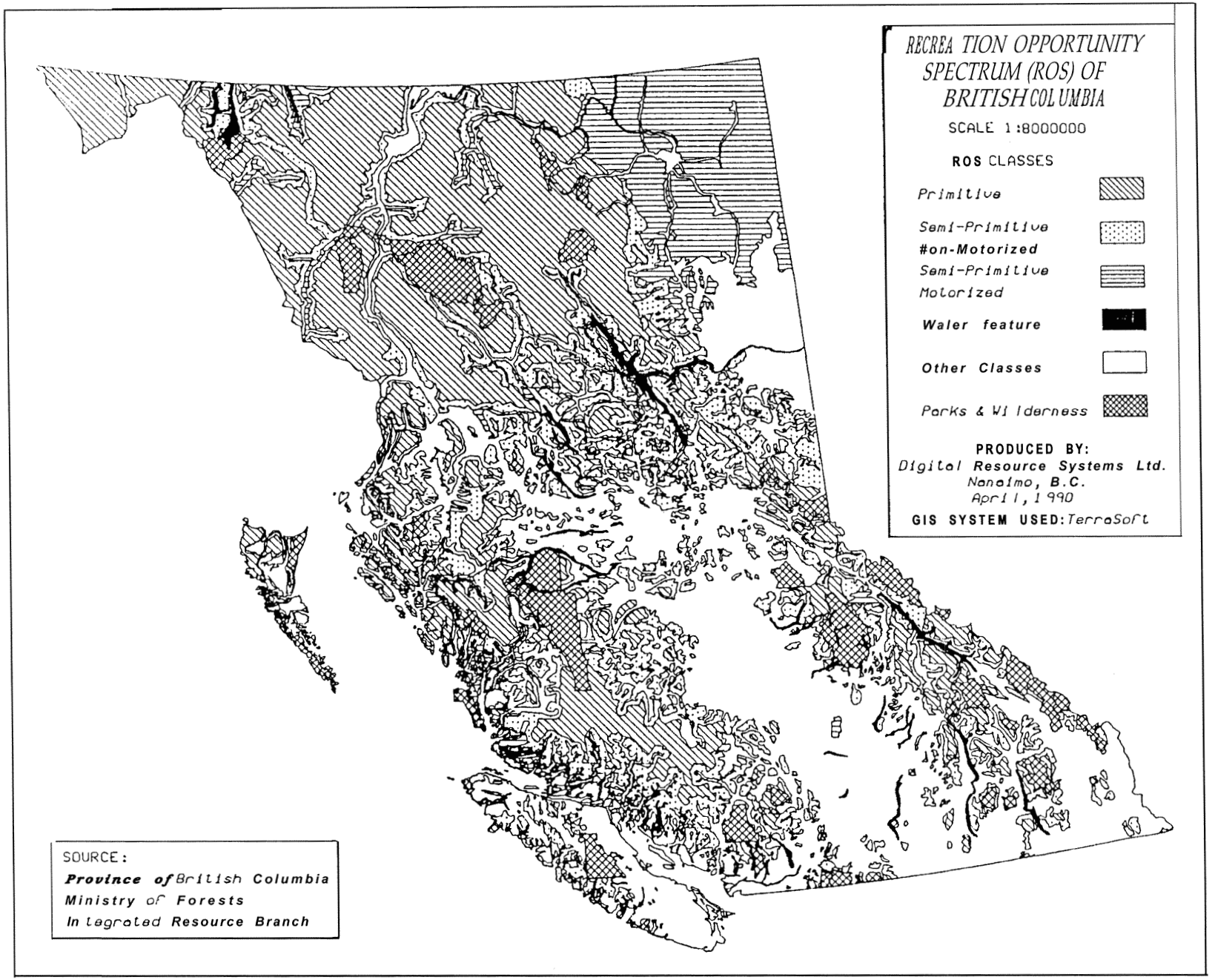


Figure 1: Roadless Areas and Designated Park and Wilderness Areas

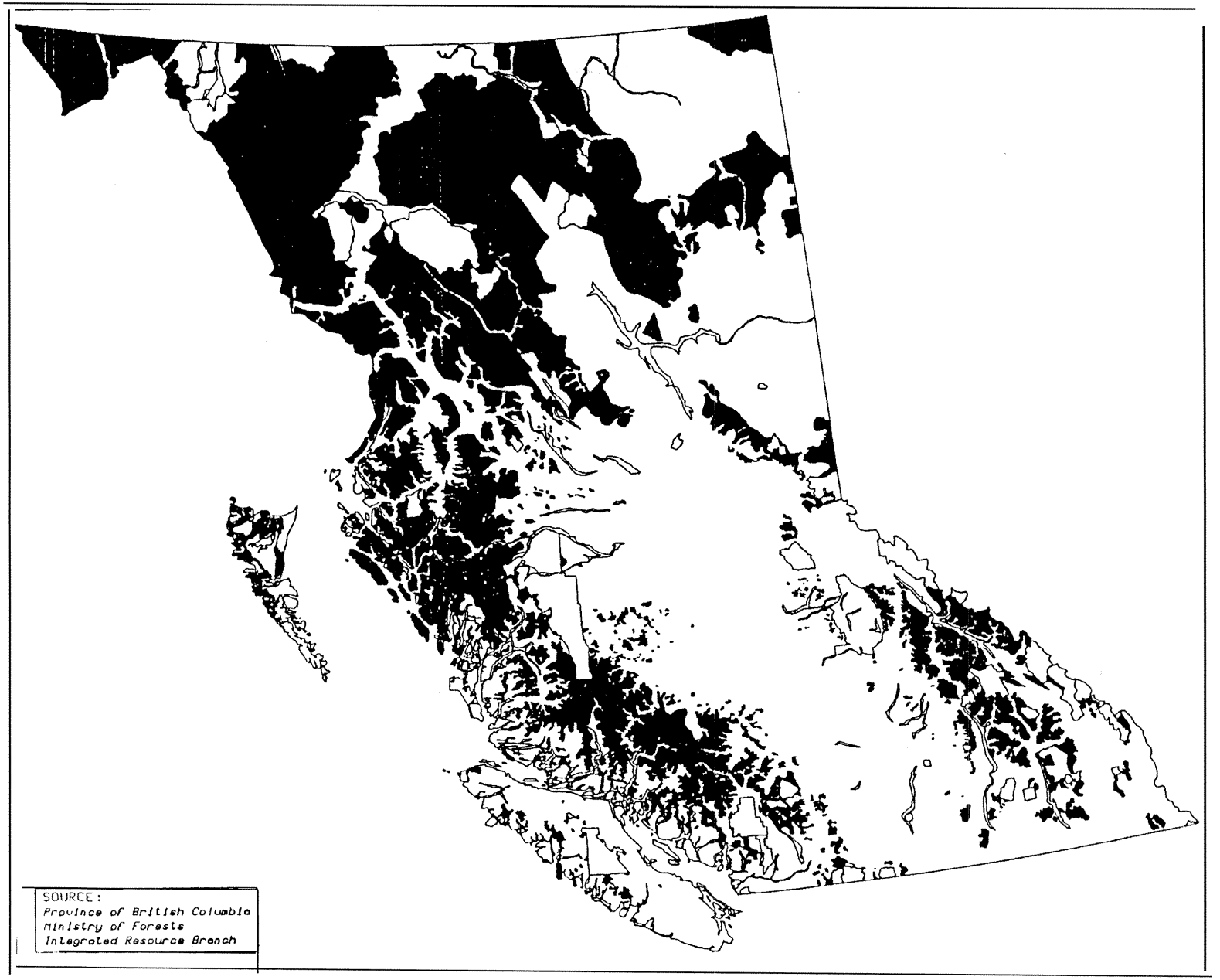


Figure 2: Roadless Areas with No Commercial Timber

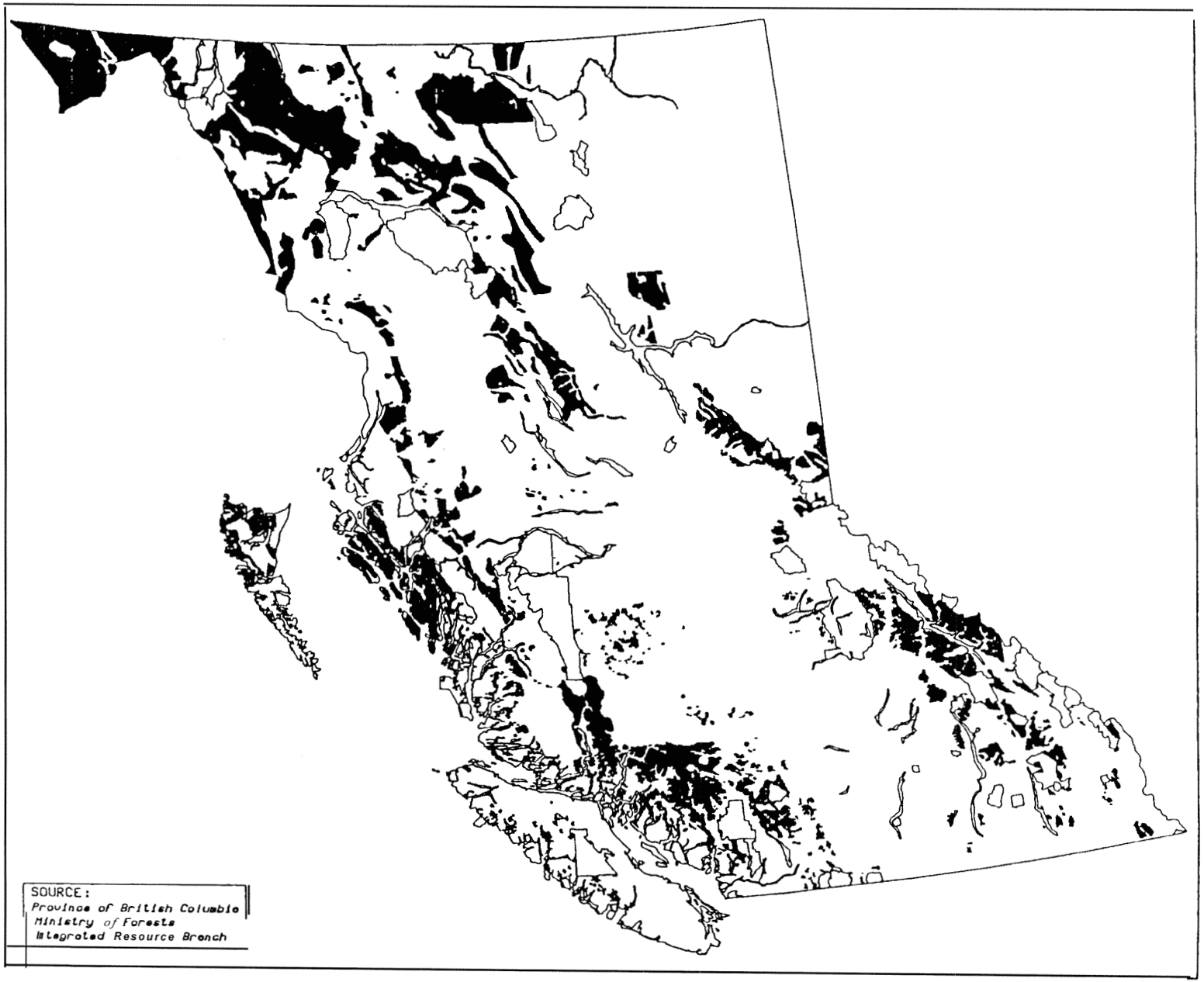
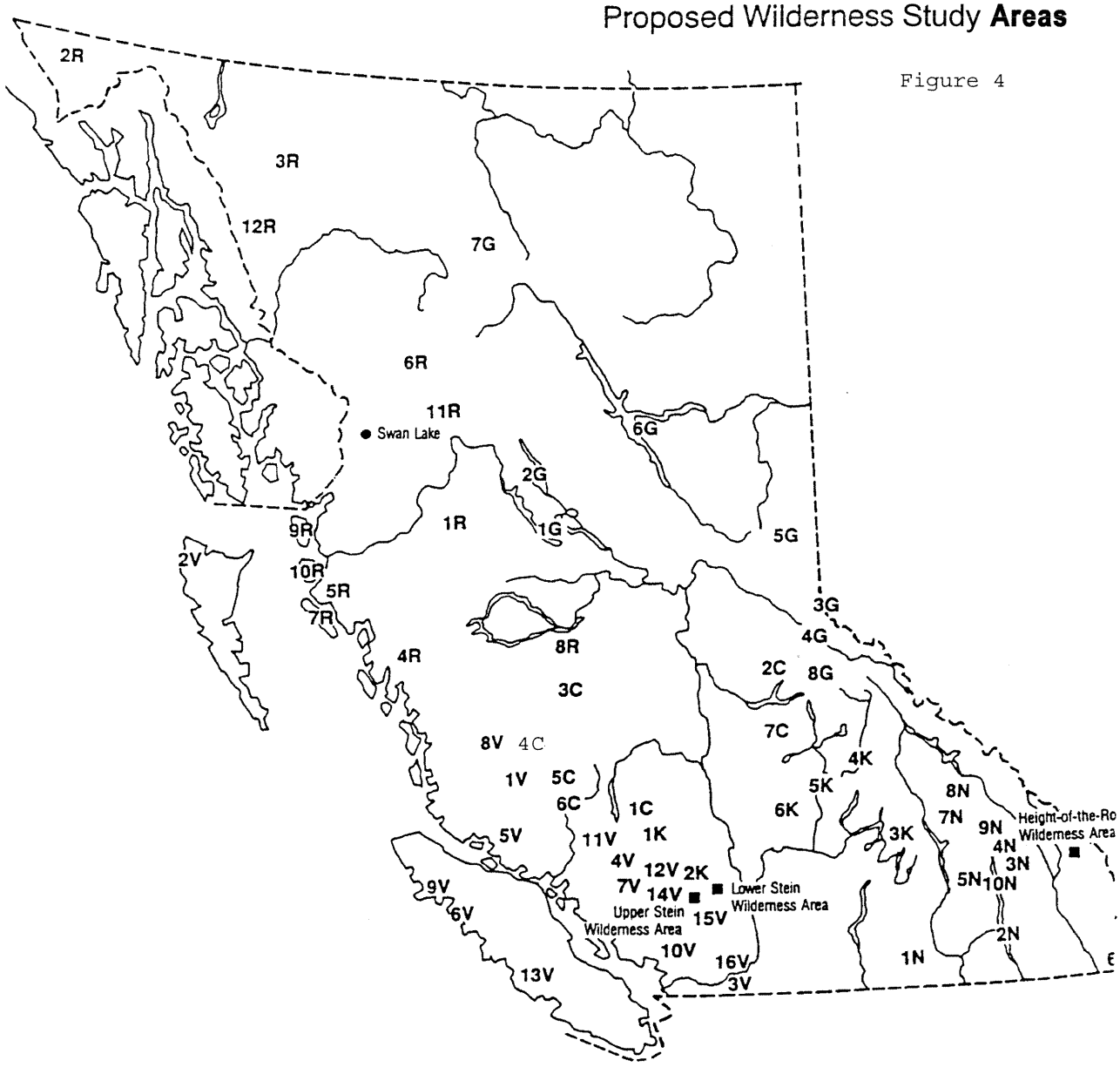


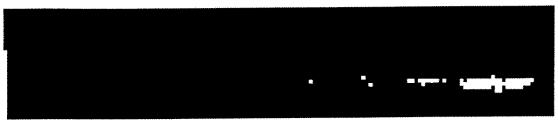
Figure 3: Roadless Areas with No Commercial Timber and Low Mineral Potential

Wilderness for the '90s

Proposed Wilderness Study **Areas**

Figure 4





APPROPRIATE SUPPRESSION RESPONSE
A DECISION-MAKING MODEL FOR WILDERNESS FIRE MANAGEMENT

Dale L. **Hom***

ABSTRACT

A decision-making process for wilderness fire suppression on the Okanogan National Forest is the "Appropriate Suppression Response." It is used to evaluate the potential suppression costs compared against the expected resource losses. A range of suppression responses are employed, depending upon the ever-changing conditions, constraints, and circumstances which apply at a given time. Three suppression response strategies are candidates for wilderness fire suppression. They are 1) confinement, 2) containment, and 3) control. Using the Appropriate Suppression Response (ASR) model, the land manager can predict the costs and benefits of decisions associated with the overall management of wilderness.

INTRODUCTION

Fire has significantly influenced the development and perpetuation of our high country forest and range ecosystems in designated wilderness. Since the early **1900s,** the Forest Service land managers and others took aggressive attack and control measures to reduce **wildlife** losses, much to the detriment of natural ecological processes that we are now striving to preserve in wilderness. Although there were some early proponents for allowing those lightning fires to burn (virtually all wilderness fires were lightning-caused in the early 20th century) for the benefit of wilderness, forest managers saw fire as an intolerable threat to resources and surrounding lands. Subsequent programs of smokejumping and fire prevention favored aggressive control. Today, land managers are realizing the importance of natural fire as an ecological agent. Our management goals are now reflecting such changes in attitude and values.

Policies have changed to allow the use of prescribed fire to meet resource goals and objectives. However, the decisions made are not without controversy and public scrutiny. This paper focuses on a **decision-**making process used for wilderness fire suppression in the Pasayten Wilderness, on the Okanogan National Forest in Washington State. The process is known as the Appropriate Suppression Response (ASR).

The Pasayten Wilderness Area, located approximately 250 miles from Seattle, is among the largest designated wildernesses of the Pacific Northwest complex. Alpine Lakes Wilderness, Glacier Peak Wilderness, and Pasayten Wilderness are the largest in Washington State. Others include Goat Rock Wilderness, Mt. Baker Wilderness, William 0. Douglas Wilderness, Chelan-Sawtooth Wilderness, and others more recently designated.

The Pasayten Wilderness lies along the Cascade Crest and eastward, spanning 53 miles along the U.S.A.-Canada international boundary and encompassing more than one-half million acres. Its neighbor to the west is Ross Lake National Recreation Area (managed as the North Cascades National Park complex). It borders Manning Provincial Park (British Columbia) and North Cascades Scenic Highway (a Congressionally designated "special area" administered by the Okanogan National Forest). (See Figure 1).

Many north-central Washington communities are highly dependent upon the Okanogan National Forest for economic, recreational, and social facets of their lives. Agriculture, timber, recreation and tourism are important, and all can be adversely affected by fire management actions. Grazing on the Okanogan National Forest has been fairly constant, although the amount of grazing is determined by forest plan standards and guidelines and (to some extent) the industry's demand for forage. Both cattle and sheep are permitted to graze within the Pasayten Wilderness. The timber industry is second to agriculture in contributing to the economy. Twenty-four percent of "commercial forest" land of Okanogan County is found on the Okanogan National Forest. Recreation and tourism are increasingly important, particularly for the people who live in the **Methow** Valley. The high scenic quality of the North Cascade Highway, the picturesque setting of the **Methow** Valley, and

*Recreation and Land Uses, Sawtooth National Forest, Twin Falls, ID 83301-7976; in May 1991, Horn was District Ranger for the Winthrop Ranger District on the Okanogan National Forest, Washington.

"westernized motif" of the town of Winthrop are major reasons for its attractiveness as a regional travel destination. The average annual recreation use is 878,000 recreation visitor days (USDA, **1980-1988)** on the Okanogan National Forest. The Pasayten Wilderness receives approximately 51,000 RVDS (6 percent total visitor use). Smoke dispersal and visibility resulting from wilderness fires present real concerns to local businesses which advertise clear skies and clean air. Ironically, there are local economic benefits from fire and smoke. Employment from fire suppression and prevention contributes to wages and income. There are 22 smokejumpers at the North Cascade Smokejumper Base, the birthplace of smokejumping. Fire suppression jobs, such as working with contract (fue) engines, and Forest Service firefighters contribute to the economic well-being of these rural communities.

Ecologically, the Pasayten Wilderness has a unique fire history. Fire has played a major role in creating the natural wilderness vegetation conditions. The "fire situation" - fire's historic role, the current potential for fire, and probable effect of present and future fires is dominated by frequent dry summer thunderstorms and lightning-caused fires which are often small in size (less than one acre). There are fewer fires of larger sizes, although these large events consumed more acres **(1,000+** acres per incident). In 1990, the Okanogan National Forest recorded 74 fires on Winthrop Ranger District; 27 were wilderness tires. The environment of the Pasayten Wilderness includes a **landform** which is steep, heavily dissected, rugged topography with **even-**aged stands of mixed conifer (lodgepole pine, Englemann spruce, hemlock-fir) with abundant dead and down fuels in the understory. Elevations range from 4,000 feet where the Pasayten River enters Canada to 8,500 feet on a few of the highest peaks. The upper elevation ridges are dominated by bare rock and meadows with subalpine fir.

The Okanogan National Forest Land and Resource Management Plan describes the desired future condition of the Pasayten Wilderness as "an area with a minimum of site controls and restrictions, and where the presence of controls are subtle. Facilities will only be provided for protection of wilderness resource values." Within the Pasayten, human use and influences are managed to preserve solitude and natural ecosystems. Certain portions are managed in a trailless condition, accessible only by rigorous cross-country travel, while the remaining portions are managed to provide trail access which is generally more difficult than trails outside of wilderness. Grazing of domestic livestock is permitted, and structures and improvements will be reviewed and phased out if not essential for protection of administration. The Okanogan Forest Plan allows a maximum party size of 12 people and 18 head of stock, allows only certain lakes to be aerially stocked with fish, and permits a few administrative sites and lookout towers to be retained. Existing helispots will not be allowed. The job of fire managers becomes more challenging in light of this wilderness direction. Wilderness fire suppression requires a different approach from "front country" situations. Managers must deal with logistical complications, i.e., communications and helispots. Also, fire prevention opportunities, such as constructed fuel breaks or fuel hazard reduction, are not possible **within** the wilderness.

APPROPRIATE SUPPRESSION RESPONSE

A decision-making process for wilderness fire suppression on the Okanogan National Forest is the "Appropriate Suppression Response." It is used to evaluate the potential suppression costs compared against the expected resource losses. To meet the intent of the Wilderness Act, management planning objectives, and fire management direction, each fire ignition is treated individually within a general wilderness fire management philosophy. Each fire ignition requires an "Appropriate Suppression Response" (ASR), utilizing criteria and parameters to determine the most cost efficient **fire** suppression strategy.

The general philosophy is to employ suppression strategy and tactics which: **1)** maximize protection of human life, historically/culturally significant sites, and capital investments; 2) minimize suppression costs; 3) minimize wilderness resource impact resulting from suppression; 4) protect adjacent land management areas with different land use objectives from the impacts of wildlife; and 5) protect off-site areas from unacceptable damage or impacts. A mix of alternative suppression strategies and tactics may be used, depending on various conditions for a given **fire** incident. On-site conditions, off-site conditions, and a variety of circumstances are continually monitored and evaluated to determine which course of action to employ.

What is The Appropriate Suppression Response?

A range of suppression responses or actions are employed, depending upon the ever-changing conditions, constraints, and circumstances; land managers must take a more aggressive suppression response (or action) to constrain a given **fire** within the Forest Service's **fire** management direction. An

aggressive approach will usually result in higher suppression costs.

Three suppression response strategies are candidates for wilderness fire suppression. They are 1) confinement, 2) containment, and 3) control. This range of suppression responses allows the deciding officer, the Forest Supervisor, to analyze the ever-changing sets of conditions of each fire ignition. As conditions become more severe or it becomes more difficult to meet management goals, we employ a more aggressive response to maintain the desired results. Using the Appropriate Suppression Response (ASR) model, we can predict the costs and benefits of our decisions associated with the overall management of wilderness. It is the land manager's challenge in light of increasing social and political concerns of fire in wilderness.

Confinement. The confinement response is employed to restrict a fire within predetermined boundaries either prior to the fire ignition, during the tire, or in an escaped fire situation analysis. Limited suppression action is taken, and may only include surveillance of the fire. It is important to remember that **"confinement"** does not imply "let burn"; rather, it is a suppression strategy which may be the least cost alternative yielding the greatest benefit to the wilderness resources.

Containment. The containment response is to surround a fire, and any spot fires, with natural or human-made containment lines (and sometimes with a control line) to check the fire's spread under prevailing and predicted conditions. Normal tactics would include indirect attack, burnout from the human-made or natural barrier, with little or no mop-up.

Control. The control response employs a control line surrounding **a** fire. Hot spots which might threaten the control line are cooled down, using **direct** attack tactics and mop-up.

The Preferred Response

The confinement strategy is the preferred suppression response for the Pasayten Wilderness. Okanogan National Forest may employ this strategy on the Chelan-Sawtooth Wilderness, the North Cascade Scenic Highway, and designated botanical areas on the Forest, such as the Tiffany Botanical Area. If the **fire** has a potential to exceed the parameters of the ASR implementation plan, which includes off-site impacts and constraints, it may be necessary to use the contain or control response.

Outside of designated wilderness, the containment strategy may be used on **fire** tolerant stands, including some designated areas such as deer winter range or research natural areas.

The control strategy is appropriate when fires occur in areas which are heavily used recreation areas. Thii strategy is also appropriate when conditions for a containment strategy are altered and exceeded, i.e., "disqualifying" it from a less expensive tactic.

Within wilderness, fire suppression follows wilderness suppression guidelines, known as "Light Hand on the Land" tactics. These guidelines **insist** on firefighter safety. "Dont compromise safety to achieve wilderness fire ethics." **Firefighters** are indoctrinated to the "Light Hand on the Land" guidelines prior to deployment to the Pasayten Wilderness. Initial attack requires the selection of tools and equipment that have "least impact" to the wilderness environment. Natural barriers and cold-trail lines are utiliid. Minimal log bucking, allowing burning trees to burn themselves out, flush cutting stumps, and minimal use of retardant are used for **direct** attack. Chainsaw use is authorized for wilderness **fire** suppression. Mop-up is accomplished with minimal spading. Charred logs are allowed to burn within the fire perimeter with natural positioning of fuels. Restoration techniques include erosion control on **firelines** and blending of "unnatural signs of suppression activities" with the natural landscape. Fiie camps incorporate light-on-land wilderness ethics to minimize disturbance; camps are located at **impact-**resistant sites and away from water sources. Travel patterns are dispersed to prevent creating pathways.

The Okanogan National Forest Land and Resource Management Plan states that a contain or control strategy would be used if wildfires: 1) threaten significant cultural resources or capital investments; 2) have a potential to cross the U.S.A.-Canada border; 3) threaten adjacent management areas with more restrictive management direction; or 4) will result in unacceptable off-site impacts, such as smoke inversions to **Methow** Valley, Ross Lake National Recreation Area, or Penticton, British Columbia.

How Does the Okanogan National Forest Declare a Confinement Fire?

A decision is made after thoroughly evaluating several screening criteria designed to assure that fire management direction and land management objectives are met. Upon detection and notification of a fire ignition, the candidate fire is initially screened by a central fire dispatch to determine the appropriate suppression response and dispatch priority. In the **1990** fire season, the Okanogan National Forest responded

to 25 lightning fires from a single storm. This illustrates the intensity of our operations during the height of fire season. If the fire threatens cultural resources, capital investments, or human life, a "contain" or "control" strategy is selected. The District Ranger and Forest Supervisor are notified of the action taken. If the screening by the fire dispatcher and fire managers determines the fire's candidacy for confinement fire strategy, a district fire team will assess the situation. The District Ranger recommends the best alternative - based on the probability of success and least cost - to the Forest Supervisor.

Three decision trees are used to determine the appropriate suppression response for candidate confinement fires. Separate decision trees are developed for distinct time periods: pre-season (May l-June 30), critical season (July l-August 31), and post-season (after September 1). Different screening criteria are used for each period: a) seasonal fire severity; b) fire cause; c) threat to the international boundary; d) threat to other land management areas; e) predicted season severity index; f) smoke dispersal forecast; g) regional fire preparedness level; h) suppression resource capability; i) cost efficiency; j) availability of a monitoring team; k) threatened and endangered species; and 1) other considerations, e.g., precipitation from the earlier month and past winter and political-economic ramifications. (See Figure 2.)

Fire Cause. If the fire is caused by lightning, it may be considered for a confinement response if the collective set of conditions are favorable. If the fire is caused by humans, the primary suppression response is containment or control.

Threat To Human Life. Fires that threaten injury or loss of human life will receive immediate, aggressive initial attack.

Threat To The International Boundary. Fiies with the potential to exceed management direction and spread into Canada will be contained or controlled. (Note: The Okanogan National Forest works cooperatively with British Columbia Forest Service in fire management operations. Firefighting resources from either country can respond to fires on their neighbor's jurisdiction upon request from the fire dispatcher, under the terms of a reciprocal agreement.)

Threat To Other Land Management Areas. Fires with the potential to exceed direction and spread into an area with different laud management objectives, e.g., roaded recreation areas, will be contained or controlled.

Predicted Season Severity Index. (See Table 1.) A predictive index, developed by the Okanogan National Forest, is based on the probability that an event will happen given the parameters of total cumulative rainfall by month.

Smoke Dispersal Forecast. Smoke produced from a confinement strategy may reduce visibility locally, which may cause economic hardships on tourism-dependent communities, such as those found in Methow Valley, nearest the Pasayten Wilderness. Typically, July and August are critical revenue-generating months for merchants. Land managers must consider the cumulative effects of several fire incidents on these "off-site" communities. The fire managers will select a containment or control strategy if there are state air stagnation alerts in effect for eastern Washington, if a warning has been issued that an official alert is imminent, or if smoke drifts into the tourism-dependent Methow Valley and remains for a period of five days.

Regional Preparedness Level and Resource Capability. If the Okanogan National Forest does not have the resources to contain or control a fire, and the regional fire situation is severe, wilderness fire ignitions may warrant a contain or control action. The availability of resources from Forest Service, National Park Service, Washington Department of Natural Resources, and Bureau of Indian Affairs are considered.

Cost Effkiency. Au important criterion is cost (firefighting funds) and resource losses. Wilderness fire suppression costs are generally higher than "front country" situations due to the remote and rugged terrain. Air support, which is authorized by the Regional Forester for wilderness fire suppression, is a major expenditure. Specialized firefighters, such as smokejumpers, are often first to respond at the scene. Table 2 illustrates the various wilderness fire suppression costs, which vary considerably. Small fires which remain the same size and appear smokeless may require aerial detection daily or every other day. This may cost only $225 per fire. If the small fire begins to smoke and shows a potential for spreading, a two-person smokejumper crew will be sent out. Aircraft time, wages, and subsistence may cost $2,600 per fire. If the fire becomes active and spreads over thirty or forty acres, two fire crews, overhead, and aircraft may result in a cost of $100,000 per fire. The Lodgepole Fire of 1989 in the Pasayten Wilderness was estimated to cost $1,190,000 under a containment strategy. A confinement strategy was estimated to cost $122,000, but was not chosen due to concerns of smoke dispersal and threats of fire spreading into Canada. Past fires have been suppressed with only two smokejumpers, while others have required as many as

250 firefighters. Other small lightning fires may never become detected. There were 27 recorded fires in the Pasayten Wilderness in the 1990 fire season. The total suppression cost was approximately $495,000.

The measurement of resource loss is less exact. It does not utilize numerically quantifiable values; rather, it assigns relative plus-minus ratings which will allow land managers to discuss, negotiate, and decide on the appropriate suppression response according to the environmental factors, i.e., air, visuals, cultural resources, threatened and endangered species, forage, and water.

Availability Of A Monitoring Team. If we are unable to monitor confinement fires, then containment or control responses should be employed.

Threatened and Endangered Species. The Pasayten Wilderness provides habitat for gray wolves, northern spotted owls, and grizzly bears. The appropriate suppression response must not violate the Endangered Species Act.

CONTINGENCY PLANS (FIRE SITUATION ANALYSIS)

Every decision to employ the confinement suppression response requires the ranger district management team (consisting of fire officers and resource specialists) to develop a contingency plan within one burning period of the approval if there is a potential for more than a spot fire. Existing and predicted future tire behavior are considerations for developing a good contingency plan (also known as a Fire Situation Analysis). Contingency plans should provide quality maps of the fire; identify scenarios for potential fire behavior effects; assign duties for a monitoring team; and identify anticipated resource needs, public information needs, and planned rehabilitation measures. The fire situation analysis will consider alternatives to assure selection of the action with the least cost and highest probability for success.

Before each subsequent burning period, the initial suppression strategy will be evaluated for consistency with the fire management direction. If the current confinement strategy is no longer valid, the fire will be managed as an escaped fire, and the appropriate suppression response will be re-evaluated.

SUMMARY

The Appropriate Suppression Response (ASR) has been an effective tool for fire managers and deciding officials on the Okanogan National Forest. The North Cascades National Park Service Complex, Mt. Baker-Snoqualmie National Forest, and Wenatchee National Forest operate under a reciprocal and cooperative fire protection services agreement to insure that our procedures for fire planning, smoke management, and associated fire management activities are in concert. The Okanogan National Forest has not changed its policy for managing fires in the Pasayten Wilderness as a result of the Yellowstone Complex fire experience. However, the decisions we make must consider the political ramifications, particularly during severe fire seasons.

Using the ASR process, managers can predict the costs/benefits of our decisions associated with the overall management of wilderness. Decisions for wilderness fire management require economic analysis and risk assessments within appropriate land management allocations. They require an understanding of the physical environment (i.e., geology, climate, archeological resources, water and air quality, noise, human trails), biological factors (biodiversity, rangeland, threatened and endangered species, wildlife habitat, outdoor recreation resources), and social/political factors (local tourism economic base, international relationships, and interagency and governmental relations).

Line officers will continue to wrestle with economic efficiency analysis for wilderness fire management. Recreation opportunity, wildlife habitat, air quality, and aesthetics don't have well-defined market values, although we can assign quantified words or symbols to represent benefits.

Since 1984, there have been 90 confinement fires within the Pasayten Wilderness. To date, Appropriate Suppression Response (ASR) is a proven process for wilderness fire suppression. It is cost effective and sensitive to the values of wilderness.

Figure 1 – Vicinity Map

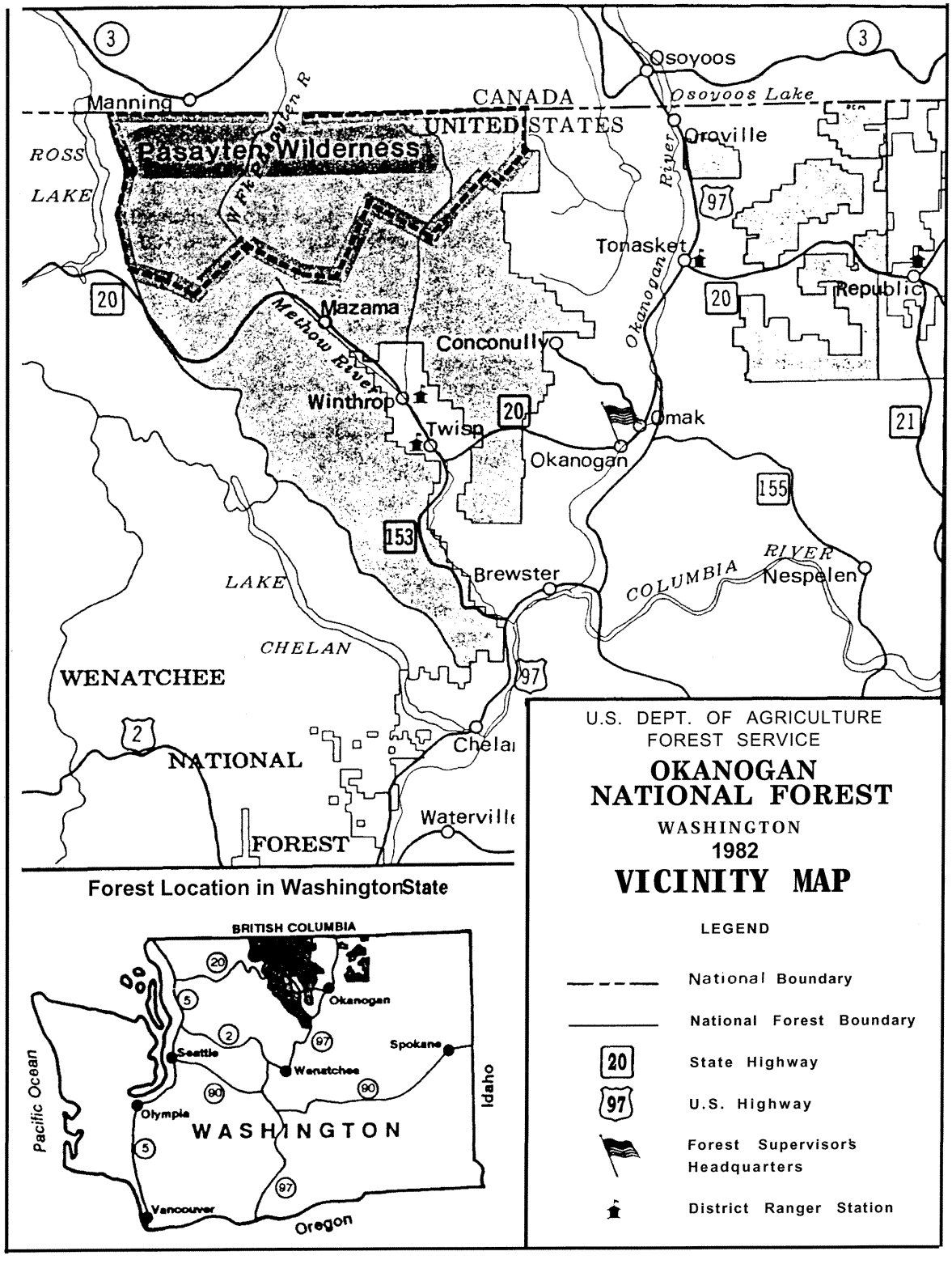


Figure 2

WILDERNESS CONFINEMENT FIRE DECISION PROCESS

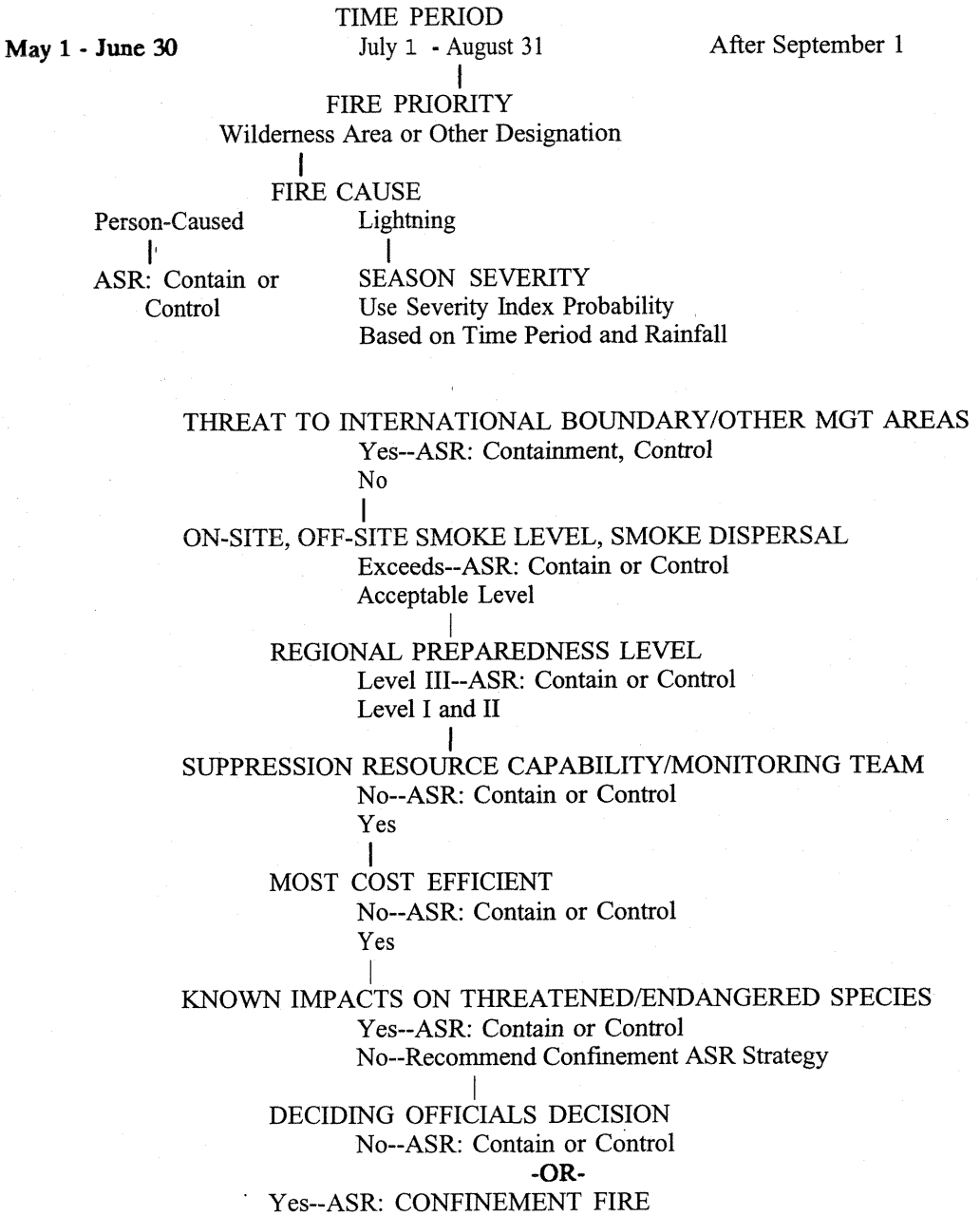


Table 1

SEVERITY INDEX PROBABILITY

Months	Rainfall	Probability Severe Fire Year
March, **April,** May	Less 1.05"	60%
March - June	**Less 1.30"**	75%
March - July	Less 2.80"	50%

Table 2

ESTIMATED COST DATA FOR FIRE SUPPRESSION

LABOR (WITH SUBSISTENCE)

2-Person Smokejumper Crew	**$2,000/Fire**
Crew, **20-Person** Hotshot Team	**$3,650/Shift**
Crew, **20-Person** Forest Service Regulars	**$5,100/Shift**
Miscellaneous Overhead	**$ 200/Shift**

AIRCRAFT

DC-6 Retardant Plane w/3,000 Gallons	**$3,500/Drop**
Helicopter, Small--Bell 206	**$ 450/Hour**
Helicopter, Medium--Bell **205,** 212	**$ 900/Hour**
Helicopter, Large--Bell 214, Sikorsky	**$1,500/Hour**

Part VII. Noneconomic Benefits of Wilderness

VALUING WILDERNESS BENEFITS: ALTERNATIVES TO ECONOMIC MEASURES

Abby Caul Scott*

ABSTRACT

This essay explores the non-economic values of benefits that can be derived from a wilderness educational experience. The National Outdoor Leadership School (NOLS) is used as an example of a program in which wilderness is believed to be necessary for the educational opportunities provided. The following postulate is presented: certain benefits are attained through a wilderness educational experience. The values of these benefits are discussed. The paper contributes to both the public and the researcher by providing assumptions upon which wilderness education bases its value to individuals, society, and to the wilderness resource.

INTRODUCTION

The Wilderness Act of **1964** set aside areas of land that offer tangible qualities from which their visitors derive many different benefits. The Wilderness Act provides protection for undeveloped lands which offer tangible qualities, such as a primeval character and influence, without permanent improvements or human habitation. Less tangible are the qualities defined in the Wilderness Act that characterize these areas which "... may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value" (Pub. Law 88-577, p. 2). At issue here is the educational value of wilderness as defined by the Wilderness Act. Currently, wilderness researchers and managers do not know what these educational benefits may be, what the wilderness qualities are that create or foster these educational benefits, and cannot yet prove if these benefits are dependent on specific wilderness features.

The value of a wilderness educational experience is difficult to characterize. People may enjoy and learn from the solitude, remoteness, unique challenges, and pristine quality of wilderness in addition to learning from a structured educational program, but is it possible to clearly articulate the benefits that these individuals, society, or the resource itself derive from this experience? The therapeutic benefits that individuals derive from wilderness have led to the establishment of a number of programs that serve to maximize these benefits. Considerable research has documented the therapeutic benefits of a wilderness experience (see Easley and others **[1990]** and references therein). However, a broader range of non-economic benefits derived from wilderness experiences is less well documented. An understanding of educational benefits derived from wilderness is needed to support what people seem to know intuitively; that wilderness provides educational opportunities that are good for the individual, society, ***and good*** for the wilderness resource.

A set of non-economic, wilderness-derived benefits is associated with wilderness education programs. Although the definitions of wilderness education vary, the definition used in this paper is, an educational program with a curriculum which is based on expected student outcomes in which the knowledge and skills gained relate directly to wilderness (its safe use and protection). Delmar Bachert **(1990)** reviewed the development of the definition of wilderness education and has a similar interpretation: wilderness education is in, about, and for wilderness. Wilderness education teaches a set of skills, leadership, and experiences that only ***together*** constitute wilderness education. The experience of living in a pristine environment is a necessary component to the definition of wilderness education used throughout this paper. Others may define wilderness education somewhat differently as it relates to wilderness management (Hansen, **1990)** or environmental education (Passineau, 1990).

The purpose of this paper is to assess the non-economic value of benefits that can be derived specifically from a wilderness educational experience. The National Outdoor Leadership School (NOLS) is used as an example of a program in which wilderness is believed to be necessary for the educational opportunities provided. There are many other wilderness education programs that provide similar benefits resulting from an experience such as provided by **NOLS.**

Through an examination of the NOLS curriculum and experiences associated with wilderness education, the assumptions upon which wilderness education bases its assertion that it has non-economic value to individuals,

*Research Manager, The National Outdoor Leadership School, Box AA, Lander Wy. 82520.

society, and to the wilderness resource are outlined. Evidence of wilderness-derived educational benefits is drawn from published research (Easley and others, 1986; Driver and others, 1990), NOLS curriculum outcomes, and anecdotal evidence from student experiences.

WILDERNESS BENEFITS, VALUE AND PHILOSOPHY

For the sake of consistency, we define a benefit similarly as other authors who have traced the foundations of the meaning of benefit from the literature in economics and other sciences. A benefit is "... an improved condition or gain - a desirable consequence - of some type that accrues either to individuals, groups, or society, with the particular type of gain specified clearly" (Driver and others, 1990, p.2). These benefits are measured by their held or assigned value; value is defined as one thing being held to be better, more desirable than another, or otherwise preferred (Brown, 1984; Driver and others, 1990).

The need for a wilderness philosophy has been discussed in numerous disciplines. Harmonious expression and agreement of wilderness benefits among researchers and the public, both wilderness users and nonusers, is what many wilderness users and researchers are striving for. Steady progress has been made toward developing a wilderness philosophy within which there is agreement on the values of wilderness (Driver and others, 1987 Rolston, 1986; Nash, 1988; Driver and others, 1990). In addressing The 4th World Wilderness Congress, Roderick Nash (1988) outlined seven values of wilderness that are currently accepted as the philosophical foundation upon which society rationalizes the need for wilderness. These seven values are: scientific, spiritual, aesthetic, heritage, psychological, cultural, and intrinsic. To this list of wilderness-dependant values used to argue for the need and benefit of wilderness developed by philosophers and other respected wilderness thinkers, the addition of educational value is suggested.

BENEFITS OF WILDERNESS EDUCATION

Wilderness education is a subset of outdoor education. The principles of outdoor education and its value to students have been articulated and integrated into many traditional programs (Hammerman and others, 1985), with documentation of numerous success models (Shuttenberg and Poppenhagen, 1980). Outdoor and traditional education offer benefits to society by the transference of knowledge, skills, and behaviors that are used in daily life. The similarities of the contributions that wilderness and traditional education give its students have been articulated previously (Miles, 1987). A common impression of educational programs occurring in wilderness is that this education is primarily related to psychological growth, self-efficacy and personal behavioral changes. It is important to point out that wilderness education is not restricted to this type of learning, which primarily enhances the user. The wilderness education addressed in this paper assesses those components which relate directly back to individuals and their contributions to society and the wilderness resource. An example of this is found in students' ability to learn how public input may affect the four government agencies managing wilderness.

An Example of Wilderness Education

NOLS offers a variety of wilderness expedition courses that are 14 to 94 days in length. Wilderness is defined as in the 1964 Wilderness Act; however, NOLS uses public and private land both in the United States and internationally that fits the description of wilderness but may not be legally designated as such. Each NOLS course teaches a core curriculum that includes four major areas: safety and judgement; leadership and teamwork; outdoor skills; and environmental studies. The NOLS curriculum follows a teaching progression which begins with essential skills of living and travelling safely in a wilderness environment. Once students and instructors are in the field, knowledge is passed along during 'teachable moments' as they occur, and then formal classes are presented when outdoor living skills are firmly established.

Although NOLS is often cited along with organizations like Outward Bound or Wilderness Vision Quest when arguments for the value of personal growth are made (Cordell and others, 1990; Schreyer and others, 1990), the NOLS mission is different from those of either program (Easley and others, 1986; Brown, 1988; Bacon and Thompson, 1988; Ratz, 1988; Young, 1989). NOLS fulfills its mission primarily by educating users in skills and ethics of wilderness travel in order to protect wild lands. To accomplish that mission, NOLS provides leadership opportunities in, for, and about wilderness. Personal growth and self-efficacy may be additional benefits of a NOLS education; however, these are not the primary focus. Because the NOLS curriculum revolves around teaching for and about wilderness, it is strongly believed that the wilderness environment is essential for achieving the wilderness education goals of the NOLS mission.

Why is the wilderness environment essential to accomplish the goals of wilderness education? I

believe that most wilderness educators would agree that every class taught in the wilderness could be taught at the Holiday Inn; however, wilderness education is the sum total of not only formal classes presented in, for, and about wilderness, but also is the experience of living in that resource that separates wilderness education from outdoor education taught in urban or rural areas. Learning by experiencing consequences of physical, emotional, and intellectual choices in the wilderness contributes to an individual's judgement for, and relationship to the land. Wilderness education is striving to teach more than knowledge and facts needed to pass a written exam.

Most wilderness education programs adapt course content to reflect the particular wilderness environment that they are in. Wilderness education material (e.g.; first aid, climbing, natural history) is often presented with instructors questioning whether the material is different due to the wilderness environment; and, if so, why is that information different? For example, when a class in first aid or natural history is taught, the course content looks **specifically** at that knowledge in relation to wilderness. Teaching first aid as it relates to the wilderness goes far beyond the basics of stabilizing a patient and calling 911. Or, if one is teaching about wilderness ecosystem processes, the unique properties that are relatively uninterrupted by human interference are a likely focus of discussion. Students then have an opportunity to integrate knowledge presented in formal classes with tangible and often dramatic examples of the class information.

Benefits to Individuals and Society

Based on expected student outcomes of the **NOLS** curriculum, it is believed that the following wilderness-derived benefits occur: 1) an enhanced environmental ethic; 2) minimum impact skills, defined as learning how to use wildlands without adversely affecting them; 3) an awareness of natural history; 4) an understanding of public land management and its related public policy and 5) leadership development, teamwork skills, and **experience/judgement** derived from a field experience. Each of these is briefly discussed in relation to expected student outcomes of each **curriculum** area **(NOLS,** 1991).

The environmental ethics curriculum is designed to enable students to accomplish the following:
-discuss and reflect upon his or her role, impact, and contributions on planet Earth;
-understand the history, facts, and potential solutions to sample environmental issues;
-use basic observation and interpretive **skills** to demonstrate an understanding and respect for the natural world;
-consistently demonstrate sound minimum-impact living and travel **skills;**
-demonstrate basic knowledge and respect for local cultures.

The outdoor skills curriculum is designed to enable students to accomplish the following:
-live comfortably in a wilderness environment;
-travel competently in the wilderness environment that they are in,
-follow practices that promote health and safety of others;
-be able to perform basic first aid and emergency planning;
-develop basic natural history observation and interpretive skills.

Leadership and teamwork skills require students to be committed to the group, and to maintain a positive attitude. The leadership and teamwork skills curriculum is designed to enable students to accomplish the following:
-work effectively as members of a team;
-communicate ideas and concerns on an individual and group level;
-accurately identify personal strengths;
-strengthen skills in developing outdoor leadership styles;
-plan and achieve safe and environmentally sound expeditions;
-use ability and initiative in a leadership role with peers;
-respond to problem situations using sound decision making and planning skills;
-display an awareness of group strengths and limitations.

The public land management and policy curriculum is designed to enable students to accomplish the following:
-understand the political process and its relation to land use;
-demonstrate knowledge of the four federal agencies managing the National Wilderness Preservation System;
-understand the mandates which guide wilderness management within each agency,
-understand the issues facing wilderness on local and national levels;
-understand how to be involved with public land management.

The principle personal gains from **NOLS** wilderness education were first assessed by Easley, Roggenbuck,

and Ratz (1986). Their results indicated that students do gain a significant education as a result of a **NOLS** course, specifically in the areas of outdoor and leadership skills (Easley and others, 1986). More recently Driver, Peterson, and Easley (1990) were able to determine that some **NOLS** graduates were not only able to identify many perceived benefits from their NOLS course, but were also able to report many beneficial changes realized since participating in a **NOLS** course. This study also established successful methods to assess how desirable each benefit was; how much change students perceived had occurred since their NOLS course; and how much of that beneficial change occurred directly as a result of the NOLS course. Many of the perceived benefits reported in this study are the same discussed previously, as described in the expected student outcomes of NOLS curriculum (Driver and others, 1990). Other sources of documentation of the educational benefits perceived to be gained as a result of a NOLS course are student and instructor evaluations and communication with alumni. Through alumni feedback including their stories written for ***The Leader*** and Instructor Newsletter or gathered through informal NOLS surveys, it is assumed that perceived benefits of their NOLS course have helped alumni recognize the importance of the interconnectedness between wilderness and other environments and their lives.

The documentation that individuals gain specific wilderness-derived benefits leads to the speculation that these benefits can be of direct value to society. Among the wilderness-derived benefits hoped to be transferred to society via individuals are: a heightened environmental awareness; behaviors that result in an increased knowledge of minimum impact skills; knowledge of public land management; and leadership skills. The unique combination of these benefits contributes to an understanding of natural forces affecting ecosystems, and human dependence on them.

Wildland Ethics. A principal benefit of wilderness to society may be a **wildland** ethic and an attitude of caring for the environment that an individual can attain as a result of a NOLS wilderness experience. The environmental ethic which is gained or nurtured within a NOLS student is most closely related to the land ethic paradigm put forth by **Aldo** Leopold in ***A Sand County Almanac (1949)***. This ethic is developed from the premise that individuals are members of a community in which there are interdependent parts. We believe that most NOLS students gain both a biocentric and anthropocentric understanding of the many entities which are a part of wildlands. NOLS students are exposed to a number of different interpretations of the reasons for the behaviors affecting the environment taught in a NOLS course, and most often are left to judge which they believe are most appropriate.

An example of the information presented to students which depicts how NOLS conveys information regarding **wildland** ethics is provided in ***The wilderness Primer: An Introduction tWildland Ethics and Management*** (**Brame** and Henderson, 1991). The authors of this primer have traced the origins of the developing **wildland** ethic and compared this to society's broader environmental ethic. Parallels between a **wildland** ethic and its relationship to a global environmental ethic are explained. The NOLS curriculum reflects a commitment to the role of wilderness education in the evolution of a **wildland** ethic. It is hoped that a NOLS wilderness experience not only contributes to the societal benefits of a collective environmental ethic, but also to a personal ethic of care for the environment. It has been suggested that in order to obtain an environmental ethic, the natural world must be important to an individual (Shrader-Frechette, 1981; Kellert, 1987). Living in nature, such as a student does while participating in a NOLS course, allows an individual enough time to develop a meaningful relationship with nature. On the one hand, this paper points to the need for research to substantiate many of the assumptions about educational gains; on the other hand, the premise that educating wilderness users is a valid way to contribute to an individual's environmental land ethic is common (Cockrell, 1986; Miles, 1986; Mott, 1987; Cashel, 1987; Roggenbuck and Manfredo, 1990).

NOLS has believed since its inception in **1965** that a wilderness experience enhances the responsible care toward the land and that the lessons learned do not end at the trailhead (Petzoldt, 1974). Many of the skills taught in a wilderness education program are those needed by the future wilderness visitor to be a safe and responsible wilderness user. In addition, this responsible care toward the land is not limited to the minimum impact conservation practices used solely in the wilderness. The concept of minimum impact applies to all aspects of an individual's relationship to the environment. For example, students are encouraged to think globally in reducing their environmental impact. Actions could include recycling, buying in bulk, and adopting a less consumptive philosophy.

Leadership. The theories and development of leadership are discussed and woven throughout the NOLS curriculum. The ability to understand why a team needs an effective leader and participants contributes to the foundation of a society such as ours that values the qualities of leadership and cooperation

in people. Within the NOLS curriculum there are opportunities for students to develop their **abilities** to be leaders and team players. By virtue of the NOLS course format, students and instructors share an interdependence and sense of duty to community, which is balanced with freedoms and rights. Students most often experience leadership **responsibilities** when they are put in a position of **responsibility** for the travel and safety of a group of their peers. While there is not enough data to substantiate how NOLS confers leadership skills to students, it is known that at the start of a NOLS expedition-based course, most NOLS students do not possess skills that are developed enough to lead a group of people safely through the wilderness, but that person ***is*** capable of leading his or her peers by the end of the course.

Individual leadership is also discussed in relation to environmental leadership. These leadership discussions usually relate directly to an individual's responsibility to the wilderness and to the global environment they are a part of. Some specific examples of students' contributions or leadership roles follow in the discussion concerning benefits to the wilderness resource.

Benefits to the Wilderness Resource

Recently, more attention has been paid to the ecological conditions of wilderness via monitoring its "health". The purpose of monitoring may be considered to be twofold. First, there is a growing concern that agencies have not been fulfilling their mandate to provide for an "enduring resource of wilderness," as called for by the 1964 Wilderness Act (GAO, 1989). Second, there is a concern that something more vital than just the condition of a particular type of land designation is at stake. Rather, the health of wilderness ecosystems which contribute to the long-term ecological integrity of the sum of natural systems we call Earth may be imperiled by outside threats or excessive impact. An example of this greater role that wilderness can play is found in the report from the Interagency Federal Task Force on Monitoring Wilderness Conditions that states, wilderness managed to preserve natural processes may increase our abiity to ensure biodiversity for the future, and may provide opportunities to gauge the changes that man has made to the environment and to the wilderness (Task Force Report, 1991). There may no longer be a standard of land "health" because ultimately the world has been, and is, dynamically changing due to humanization (Callicott, 1990). However, we cannot lose sight that this dynamic and imperfect baseline, resulting from monitoring current wilderness ecosystem health, is far better than no baseline at all (Noss, 1991).

What then can wilderness education derive from the wilderness resource that is of benefit to the far reaching value of wilderness and the planet? If wilderness contributes to the ecological health of our planet, then fostering support for wilderness is a useful function. Wilderness education can foster that support. This support can be brought about on two levels: the ethical, attitudinal level, and the on-the-ground, behavioral level. Time spent in wilderness can build an intuitive **understanding** of its value. Long-term support for natural areas, for maintaining their ecological health, can be supported by instilling or nurturing an ethic of respect for the land and natural processes.

Classes presented on an extended field expedition can enhance intuitive understanding by presenting detailed descriptions of natural processes. Wilderness classrooms offer memorable encounters with natural history. For example, students gain a vantage point from which to view the expanse of a glacier laid out directly below them. A class on basic glaciology takes on immediacy when descriptions of lateral moraines, crevasses, and other features are also features that these students will be walking over.

Another aspect of course curriculum that can influence the support of the wilderness environment can be found in land management topics. An overview of land management aids in building an informed constituency that understands and supports land management. NOLS courses deliver a general outline of the major federal land management agencies, their missions, responsibilities, authorities, and current challenges. Understanding of the societal context for wilderness and natural areas - their role vis-a-vis other land uses and their place in the multiple-use spectrum of developed and undeveloped lands - aids in fostering support for wilderness. Ideas about how to be involved in land stewardship are presented. Examples include discussions of involvement through public comment processes or partnership opportunities. Blind support is nor the objective, but rather the objective is an informed level of understanding that can lead to critical, discerning, and constructive examination of the stewardship of public lands. Again, the ability to present this information while in the midst of the wilderness resource serves to reinforce the value of wilderness to the students.

At the action-oriented and behavioral level, wilderness education can help mold users' behaviors through minimum-impact camping skills so that there are minimal negative effects in the primeval character and influence of wilderness. The most immediate

consequence of a well run wilderness education program is a heightened knowledge of minimum-impact conservation practices. Paul Petzoldt, the founder of NOLS, wrote in his first report to the school's trustees: "In 1965 we found the teaching of use, with conservation, of our recreational lands to be one of the most necessary parts of our program. In the end it might be one of the most beneficial parts of our program. We recommend a stronger emphasis on the above, with cooperation of agencies managing these lands" (Petzoldt, 1965). A 30- or 90- day NOLS course provides the luxury of time in which to instill and practice techniques that attempt to minimize our degradation of the resource. The teaching process integrates the skills acquired in the formal learning atmosphere of a wilderness course with the ethical system of respect for the land that is concurrently developed as students attempt to "leave no trace." This process falls into one of three routes to learning or persuasion that can be used by wilderness education, as outlined by Roggenbuck and Manfredo (1990). The authors state: "Wilderness education can help protect wilderness resource values and experiences. Second [of three routes], the central route to persuasion accomplishes learning through high attention by the recipient to message content, careful thought or elaboration of the message content, and integration of the message content into existing belief systems" (Roggenbuck and Manfredo, 1990, p.111).

Service projects, as a component of course content, can also influence support of the wilderness environment. Field programs or expeditions can aid land managers with management functions that directly contribute to the well-being of wilderness areas. Service projects, such as campsite cleanup and trail maintenance, are common activities. NOLS has been involved for several years in a campsite inventory project with the Shoshone National Forest in Wyoming. A summary of the project states: "Long term monitoring of wilderness resources is a critical part of the Lander District's wilderness management program. The District views NOLS as playing a integral and essential role in this monitoring" (Quintana, 1990).

In addition, public land managers are increasingly taking advantage of organized wilderness education programs to enhance other less tangible aspects of wilderness management. For example, courses in the field can assist research by participating in data collection or by serving as research subjects themselves. Students and instructors can participate in monitoring the condition of a number of wilderness values, both recreational/sociological and ecological. Wilderness educators often are able to report back to resource managers about the physical condition of the resource. For example, NOLS collects data for State Game and Fish agencies and the Forest Service on location of fish species, the total numbers caught or released, and the numbers and locations of encounters with animals or people.

Further Research is Needed

The wilderness-derived benefits discussed in this paper represent the benefits upon which NOLS and possibly other wilderness education programs base their non-economic value to individuals, society, and the wilderness resource. A purpose of this paper is to indicate areas where research can contribute to the effectiveness and vitality of wilderness education. Two needs come to the forefront. The first is to determine actual versus perceived benefits of students and the relationship and magnitude of these benefits to the broad societal and environmental implications discussed in this paper. The second is to indicate or enhance methods to create or maximize these suggested benefits.

Wilderness education programs can support this research by allowing their classes and participants to serve as field laboratories and subjects. Appraisal of wilderness-derived educational benefits and a commitment to seeking out the best role of wilderness education in providing non-economic benefits from wilderness will certainly serve the resource well.

This paper contributes to both the public and the researcher by providing assumptions upon which wilderness education bases its value to individuals, society, and the wilderness environment. These assumptions call for more quantitative research. In suggesting the need for further research, it is recognized that there is a need to advance the methodologies that can quantify benefits gained directly from wilderness education. It is my aim here to emphasize that those benefits should include not only the personal benefits to the wilderness user, but also the benefits that directly affect the wilderness resource.

CONCLUSION

The Wilderness Act has provided Americans and all citizens of the world with a basis for a tremendous resource that provides both economic and non-economic values. Over the past 25 years we have recognized that wilderness ecosystems are an integral part of the Earth and are needed not only to further understand global environments but are needed to provide the unique opportunities and values protected by the Wilderness Act. This essay has explored the educational value of wilderness which is protected by

the Wilderness Act. Wilderness managers and researchers do not know a lot about wilderness education content and its benefits and cannot yet "prove" these educational outcomes. However, NOLS students, alumni, and many wilderness managers believe that wilderness has learning benefits, and these benefits are enhanced by NOLS courses.

Finally, in returning to the intuitive knowledge that wilderness education provides the benefits of an enhanced **wildland** ethic, leadership, and minimum-impact **skills,** it is encouraging to think that these contribute to the evolving wilderness philosophy. Joseph Passineau (1990) summarized the overriding benefit of wilderness education as its **ability** to foster a wilderness ethic which may, in fact, be necessary to conserving our planet. The timeless words of Thoreau, "In wildness is the preservation of the **world,**" best **define** what potentially may be the most important benefit of wilderness education.

Acknowledgements

Joseph Roggenbuck, Chad Henderson, Chavawn **Woodall,** and Reb Gregg provided extremely helpful insights and reviews of this paper.

REFERENCES

Bachert, Dehnar. 1990. Wilderness education: a holistic model. In: Easley, A.T.; Passineau, Joseph F.; Driver, B.L., **comp.** The use of wilderness for personal growth, therapy, and education. Gen. Tech. Rep. RM-193. USDA Forest Service. 65-167.

Bacon, Stephen; Thompson, Donna. 1988. Outward Bound USA. In: Martin, Vance, ed. For the conservation of the earth. Golden, CO: Fulcrum Inc. 349-352.

Brame, Susan; Henderson, Chad. 1991. Wilderness primer: An introduction to **wildland** ethics and management. Lander **WY:** The National Outdoor Leadership School Publications, in press.

Brown, Michael. 1988. Wilderness vision quest. In: Martin, Vance, ed. For the conservation of the earth. Golden CO: Fulcrum Inc. 338-344.

Brown, Thomas C. 1984. The concept of **value** in resource **allocation.** Land Economics. **60(3):231-246.**

Callicott, J.B. 1990. Standards of conservation: Then and now. Conservation Biology. **4:229-232.**

Cashel, Christine. 1987. Teaching outdoor ethics outside the classroom. In: Proceedings of the international conference on outdoor ethics. Izaak Walton League of America. 32-34.

Cockrell, David. 1986. Teaching environmental ethics in adventure education. In: Proceedings of the 1986 Association for Experiential Education national conference. 7-14.

Cordell, Ken H.; Bergstrom, John C.; Hartmann, Lawrence A.; English, Donald B.K. 1990. An analysis of the outdoor recreation and wilderness situation in the United States: 1989-2040. Gen. Tech. Rep. SE-51. USDA Forest Service.

Driver, B.L.; Nash, Roderick; **Haas, Glenn.** 1987. Wilderness benefits: A state-of-knowledge review. In: Lucas, Robert C., **comp.** Proceedings - National wilderness research conference: Issues, state-of-knowledge, future directions. 294-319.

Driver, B.L.; Peterson, George; Easley, A.T. 1990. Benefits perceived by past participants in the NOLS Wind River course: A methodological inquiry. In: Easley, A.T.; Passineau, Joseph F.; Driver, B.L., **comp.** The use of wilderness for personal growth, therapy, and education. Gen. Tech. Rep. RM-193. USDA Forest Service. 52-63.

Easley, A.T.; Roggenbuck, Joseph; **Ratz,** J. 1986. Wilderness education at NOLS: Student outcomes and correlates of perceived instructor effectiveness. In: Lucas, Robert C., **comp.** Proceedings - National wilderness research conference: Issues, state-of-knowledge, future directions. 377-384.

Easley, A.T.; Passineau, Joseph F.; Driver, B.L., **comp.** 1990. The use of wilderness for personal growth, therapy, and education. Gen. Tech. Rep. RM-193. USDA Forest Service.

General Accounting Office (GAO). 1989. Wilderness preservation: Problems in some national forests should be addressed. Washington, DC: GAO/RCED-89-202.

Hammerman, Donald R; Hammerman, **William** M.; Hammerman, **Elizabeth** L. 1985. Teaching in the outdoors. **Danville,** IL: The Interstate Printers and Publishers. **185** pp.

Hansen, Gregory F. 1990. Education, the key to preservation. In: Lime, David W. ed. Managing America's enduring wilderness resource. St. Paul, MN: University of Minnesota.

Leopold, Aldo. 1949. A Sand County almanac, and sketches here and there. New York: Oxford University Press.

Kellert, Stephen R. 1987. Social and psychological dimensions of an environmental ethic. In: Proceedings of the International Conference on Outdoor Ethics. Izaak Walton League of America pp. 18-19.

Miles, John C. 1986. Teaching in the wilderness: ethical issues and moral dilemmas. In: Proceedings of the 1986 Association for Experiential Education national conference. 1-6.

Miles, John.C. 1987. Wilderness as a learning place. Journal of Environmental Education. 10(3):33-40.

Mott, William P. 1987. A National Park Service perspective on ethics. In: Proceedings of the international conference on outdoor ethics. Izaak Walton League of America. 39-40.

Nash, Roderick F. 1988. Why wilderness? In: Martin, Vance, ed. For the conservation of the earth. Golden, CO: Fulcrum Inc.

NOLS. 1991. NOLS wilderness education notebook: A developing guide to the NOLS curriculum. Lander, WY: National Outdoor Leadership School Publishing.

Noss, Reed D. 1991. Sustainability and wilderness. Conservation Biology. 5(1):120-122.

Passineau, Joseph. F. 1990. Teaching a wilderness ethic: Researching beyond the forest. In: Lime, David W., ed. Managing America's enduring wilderness resource. St. Paul, MN: University of Minnesota.

Petzoldt, Paul. 1965. National Outdoor Leadership School - Review and report to trustees, 1965. Lander, WY: National Outdoor Leadership School Publishing.

Petzoldt, Paul. 1974. The wilderness handbook. W.W. Norton & Co., Inc.

Public Law 88-577. 1964. The Wilderness Act. 88th United States Congress.

Quintana, Arthur. 1990. NOLS project summary. Report by the District Ranger to the Forest Supervisor, Lander Ranger District, Shoshone National Forest.

Ratz, Philip, J. 1988. The National Outdoor Leadership School. In: Martin, Vance, ed. For the conservation of the earth. Golden, CO: Fulcrum Inc. 349-352.

Roggenbuck, Joseph; Manfredo, Michael. 1990. Choosing the right route to wilderness education. Lime, David, ed. Managing America's enduring wilderness resource. St. Paul, MN: University of Minnesota. 103-112.

Rolston, Holmes. 1986. Philosophy gone wild: Essays in environmental ethics. Buffalo, NY: Prometheus Books.

Rolston, Holmes. 1989. Environmental ethics, duties to and values in the natural world. Temple University Press.

Schreyer, Richard; Williams, Dan; Haggard, Lois. Episodic vs. continued wilderness participation - implications for self concept enhancement. In: Easley, A.T.; Passineau, Joseph F.; Driver, B.L., comp. The use of wilderness for personal growth, therapy, and education. Gen. Tech. Rep. RM-193. USDA Forest Service.

Shrader-Frechette, K.S. 1981. Environmental ethics. CA: The Boxwood Press.

Shuttenberg, Ernest M.; Poppenhagen, Brent W. 198 Current theory and research in experiential learnin for adults. Journal of Experiential Education. 3(1

Task Force Report. 1991. Report from task force on monitoring for wilderness conditions: Private and interagency cooperation. Hosted by USDA Forest Service, February 6-9, 1991.

Young, Anderson, B. 1989. The outdoor program opportunity matrix: Toward a taxonomy of outdoor programs. Trends. 26(3):34-39.

ECONOMIC COST/HEALTH BENEFIT OF WILDERNESS: PROSPECTS FOR ASSESSMENT

Blair Dillard Erb*

ABSTRACT

"The ground on which the body moves offers according to its quality more or less large obstacles which have to be overcome one way or another. The constant exercise of overcoming these obstacles is a form of gymnastics which greatly influences the human body, and not only improves the general physical condition, but also can be used in rehabilitation in cases of poor health. The nature of the terrain has so far never been used as a treatment, although the exercise of overcoming obstacles through walking hiking, and mountain climbing strengthens the heart and greatly influences the circulation of the blood."

... Professor M. J. Oertel
University of Munich, 1886

INTRODUCTION

Health is often suggested as one of the benefits accruing to wilderness and outdoor recreational activities. If such is the case, can a relative value for health be applied to the cost of developing and maintaining wilderness and outdoor recreational areas? And if the cost can be determined, can a cost/health benefit relationship be established?

Current issues in wilderness management, although recognizing advantages of human use from recreation and enrichment perspectives, may be extended by **adding** a health dimension. There is evidence that physiologic and psychologic effects of wilderness activities have a positive impact not only on quality of life, but also on measurable parameters of health. Examination of the relationship between health issues and economic costs of wilderness and outdoor recreational activities requires understanding the nature of wilderness experiences and a description of the potential benefits from participation in such activities.

Wilderness activities, however, are not without their liabilities. Among them are the health risks and economic costs of providing care for injuries and **illnesses** resulting from participation in these vigorous and perhaps hazardous activities. Costs related to search and rescue, care, and even the economic cost of selecting participants as a preventive measure must be factored into the equation.

The magnitude of data required for proof of a positive health benefit from wilderness activities discourages this assessment. Its interpretation requires a clear definition of precise health end-points. The collection of data related to using health end-points for wilderness activities, such as morbidity, mortality, and productivity figures is in its infancy and would be considered at this time as inadequate for conclusions.

A debate addressing the advantages and ultimately the economic value of exercise as a preventive and therapeutic tool in medicine which has continued over a 25 year span is similar to this issue. Recognition of the health benefits derived from regular physical activity has resulted in recommendations for general participation in rational recreational and exercise activities. Much of the emphasis on exercise in the past has been on high intensity activities requiring special skills, equipment, or facilities. More recently, however, walking and outdoor activities have been the focus of attention. This is attractive not only to young, vigorous, and adventuresome citizens, but also to our aging population.

Using the same approach as was used in this debate over cost/health benefit of exercise, we have examined prospects for reviewing the economic cost/health benefit of wilderness activities.

There are three broad categories of data involved in determining the economic impact of wilderness activities on health: 1) epidemiologic and biostatistical health data, 2) economic cost of health care, and 3) economic cost of maintaining wilderness resources.

* **M.D., F.A.C.P., Clinical Professor, Preventive Medicine, University of Tennessee College of Medicine,** Knoxville, TN, Wilderness Medical Society; Jackson Clinic, Jackson, TN **38301.**

EPIDEMIOLOGIC AND BIOSTATISTICAL HEALTH DATA

Epidemiologic and biostatistical health data proving a positive relationship between activity and health does not exist. Figures are so diffuse as to require very large samples which would be adequate to have a level of significance and power which could meet the demand for reasonable conclusions.

There have been studies, however, which relate vigorous outdoor activities, especially in mountains, with longevity. Study design, methodology, reporting vehicles, and sources of support are so vastly different as to render them and other studies incomparable. They do, however, introduce the uninitiated to the complexities of the field (Table 1).

Longevity and Lifestyle

Alexander Leaf's assessment of centenarians in three mountainous regions of the world implies that there is health influence from living in each of the regions studied: Abkazia in the Caucasus Mountains of the Georgian Soviet Socialist Republic in southern USSR; Hunza in the Karakoram range in Pakistani-controlled Kashmir; and the Andean village of Vilcabamba in Ecuador (Leaf, 1973). Although it is impossible to factor out the specific reason(s) for such longevity from statistical analysis in a retrograde study such as this, the implications are that lifestyle superimposed on a genetically protected population may have a favorable impact on longevity.

The common denominator in lifestyle in these three population groups relates to the mountainous terrain in their homelands. It has been postulated that perhaps longevity here is a function of the physical activity required simply for walking in the mountains.

A Georgian cardiologist practicing in the Caucasus recognized many types of cardiovascular disease among the people, but suspected survival is improved by enhanced cardiovascular function resulting from improved oxygen supply to the heart. It is clear that the energy expenditure of walking in the mountains is significantly greater than that associated with flatland living.

Physical Activity and Heart Attack

The relationship between physical activity and heart attack has long been recognized. The classic study by Morris of London bus drivers and conductors and of British government workers and postal carriers established epidemiologic evidence supporting the protective effect of occupational physical activity from cardiovascular mortality (Morris et al., 1953; Morris et al., 1966).

In the study of London Transport System, bus drivers were found to have a higher mortality from myocardial infarction than the more active and vigorous conductors, who are on their feet all day collecting tickets, moving about the bus, and climbing up and down the stairs of the London double-deck buses. Similarly, in the Government workers study, letter carriers were found to have a significantly lower incidence of death due to myocardial infarction that clerks and other more sedentary Government workers.

Recognizing that occupational physical activity may be a protective health factor and that high intensity physical work is less frequently a component of today's occupations, Morris has turned his attention to assessing the health benefit of leisure-time activities. A classic study of 16,882 male executive British Civil Servants, age 40-64, analyzed the effect of vigorous leisure-time activities, defined as energy outputs of 7.5 Kcal./min. (6.5 METs), corresponding to heavy industrial work (Morris et al., 1973). Among the men participating in "vigorous" activities, the relative risk of developing coronary disease was about one-third of that found among comparable men who did not participate in such activities. The hypothesis was stated that vigorous exercise promotes cardiovascular health.

An inverse relationship between physical activity and risk of heart attack was reported by Paffenbarger (Paffenbarger, Wing, and Hyde, 1978). In his study of 16,936 Harvard male alumni, age 35-74, of whom 572 sustained heart attack, physical activity was shown to have an independent protective effect on cardiovascular events. Recorded in the form of composite physical activity index, men who expended less than 2,000 Kcal. per week in strenuous leisure activities were at 64 percent higher risk that their classmates with a higher level of energy expenditure.

Maximizing Physical Condition

Members of a little known Indian tribe living in an isolated mountainous area of Mexico at the North American Continental Divide were studied by Balke and Snow (1965) and by Groom (1971). Their name, Tarahumara, probably a corruption of their words for "fleet foot" or "foot runner," describes their physical training for the arduous life in their region, which is among the most rugged in North America.

The unusual stamina of the Tarahumara is documented in early anthropological literature describing their hunting prowess by primitive methods of running a deer for several days until the animal drops from exhaustion and from stalking wild turkey until the bid can no longer rise from the ground in Right.

Their unique "kick ball" races demonstrate their high level of physical conditioning. In these races, participants run day and night continuously for distances of 75-160 miles, kicking a wooden ball approximately the size of a tennis ball with the dorsum of their foot. Physiologic observations, such as blood pressure measurements, heart rate, respiratory rate, weight, etc., indicate a remarkable tolerance and adaptability to this prolonged physical challenge. Energy expenditure is estimated at approximately 11.6 Kcal./min. (@ 10 METs). Estimates indicate that a 100 mile race requires an energy expenditure of more that 11,000 Kcal.

From this study, it is recognized that the physiologic parameters of physical conditioning through culturally integrated exercise are metabolically measurable entities and that the human cardiovascular system can be conditioned to withstand extremes of continuous exercise. These phenomenal feats of endurance yield convincing evidence of the prospective potential for enhanced cardiac reserve among our more sedentary society.

Mechanics of Epidemiologic and Biostatistical Studies

The inference from Leafs longevity observation, from Morris'retrospective studies on the protective effect on the cardiovascular system by the occupational and leisure activities, the lifetime conditioning for enhanced reserve of the Tarahumara runners, and the precision with which Morris, Groom, and Paffenbarger can calculate energy expenditure from observation of activities lends promise to the prospect of assessing the link between physical activity in the wilderness and enhanced health. Properly designed prospective, and perhaps retrospective, studies relating wilderness activity and health may be fruitful.

Epidemiologic and biostatistical studies may vary in objectives, design, support, and scope. The classic prospective study is the 30 year ongoing Framingham study which relates specific risk factors to coronary artery disease in a large population group. The role of physical activity in Framingham was initially reported by Kannel (Kannel, McGee, and Gordon, 1976).

Population studies require a sample size which may vary according to experimental design, variability of the observations, availability of information, variability of the observations, and control over the observations (Remington and Schork, 1967). Environmental influences, such as air, ground and water pollution, variable responses to aesthetic attraction and perceived risks from injuries and environmental illness associated with wilderness activities must be built into the equation.

The complexity of projects studying broad health data warrants careful attention to experimental design. Because a wide range of professions, each with its own language, is interested and influenced by the outcome of studies on the impact of the wilderness on human well being, it would be prudent to convene authorities from all related fields of expertise, especially including those in epidemiology and biostatistics, before a major project examining the health benefit of wilderness activities is undertaken. Project leadership should include groups responsible for experimental design, as well as groups of experts experienced in methodology.

Perhaps from a properly designed project a mechanism for assessing the impact of wilderness activities on human health, both quantitatively and qualitatively, can be developed which could assist in assigning national resources to wilderness management.

ECONOMIC COST OF HEALTH CARE

The total economic cost of health care in the United States is staggering. In 1988 it was 540 biion dollars, or 11.1 percent of the Gross National Product (Health Care Financing Administration, 1990). Previous estimates indicate that 69 percent of total health care costs are expended for person under age 65. This age group, representing the years of greatest productivity, makes up 89 percent of our population. If anything can be done to prevent illness among this group, then significant savings and increased productivity might be realized (Erb, 1986).

Estimates of the economic cost of illness, such as those by Rice, Hodgson, and Kopstein (1984), include both direct and indirect costs. Direct Costs are defined as those expenditures for health services required for prevention, treatment, and rehabilitation. Indirect costs represent the wasted human capital resulting in lost productivity. This approach assists in assessing the potential benefits of health promotion and in targeting particular diseases, health behaviors, and population groups.

Although there are non-modifiable determinants of health, such as age, gender, and genetic inheritance, there are clearly defined behaviors, risk factors, and

surrounding **influences** which contribute to morbidity, mortality, and, in turn, the total economic cost of illness **(Amler** et al., 1984) (Table 2).

Especially in the realm of cardiovascular disease, the modifiable risk factors include physical inactivity, in addition to such behaviors as cigarette smoking, dietary indiscretion resulting in obesity, lipid disturbances, stress, and hypertension, etc. Estimates from 1980 studies indicate that modifiable risk factors contribute to 52 percent of the total economic cost of illness (Rice, Hodgson, and Kopstein, 1984, Harwood et al., 1984) (Table 3).

Particular attention has been paid to the costs of cardiovascular disease because of their prevalence, because of the clear recognition of risk factors which are vulnerable to intervention, and because the effects of preventive and therapeutic intervention are so clearly recognized.

Pell's study of 25,000 DuPont employees over a 25 year period from 1957 to 1983 indicates a reduction in morbidity and mortality from coronary heart disease (Pell and Fayerweather, 1985). Statistical data indicate that this reduction in morbidity and mortality was not as much a result of therapeutic intervention as it was a reduction in the prevalence of the disease. It was suggested that risk factor modification resulted in this reduction in the prevalence of coronary heart disease.

Following the principle that a program of risk factor reduction, **including** increased physical activity, may be helpful in reducing disease, the Rand Corporation estimated the. external cost of a sedentary lifestyle (Keeler et al., 1989). These costs included health insurance, sick leave coverage, disability insurance, and group life insurance. Conclusions suggest that a sedentary lifestyle results in a lifetime subsidy of $1,900 from others. In as much as about 1/6 of our population is sedentary but not physically limited, the Rand study concludes that successfully encouraging a small percentage of sedentary individuals would justify expenditure for facilities, services, and encouragement to participate in an active lifestyle.

Analyzing the cost effectiveness of health promotion activities as a technique for risk factor modification on 1,000 hypothetical 35 year old men followed for 30 years, Hatziandreu et al. concluded that there were 78.1 fewer coronary heart disease (CHD) events and 1,138.3 Quality Adjusted Life Years **(QALYs)** added (Hatziandreu et al., 1988). The cost per QALY over a 30 year period was $11,313, or $377 per year, a favorable figure when compared with other preventive or therapeutic interventions for coronary heart disease.

Tracking the source of financial support for specific medical interventions and accounting for their success is difficult. Funding - by private insurance, government insurance, health maintenance organizations **(HMOs),** public health services - at various levels of **influence** - whether local, regional, or national - affects the services rendered. Diagnosis Related Groups **(DRGs),** implemented as a funding mechanism by the federal Medicare/Medicaid programs, may provide an immediately accessible set of figures which, although at times seeming arbitrary, could provide a basis for reviewing the costs of contemporary acute care.

None of the acute care data, however, addressed the issue of cost of preventive care. Primary preventive measures are explicitly excluded from health insurance and remain in the domain of professionals usually outside the health care industry, albeit often in consultation with health professionals.

Earlier studies reviewing the economic advantages of preventive programs in cardiovascular disease, focusing on the numerical precision found in the Human Capital approach, suggest a savings of up to 6 percent of Disposable Personal Income could be derived from preventive programs focused on diseases of the heart and circulatory system (Appendix A). The economic value of rehabilitation, on the other hand, using Helander's approach (Helander, **1970),** suggests a 3 percent yield in economic value for the total economic result of rehabilitation (Appendix B).

The estimated savings from prevention (6 percent) plus rehabilitation (3 percent) when applied to the 1988 cost for cardiovascular disease ($72 billion) would result in a savings of about 6.5 billion dollars.

If the same savings were possible across the scope of private health care expenditure, the savings would be such magnitude, $48 billion, that if only 1 percent were applied, a sum of $4.8 billion would be available for managing health promotional activities.

If increased participation in wilderness activities results in a positive health effect, the cost of maintaining wilderness resources would increase because of increased demands on wilderness areas. Savings from health expenditures resulting from reduced disease could be applied to this cost of maintaining wilderness resources. At issue is the economic value of health benefit, if any, derived from participation in wilderness activity.

ECONOMIC COST OF WILDERNESS AND OUTDOOR RECREATIONAL RESOURCES

The total federal commitment to wilderness and outdoor recreational management is $6.3 billion. This includes the budget for the U.S. Forest Service ($3.5 biion), the National Park Service (1.0 biion), the U.S. Fish and Wildlife Service ($1.1. biion), and the U.S. Bureau of Land Management ($700 million) (United States Department of Interior, 1990). When private funding is added **(1986=$132** biion), the total financial commitment by the U.S. is $140 biion.

The 1991 U.S. Budget includes $630.1 million for a major initiative for wilderness and outdoor resources. Called "America the Beautiful," it is to be administered by the Departments of Interior and Agriculture. The purposes are to promote reforestation, enhance recreational opportunities, and benefit nationally significant natural and cultural resources.

For the "America the Beautiful" program, allocations to the Department of Interior, directed to the National Park Service, Bureau of Land Management, and Fish and Wildlife Service, include $205.1 million for a program called "Legacy **'99"** for Resources Protection/Recreation Operations ($156 million) and Construction ($49.2 million). Large as these numbers are, they are relatively small in comparison to expenditures for health.

The total commitment of financial resources to emergency care, safety, search and rescue for individuals with injuries and illness resulting from participation in vigorous, and perhaps hazardous, outdoor activities is unclear. Local services are usually involved in care as part of the overall health care and emergency systems. Most emergency services for search and rescue are incorporated in local sheriffs department budgets, and continuing care is absorbed into the hospital program.

Although information does not exist on the total of injuries/illness events in wilderness activities, one pilot study in Idaho is attempting to assess wilderness related emergencies presenting to the emergency rooms of five regional hospitals. As the pilot study proves to be promising, then the project could be expanded to establish a national data base for wilderness health (Blackman, 1991). Until the scope of the problem is recognized, it is difficult to establish economic costs of these services.

DISCUSSION

That wilderness natural resources are an extraordinary national asset is unquestioned. Benefits have been outlined and classified by Driver, Nash, and **Haas** (1987). The greatest single impact of these benefits is the overall effect on our quality of life.

At issue, rather, is the relative value of support for wilderness resources when compared with other national systems and services and the potential overlap of impact. Specifically, the enormity of the national expenditure for health care, especially as a percentage of the Gross National Product, requires constant re-examination for means of reducing its real and its economic need. Can anything be done to improve our collective state of health and to prevent, either primarily or secondarily, the need for the extraordinarily marvelous, highly technical interventions focused on end-stage disease? Perhaps relatively small economic outlays with appropriate encouragement could affect the nature, extent, and character of illnesses through prevention.

A wellness-illness cycle reflects the process of evolution of health (Erb, 1986). Beginning with exposure to risks, the vulnerable person may develop asymptomatic disease. The onset of symptoms signals the need for the subject to enter the medical system for acute care. The outcome may be a return of the subject to a functionally well state, or death, or some functionally impaired state (Figure 1).

Efforts to prevent disease by intervention early in the cycle reflect primary prevention; efforts to prevent recurrence after treatment are known as secondary prevention.

Distinctions between a "wellness system" and the existing "illness system" have been conceptualized (Lewis, 1978). Primary and secondary prevention are directed toward reducing demand on the very expensive acute care "illness system," but may be provided by the "wellness system." The "wellness system" is more of a non-system made up of heterogeneous groups, bodies, and individuals committed to maintaining health through various means, some accurate, some erroneous. The wellness system is unstructured and varies in products and delivery. As such, there is very little organized quality control. The distinction between the systems is reflected in Table 4.

Lifestyle, habits, and interests undoubtedly play a major role in health. Lester Breslow, M.D., **M.Ph.**, former chair of the UCLA School of Public Health, says, "It is what you do hour by hour and day by day that largely determines the state of your health,

whether you get sick, what you get sick with, and perhaps even when you die." The rational use of well managed, accessible wilderness resources could influence health by providing and attractive stimulus for healthy lifestyle.

The time has come to begin an appropriate assessment of the health impact and the economic cost of vigorous outdoor life. If prevention reduces costs of health care, then those savings could be used to provide and manage wilderness. In an effort to address the question of possible health benefits from wilderness activities and of possible economic justification for providing these resources from a health perspective, a series of related projects should be undertaken to include: 1) A data base for medical needs, to include collection and study of the types and extent of injuries and **illness** associated with wilderness activities; 2) Assessment of the cost and extent of providing medial services, including search and rescue for wilderness medial events; 3) Epidemiologic studies of impact of wilderness activities on risk factors and health; 4) Analysis of the economics of the vigorous lifestyle and the physical activity component of health maintenance factored out of health care expenditures; 5) Determination of the costs of providing the human use component of wilderness resources; 6) A mechanism for interfacing experts in wilderness management, economics of wilderness management, preventive medicine, sports medicine, epidemiology, methodology, and other specialties germane to resolving the question.

The issues relating health care, economics, and management of wilderness are of such complexity that the development of a mechanism for interfacing the authorities is of primary importance. In order to bring authorities in these fields together, we propose the following:

RECOMMENDATION

It is our recommendation that a group of authorities from the fields of health care, economics, and wilderness management be brought together in conference to address the issues of economic cost/health benefit of wilderness activities. Specific objectives should be:

1. To assist in establishing and maintaining a data base for health related wilderness injuries and illnesses.

2. To assess the epidemiologic evidence of the impact of wilderness activities on health.

3. To examine the influence of wilderness activity on health economics.

4. To consider the effects of health initiative on wilderness economics.

5. To assist in the design of a series of projects which could lead to a better understanding of these issues.

6. To develop a central mechanism for continuing dialogue for health related matters in the wilderness.

Using the 25 year model of exercise cost/health benefit experience, health care specialists, wilderness managers, and economists can begin such a study of the cost/benefit relationship of wilderness outdoor recreational activities.

Meanwhile, since it would take many years to arrive at a statistically significant conclusion from such a study, until such time as this initiative can become a reality, it would be prudent to assemble experts in these fields to provide their best "opinions" and advice on issues of cost/health benefit in wilderness activities.

Perhaps Oertel's dream will come true...that we can improve health by "walking, hiking, and mountain climbing' which can greatly influence the human body and...improve the general physical condition, **and...can** be used in rehabilitation in cases of poor health (Oertel, **1886)."**

Acknowledgement: The author is indebted to Professor Karl Stoedefalke, Pennsylvania State University, for the translation of Ueber Terrain Kurorte, by Professor M.J. Oertel (Oertel, **1886).**

REFERENCES

Acton, J. P. 1975. Measuring the social impact of heart and circulatory disease programs: Preliminary framework and estimates. R-1697-NHLI. The Rand Corporation.

Amler, R.W.; White, C.C.; Barry, M.K., et al. 1984. Closing the gap: Summary of leading risk factors. Proceedings of the Health Policy Project of the Carter Center of Emory University.

Balke, B.; Snow, C. **1965.** Anthropological and physiological observation on Tarahumara endurance runners. American Journal of Physical Anthropology. **23:293.**

Blackman, James. 1991. Personal communication.

Driver, B.L.; Nash, R.; **Haas,** G. 1987. Wilderness benefits: State of knowledge. Gen. Tech. Rep. INT No. 220. U.S. Forest Service. In: Proceedings, national wilderness conference. **294-319.**

Erb, B.D. 1986. Prospects for research and development in work physiology. **Annual** American conference of Government Industry Hygiene. 14: 411-419.

Groom, D. 1971. **Cardiovascular** observations on Tarahumara **indian** runner: The modern Spartans. American Heart Journal. **81:304-314.**

Hardwood, H.J.; **Napolitano,** D.M.; Kristiansen, P.L. et **al.** 1984. Economic costs to society of alcohol and drug abuse and mental **illness.** Research Triangle Institute.

Hatziandreu, E.I.; Koplan, J.P.; Weinstein, M.C.; Caspersen, CJ.; Warner, K.E. 1988. A **cost-**effectiveness analysis of exercises as a health promotion activity. American Journal of Public Health. **78:1417-1421.**

Health Care Financing Administration, Office of the Actuary. 1990. National Health Expenditures in 1988. Health Care Financing Review. **11:30.**

Helander, E. 1970. Economic aspects of the rehabilitation of patients with **cardiovascular** and **cerebrovascular** disease. **Acta** Cardiologia 26. Suppl. **XIV:53-60.**

Kannel, W.B.; McGee, D.; Gordon, T. 1976. A general **cardiovascular** risk profile: The Framingham study. American Journal of Cardiology. **38:46-51.**

Keeler, E.B.; **Manning,** W.G.; Newhouse, J.P.; Sloss, E. M.; Wasserman, J. 1989. The external costs of a sedentary life-style. American Journal of Public Health. **78:975-981.**

Leaf, A. 1973. Every day is a gift when you are over 100. National Geographic. **143:93-119.**

Lewis, **F.A.** 1978. Denver Medical Society. The **Illness/Wellness** System.

Morris, J.N.; Adam, C.; Chave, S.P.W.; Sirey, C. 1973. Vigorous exercise in leisure-time and the incidence of coronary heart disease. Lancet. 1:333-339.

Morris, J.N.; Heady, JA.; Raffle, P.A.B.; Roberts, C.G.; Parks, J.W. 1953. Coronary heart disease and physical activity of work. Lancet. **2:1053,** 1111.

Morris, J.N.; Kagan, A.; Pattison, D.C.; Gardner, MJ.; Raffle, PA..B. 1966. Incidence and prediction of ischemic heart disease in London **busmen.** Lancet. **2:553.**

Oertel, MJ. 1886. Ueber Terrain Kurorte, Leipzig F.C.W. Leipzig: Vogel Publishers.

Paffenbarger, R., Jr.; Wing, A.L.; Hyde, R.T. 1978. Physical activity as an index of heart attack risk in college alumni. American Journal of Epidemiology. **108:161-175.**

Pell, S.; Fayerweather, W.E. 1985. Trends in the incidence of myocardial infarction and in associated mortality and morbidity in a large employed population, 1957-1983. N.EJ.M. **312:1005-1011.**

Remington, R.D.; Schork, MA. **1967.** Determination of number of subjects needed for experimental epidemiologic studies of the effect of increased **physical** activity on incidence of coronary heart disease: Preliminary considerations. In: Karvonen, MJ.; Barry, AJ. Physical activity in the heart. Springfield, IL: Charles C. Thomas. 311-319.

Rice, D.P.; Hodgson, TA.; Kopstein, A.N. 1984. The economic costs of illness: A replication and update.

United States Department of the Interior. 1990. The Interior budget in brief, 1991, **fiscal** year highlights. January **19, 1990.**

APPENDIX A

In a Rand Report, **Acton** determined the human capital lost due to mortality by defining the net present value of expected earning **(Acton,** 1975).

The human capital or livelihood of a person **n** years of age is defined as:

$$L_n = \sum_{i=n}^{\infty} \frac{P_i E_i}{(1+r)^{i-n}}$$

Where:

L_n = human capital or livelihood of person **n** years of age.

P_i = probability of being alive the ith year.

E_i = expected earnings of that person in the ith year.

r = **discout** rate.

The major source of variation in human capital measures arises from different ways of accounting for housework and for the selection of a discount rate.

APPENDIX B

Helander approached rehabilitation from the perspective of the economic aspects associated with restoration of vocational ability (Helander, 1970). His estimate of the total economic result of rehabilitation was derived from loss of production, costs associated with handicap, costs of rehabilitation, costs of non-rehabilitation, and the economic value of the rehabilitated individual, as compared to a non-rehabilitated individual.

$$E_R = V_R - V_O - C^R + Y^T + A$$

Where:

E_R = economic result of rehabilitation.

V_R = economic value of rehabilitated person working in production.

V_O = economic value of the non-rehabilitated person.

C^R = costs of rehabilitation.

Y^T = costs of disability pension.

A = costs of replacing the individual with a non-handicapped person.

TABLE 1

STUDIES RELATING PHYSICAL ACTMTY AND HEALTH

AUTHOR	SUBJECT	METHOD	CONCLUSIONS
Leaf, A. (Leaf, 1973)	**3** Populations of Centenarians	Site Visit, Anecdotal	Longevity ± Due to Physical Activity and Genetics
Morris, J.N. (Morris et al., 1953; Morris et al., 1966)	London Bus Drivers Conductors 1949-1958 160,000 man years	Retrospective	Less CHD Among Conductors
Morris, J.N. (Morris et al., 1953)	Government and Postal Workers	Retrospective	Less CHD Among Letter Carriers
Morris, J.N. (Morris et al., 1973)	16,882 Male British Civil Servants	Questionnaire	**1/3** Less CHD with Vigorous Activity
Paffenbarger, R. (Paffenbarger, Wing, and Hyde, 1978)	16,936 Harvard Male Alumni	Questionnaire	**2,000 Cal.** Exercise Per Week Is Protective
Balke, B. and Snow, C. (Balke and Snow, **1965)**	Tarahumara Indians	Site Visit	Physiologic Measurements
Groom, D. (Groom, 1971)	Tarahumara Indians	Site Visit, Anecdotal	Physical Conditioning by Outdoor Exercise
Kannel, W.B. (Kannel, McGee, Gordon, 1976)	5,000 Framingham Residents	Prospective 30+ years	Risk Factor Identifications

Table 1. Studies relating physical activity with health indicate a relationship between frequency and intensity and positive health benefits.

TABLE 2

HEALTH BEHAVIORS AND OTHER RISK FACTORS

Health Behaviors

Smoking
High Blood Pressure
High Cholesterol
Diet
Obesity
Lack of Exercise
Stress
Alcohol
Drug Misuse

Other Risk Factors

Seat Belts Neglected
Solar Radiation
Ionizing Radiation
Work Site Hazards
Environmental Contaminants
Infectious Agents

Table 2. Most epidemiologists feel the 33.2 percent decline in death rate from cardiovascular disease between 1%9-1981 is due to changes in health behaviors such as dietary change, decreased smoking, and increased recreational exercise (Amler et al., 1984).

TABLE 3

RISK FACTORS AND TOTAL ECONOMIC COST OF ILLNESS

Behavioral Related 52.5%	
Smoking	9.2%
Alcohol	18.5%
Auto Accidents	6.4%
Other Injuries	11.8%
Drug Abuse	6.6%
All Others 47.5%	

Table 3. Data from Rice, Hodgson and Kopstein (1984) and **Harwood** et al. (1984) suggest over 52 percent of the total economic cost to illness is attributable to diseases resulting from behavioral factors.

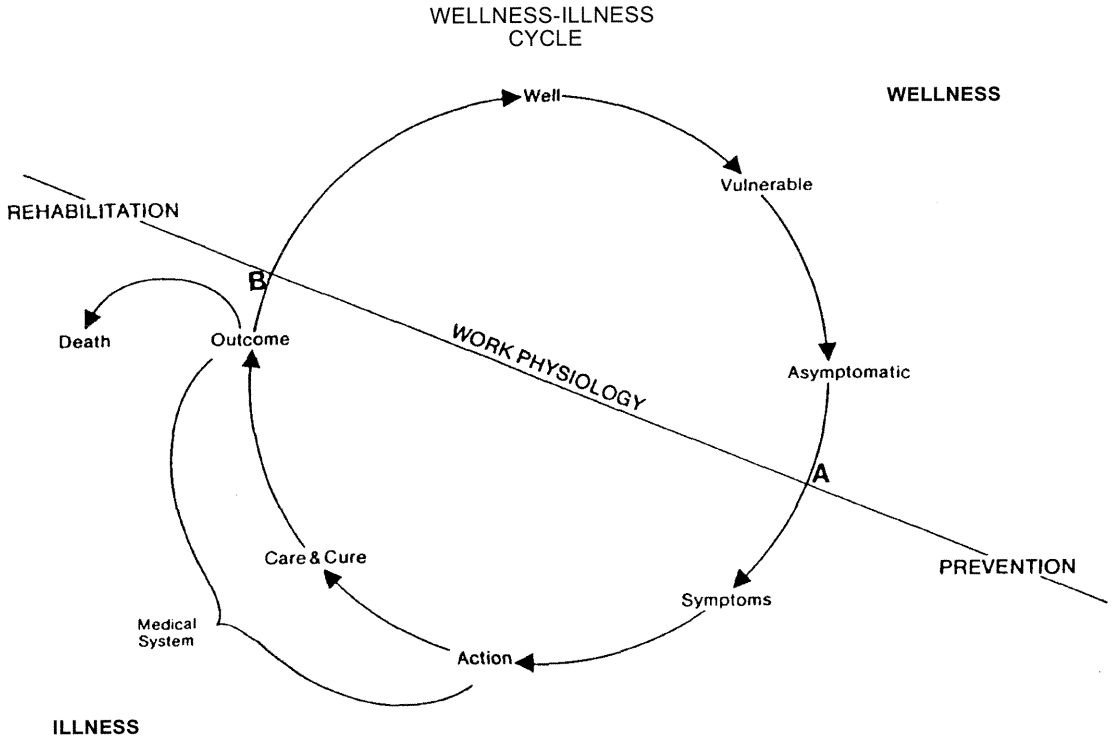
TABLE 4

CHARACTERISTICS OF THE ILLNESS AND WELLNESS SYSTEMS

CHARACTERISTICS	ILLNESS SYSTEM	**WELLNESS SYSTEM**
1. Authority	Organized Medicine	Other than Organized Medicine
2. Profession	Medicine	Public Health Preventive Medicine Health Promotion
3. Responsibility	Physicians	Diverse Groups in Society
4. Personnel		
a) Educational Requirements	Medical School	Medical School Not Required
b) Responsibility of Ancillary Personnel	Minor Function	Major Function
c) Delivered by:	Physicians Only	Also by Non-Physicians
5. Delivered to:	One at a Time	Groups Also
6. Financial Responsibility	Third Party Insurance	No Insurance
7. Marketing	Solicitation Unethical	Solicitation Essential

Table 4. Differences in structure, delivery, and financing the illness and the wellness systems. Rehabilitation and secondary prevention are at the interface between illness and wellness (Lewis, 1978).

Figure 1


WELLNESS-ILLNESS
CYCLE
Well
WELLNESS
Vulnerable
REHABILITATION
B
Death
Outcome
WORK PHYSIOLOGY
Asymptomatic
A
PREVENTION
Care & Cure
Symptoms
Medical
System
Action
ILLNESS

WILDERNESS, ITS ROLE IN OUR ECONOMY

Jerry **Covault***

This discussion is titled "Wilderness, Its Role In Our Economy," but it is not about how many dollars wilderness can bring into the local economy. It is not about money at all. I'm talking about why we need to change how we look at wilderness and the benefits we will get, economic and otherwise, when we make that change.

When we look at wilderness economically we often see it as a collection of natural resources with a protective ring drawn around them. To many this is timber that can't be harvested, oil that can't be drilled, and water that can't be ditched, tunneled, and dammed. This is not the way to look at wilderness, not the way to value wilderness, and not the way that wilderness can make the greatest contribution to our society and our economy.

We need to think of wilderness like we think of art. It has value just by being there. It will enrich our lives by its beauty, by its challenge to our minds, and by its tranquility. Wilderness offers us many values that we need to acknowledge. Then we need to work out ways to benefit from these values.

I suppose you could say that valuing wilderness as art isn't very close to dealing with the economic value of wilderness, but it's close enough to get this paper "in the door" at this conference, so let's proceed.

BENEFITS OF WILDERNESS

In the context of my topic, the benefits wilderness provides for people could just as well be thought of as economic, even though I am not talking about monetary increases. I am talking about people just being better off. Our quality of life is increasing because of what wilderness has to offer us, if we will use it.

Let's begin with the natural scenic beauty of wilderness. I want to emphasize the word natural. In today's world, most people do not see natural scenic beauty on a daily, monthly, or yearly basis. Many will never see natural scenic beauty. More and more we live in a built environment. Over half of Americans live in cities of more than one million people. There is outdoor beauty for them to see, tree lined streets, parks, cultivated agricultural land, even many wooded areas, but natural scenic beauty is not available where most people live. More and more people go to Disneyland or Disney World to see "magic mountains," rivers, swamps, sea life, and imitation animals. So, is wilderness important? I think so. We've established that art is important, and we need to accept that natural scenic beauty is important also.

From 1492 to the end of the **1800s,** the economic movement was to make the great American wilderness safe and more comfortable for a European type society. We did that but in the process began to lose sight of the natural beauty of the land. Forests were cut without regard for anything but making money.

The tall grass prairie of the **midwest** is described in wonderful detail as a beautiful place by James **Fennimore** Cooper in his prairie series books. It must have been a fascinating ecosystem with grass as high as a horse's back, hardwoods along the streams, and a cornucopia of wildlife thriving in the richness. There were elk, buffalo, grizzly, grouse, rabbits; it must have been something special to see and experience. Nobody alive today has seen this natural landscape. It has been gone for over 150 years. The tall grass vegetation has been replaced by row crops of corn and beans, by wheat and bluegrass. The buffalo, elk, and grizzly had to give way to hogs, cattle, and chickens. We are all living very well because of that change. But I wish we would have saved enough of the tall grass for us to go see, feel, experience, and learn from it. We should be able to enjoy its variety, tranquility and beauty. But we can't; it's gone.

We have lost much of our land's natural beauty because we did not know how to put a price on a sunset, the beauty of the prairie, a view of a free flowing river, or the sound of the mountains. Now we are left with only remnants of natural beauty in this nation. Most people live their day to day lives seeing and experiencing the "built environment." That isn't

*Forester, **Lolo** National Forest, responsible for programs in Recreation, Wilderness, Range, and Trails, Fort Missoula, Missoula, MT 59801.

necessarily bad, but it does emphasize the importance of the areas of truly natural beauty that remain.

Natural beauty is valuable to our quality of life. It is found in wilderness and it is scarce. In our economy, what is scarce increases in value!

WILDERNESS AS A VISION FOR GOOD

Our well-beii economically and otherwise, depends to a large extent upon how we think about and treat our environment. Of course, everything we do is a thought before it is an action. We think about how to take the water from a stream and transport it to an agricultural area or city before we do it. Everything we have or use was a thought before it was made into the product or the service. Even a simple pencil was a thought in a person's mind before it became a pencil.

It follows that to have a good environment in which to live, we have to have thoughts that lead to pleasant, safe environments. Wilderness is the kind of place that encourages people to think about the good land, the good life, and things that are really important - beyond making money - in this life.

It is obvious that "good" thoughts will be easier to generate if you are walking through a beautiful garden rather than a dump. It is worthwhile to have the ambiance that can encourage creativity and good thoughts. That may be why the best meeting rooms have pleasant surroundings and art.

Wilderness can do more for our minds than provide a setting that stimulates good thoughts. It can be an example for us to improve the world in which we live. Wilderness can provide a vision for us to work toward. There are a few people who can visualize and comprehend beyond what can be seen. These people have names that we know - Beethoven, Thoreau, Einstein, Hawking, and others.

But most of us need examples and experiences from which to draw. From those examples and experiences we can create a vision for making our place better. Wilderness can be an example and become a part of our vision to improve the place where we live. We **first** have to visualize cleaner air, cleaner water, recycled materials, and quiet, before we can make these things happen.

Return with me to the example of the lost tall grass prairie. It was a self sustaining ecosystem that produced tremendous amounts and varieties of vegetation and animal life. I mentioned how this variety of life was replaced by a relatively few exotic species, corn, soybeans, clover, bluegrass, and hogs, cattle, and chickens. **Almost** everyone would say this change has made our lives better. But we may have gone too far. These exotic plants and animals are sustained by machines, imported oil, chemicals, and, in many cases, imported water. Under this system the soil is being eroded at an alarming rate. We may not be able to sustain this type of land use. When you think about that, it's alarming! We don't have a vision of another way. There aren't tall grass examples of self sustaining ecosystems that we can think about and use as a model for better ways. A tall grass wilderness may have tremendous economic value for us now, but we don't have any left.

We can use the wilderness we have as an example or model to build a better vision of the environment where we live everyday. When we have the vision, we will do it.

WILDERNESS **AS** CONSCIENCE

A person's conscience is his point of reference for what is right and wrong. When a person acts opportunistically or unethically, he or she knows it. Conscience is there reminding them of how it should be if things were ideal. The person may change or may not, but the conscience is a reminder and the person is better for it.

Wilderness is the world's conscience for how we treat our environment. It is a very clear example of how a self-sustaining ecosystem works, of natural beauty and harmony.

When people visit wilderness and return to their built environment, questions of conscience will follow. Is the air where I live as clean as it should be compared to how it is in wilderness? Could the way I live be more in harmony with the earth's environment? What could be done to preserve more natural beauty in the built environment?

Like the person who doesn't always do what his conscience tells him, we will not make over our built environment to be like wilderness. There are those things we can do to make our environment better. With wilderness as our conscience, we know we should get on with it.

WILDERNESS, OUR SOCIAL CULTURE AND CULTURAL LANDSCAPES

Another benefit of wilderness is that it has shaped our values as Americans. It has been an important factor

in giving us our identity. Stories of the frontier and wilderness have been and still are an important part of the American culture. These stories have provided background for how we view ourselves as individuals and as a nation of people. It is by stories being told and written that people are drawn together and values are formed. When the stories are focused around places that can be visited and experienced our values are strengthened. We can all feel a little more like Paul Bunyan when we visit the "North Woods." When we have been to the wilderness we can respect and value the effort and endurance it took to live on this continent before there were roads and the built environment. We need wilderness to keep track of what those stories in the history books really mean and how our values have been shaped by the land. It is important to some people to be able to feel what it is like to go into wild land. Then we can better understand the stories that mold a culture and are able to create new stories that give definition to the values of American culture. It is equally important for many people to just know there is still wilderness in this country, even though they may never go there. It is something they value and want the nation to have.

It would be accurate to say wilderness is one of the cultural landscapes of America. Cultural landscapes are those pictures we get in our mind of a countryside. With that picture are the history and values of the people who live there, and the lifestyle associated with that landscape.

It is relatively easy for us to imagine a cultural landscape of New England. A red barn, a white church with a steeple, a winding road, and ridge forested with hardwood trees in the background. In the South, a cultural landscape is an antebellum plantation house with large white porch columns, cypress trees with hanging moss, and a woman in a **hooped** dress in the scene.

The Midwest's cultural landscape is rolling hills with row crops, a Victorian house, and the stoic farmer and his wife. In the West our cultural landscape probably has something to do with broad expanses of land, cows, horses, and maybe corrals. These cultural landscapes are important to people. They give definition to who we are, what we've done, and how we have come to live on the land. These landscapes are everyone's art, they form our stories and our music. Wilderness is an important cultural landscape in America.

It wasn't long ago that this country was mostly wilderness; today it is rare. More people need to experience it, learn about it, and come to value it as a part of our culture.

WILDERNESS CAN BE LOST TO ECONOMIC PRESSURE

I have been discussing the benefits wilderness can contribute directly to our quality of life: natural scenic beauty, a vision for what is good, a conscience when we consider more impact to our world, and a cultural landscape. I'm sure you can come up with some other benefits of wilderness that relate to our quality of life, including our economics.

Wilderness can be lost to short-term economic pressures. We all know this. It is the story of the systematic, progressive cutting of our forest land, conversion of prairie to agriculture and livestock grazing, commercial hunting, and strip mining. The fact that we now have a Wilderness Act and some level of wilderness awareness in the 90s does not mean all wilderness is safe from invasion for short-term economic resource extraction. We need to look at this issue with intelligence and concern.

Since the early 20s wilderness has been kept and preserved in this nation by a few people. They have worked very hard and very intelligently because they loved wilderness. Love of wilderness is not enough to sustain it indefinitely. The rules of our capitalistic economic system are too harsh to keep things that have monetary costs but no monetary return. Many people view wilderness that way. Those who take the **short-**term economic view of resources can only see wilderness as timber, water, oil reserves, habitat for big game, and grazing. These are very powerful forces in this country.

With the present drought in California, there is increasing talk of water transportation systems to bring water from as far away as Alaska to serve thirsty California. These systems have the potential to disrupt whole mountain range ecosystems. With this kind of discussion going on, there will soon be alternatives developing for tunneling and ditching the headwaters of the great Western rivers that have their beginnings in wilderness. This kind of activity is even allowed in the law.

Oil is another resource that may have such a powerful short-term benefit that we will justify going after it in proposed wilderness and even designated wilderness. The Badger Two Medicine country in Montana, adjacent to the Bob Marshall, and the interior of Alaska are two cases that are being considered now.

Big game has monetary value. There will always be the temptation to "improve" big game habitat in or adjacent to wilderness, to increase the number of these animals. This would be much easier than considering

what the wilderness resource really is. "Big game" are really animals that need to fit into the biologically diverse ecosystem with a normal age population structure that is sustained by the habitat and the natural changes it undergoes.

These and other threats to wilderness are reasons we need to think of the role of wilderness in our economy in long time frames and in the broad basic context of improving our quality of life. We need to resist considering short-term monetary returns that certain natural resources could provide.

WILDERNESS, **ITS** MONETARY CONTRIBUTION

We can strengthen the case to protect and perpetuate wilderness considerably if we are able to point to some real and short-term monetary benefits and jobs that result from wilderness.

To explore that, travel with me in your mind to Colorado, and consider another resource. Fifty years ago most people thought this resource was rather worthless, even a nuisance. But a few people started to turn it into a basis for small businesses. These businesses grew into a large and economically solid industry with off-shoots of other businesses. Finally this resource became the basis for a way of life that people came from throughout the country and internationally to experience. That resource is snow and the business is skiing.

Wilderness can be a resource that forms the basis for a variety of businesses. Together these businesses can form a major industry and even a lifestyle that others will seek. Succinctly, I can visualize it something like this. The outfitter industry, lodges, hotels, restaurants, travel agents, state departments of commerce, and others will cooperate to get the message to American and foreign publics. The American West is space, clean air, natural scenic beauty, and you can experience the wilderness beauty in a very civilized way. Of course, this is already happening. With movies like "Dances With Wolves" getting seven Academy Awards, the time is probably prime for increasing peoples' desire to come visit our wilderness and experience it. Wilderness can be the resource that is the draw that will bring people. These people will come because of wilderness and by doing that, support hotels, motels, lodges, outfitting, restaurants, transportation businesses, shops, travel agents, gas stations, cultural events, and a host of other businesses and enterprises.

But if all that happens, will wilderness be destroyed as we know it? Well, maybe not. Most people can visualize being in the heart of wilderness. Many of these people can be happy having their wilderness experience from a comfortable lodge in a "wilderness-like" place. People can be happy by either taking a guided motor vehicle trip through a wilderness-like area, or by hiking from hut to hut through high alpine wilderness-like country. The possibilities are endless, the economic opportunities are significant. To accomplish such a program will take marketing and the capital investment by private industry and government in quality facilities. This means everything from dust free roads to **fine** china in quality restaurants.

SUSTAINING WILDERNESS BY INCREASING AWARENESS

Would the economic benefits be worth the risk of degrading wilderness by overuse or overexposure? This needs to be explored.

Earlier in this discussion it was stated that in a capitalistic economy, those elements that are not valued are in jeopardy of being lost. Normally, we only value those things that we know. When we decide to keep something, it is because it has monetary or possibly emotional value. However, it is essential we recognize value or out it goes.

Let's consider an example, wild elephants. I've never seen a wild elephant; probably a few people in this room have; but most people in the world will never see a wild elephant. But we **all** know about them, from pictures, literature, and verbal stories. The only thing wild elephants contributed to the monetary world was ivory. It was worth a lot of money; so much so that the illegal killing of elephants for ivory was threatening the species with extinction. A few years ago people concerned about this started to let the world know the situation. A strange thing happened; people everywhere started to make the little personal decision, "I'd rather know there are wild elephants than have this piece of ivory, even though I will probably never see a wild elephant." Some countries passed laws against importing ivory. But it was mostly because of individual personal decisions throughout the world that the ivory market collapsed and the elephant population has received a measure of protection.

People knew about a resource, and they valued knowing it was there more than the monetary product that came from it. Wilderness can be like that. As taking care of our natural world becomes more broadly accepted and better understood, people will be drawn to wilderness and wilderness-like places. There will be more interest in reading about these places, seeing pictures of them, telling stories about them, and

experiencing the wilderness and wilderness-like places. People will travel there in their minds, through literature and film, like so many of us have enjoyed the Serengeti plain in Africa. This wilderness resource will enrich our thinking as well as our monetary well-being.

SUSTAINING WILDERNESS WHILE USING IT

To sustain wilderness while using it, there are some things we must do. They include: get users to respect and understand wilderness through education; improve our knowledge and technology in wilderness management; and use wilderness-like landscapes for a variety of wilderness type experiences for visitors.

WILDERNESS EDUCATION

The way to get wilderness users to respect it and take care of it is to educate them. There is nothing new here. We have many programs aimed at educating all kind of people about wilderness. An area of education that could receive more emphasis is through the outfitting and lodging industry. We could incorporate a fun, hands-on education as a keystone in the client's recreation experience. This will take innovation and effort, but that is what good businesses do well. The tourism industry needs to look at the long-term economic picture and see that educating people about the pleasures and benefits of being in wilderness or wilderness-like country will bring them back, with friends, year after year.

The ski industry learned this, and every ski area has a ski school. Ski schools get people involved and interested in the place and activity, and keep people coming back. Outfitters, lodges, and others, could get people involved and interested in wilderness-related activities. Some of these activities may be animal viewing and behavior observation, plant taxonomy and ecology, historic and prehistoric cultural resources, minerals and gems, and on and on. Education can be fun for clients, and the providers can profit as well.

KNOWLEDGE AND TECHNOLOGY

There is a need for more knowledge, through research to understand the wilderness resource, how people behave when they are there, and how to protect and sustain the resources with use.

Programs like pack-it-in, pack-it-out, and **light-on-the-**land packing and camping need to be developed further. We need to develop new programs that can protect the wilderness resource while people use it.

There is a need for more knowledge, through research, to understand the wilderness resource, and the elements of it. There is more to be known about fire and its effect on ecosystems and how much unconstrained **fire** our society and economic system will accept. We need to know more about wildlife and the relationship with habitat. We need to know more about how ecosystems sustain themselves and respond to change whether it is sudden like a fire, or gradual like a drought. We need more knowledge that can be put to effective use in better management systems.

WILDERNESS-LIKE LANDSCAPES

Sustaining wilderness is closely linked to having wilderness-like places. These are places where people can be in touch with natural scenic beauty, trails, and open, natural-appearing landscapes. Yet, they can enjoy the comforts of vehicle travel, a bed, warm showers, and other amenities many of us **find** necessary. These wilderness-like cultural landscapes can be restored and managed to treat many people to elements of the wilderness and the wilderness experience, to let the land introduce them to new thoughts, concepts, and feelings.

The resort industry needs to expand in these wilderness-like places and emphasize that experience. The Federal land management agencies which administer much of the wilderness-like land should re-examine policies to be more open and accommodating. They should work with the tourism industry and communities to provide wilderness-like experiences to the public. The ski industry has been successful in these types of partnerships with the Forest Service. Similar partnerships could be worked out to provide greater opportunities for the public to enjoy more of the great wilderness-lie landscapes on the public lands. Examples of this could be permitting new lodges at scenic lakes and other places of natural beauty on public lands. We can encourage a privately operated hut system for profit. We should encourage private industry to innovate new types of outfitting services on public lands. In general, we need to be creative in working with the profit-making private sector to serve the public. With this approach, many people will benefit and the wilderness will not be changed.

SUMMARY

The wilderness resource has economic contributions to offer. It is a place of harmony and natural beauty for the human mind to form thoughts for our collective good. Wilderness is a place to serve as our collective conscience to raise the standards of how we treat the earth, and thus ourselves. Wilderness can contribute monetarily by being a draw for people to come for their vacations, education, expanding knowledge, and recreation.

There is the danger of resource exploitation if wilderness is to serve in this role. There is the danger of losing wilderness to commodity resource values or neglect if it doesn't serve in this role. Wilderness can be sustained and still renew and educate people if we value it. If we develop knowledge about wilderness and commit budgets and managerial effort, we can have people use it and sustain it. Wilderness will be there to inspire and challenge us and be an arena for artists to bring us stories, songs, and pictures to make our lives better.

I think John Denver said it very well in one of his songs of the 70s:

I am the eagle, I live in high country
In Rocky cathedrals that reach to the sky.
I am the eagle, there's blood on my feathers
but time is still turning, they soon will be dry
And all those who see me and all who believe in me
share in the freedom I feel when I fly.
Come, dance with the west wind, touch all
the mountain tops, sail over the canyons and up to the sky.
And reach for the heavens and hope for the future
and all that we can be and more than we are.

Maybe we will yet understand what Thoreau meant when he wrote, "In wilderness is preservation of the world".

Part VIII. Special Reports

THE ECONOMIC VALUE OF WILDERNESS

Honorable Wayne Owens*

Thank you very much for inviting me; this is a pleasure. There is currently little data on the economic foundations and implications of wilderness, so I look forward to receiving your papers. Pm delighted that you undertook that subject. I have great respect for professional land managers; as professionals, I know many of you are earning less money doing what you are doing than you could in other areas where your talents would take you, and I have great regard and admiration for you. I am grateful to you for what you are doing.

I brought with me this evening my son, who is an attorney in Washington; you heard that I am an attorney; my second son begins law school this fall. That is probably more attorneys than we really need in the Owens family. I have a third son, with whom, for three summers running, I have attended the course at the Yellowstone Institute. Three or four years ago when I returned to Congress, after an absence of twelve years, I took him to Washington to be a Page at the invitation of a friend of mine in Congress, who appointed him, thinking "This is a wonderful opportunity for a father, for his son to see what he is doing, to have the opportunity to participate in these activities." My two older sons had an interest in the law and politics, and my younger son, I thought, could do with a little training. It was a great year and he really loved it; but at the end of the year he said to me, "Dad, if it is all the same to you, I would just as soon be a wildlife biologist so the world benefits."

You may know that this past week brought the resignation of Congressman Morris Udall from the House of Representatives, after 30 years of unparalleled service in environmental issues of this country. This great man, with his brother Stuart - both have been close personal friends of mine - have done more for landmark environmental legislation than any one, I believe, in the modern history of our country. The Wilderness Act of 1964, the Federal Land Policy and Management Act for the Bureau of Land Management, the Endangered Species Act, the Alaska Native Claims Act, the National Environmental Policy Act, the National Wetlands Act, the Surface Mining Act - all these and more from the 60s and the 70s really have laid the foundation for this great concern and care for environmental values, and these two great men had that impact. Unfortunately, in the beginning of the 80s, we began to see the whittling away of some of this fundamental legislation which has sharpened and protected our environmental interests.

As you may know, a distinguished resident of Jackson, Wyoming is Mr. James Watt, whose boss, Ronald Reagan, said, "Trees are the real cause of pollution in this country"; you may remember that story, he said it one day on an airplane traveling to a campaign meeting in 1980. He appeared on a campus, I think it was UCLA, the next day. Someone had tied signs on all the trees on campus, saying "Cut me down before I kill again." The political interference of members of Congress and office holders with the administration of those landmark bills and others, has been a very, very serious problem; the laws are under attack by people who want to eviscerate them. One of the best new environmental leaders is the man who replaced Mo Udall as Chairman of the Interior Committee - on which it is my honor to serve - Congressman George Miller of California.

The Yellowstone ecosystem, as everybody knows, is the world's largest ecosystem - they tell us at least - functioning in the temperate zones; the largest in the world is, perhaps, in Antarctica, for which two weeks ago the House passed a resolution, which I had introduced through the process, which places the House on record as favoring a natural park of wilderness, on all of Antarctica, favoring a ban on all mineral and oil and gas exploration for the next 99 years. That was a significant movement for the Congress. Our interest is to reserve those special areas as unspoiled locations for scientific exploration; it is the one best place on earth for academically-perfect baseline studies on ozone depletion and any other global climatic changes.

The Yellowstone ecosystem is much closer to us at home, and here I have worked to preserve the right of nature to reign supreme; if nature can't function in the national parks without political interference, where can it? The answer is "no place." That ideal is apparently even harder to achieve in Yellowstone, which is the crown jewel, as everyone knows, of our natural places

*U.S. House of Representatives, Washington, DC 20515.

in this country. Four years ago, visiting Yellowstone officially in my capacity as a member of the Parks and Recreation Subcommittee, I learned of the interference in the reintroduction of the wolf to Yellowstone. On the flight home, by hand, I wrote a bill directing the Park Service to implement the plan worked out by the land managers to reintroduce the wolf into the park. It created a lot of tension, but it has been rewarding at times. Last fall, that legislation basically was written into law, providing for a committee of local people from the three border states to write a plan for the reintroduction of the wolf. The wolf had been killed initially, as you know, because it howled at night and "ate small children." By official policy, it was eradicated from the lower 48. In this ecosystem, specifically, the local Senators and Congressmen, deciding they didn't only want to write law, they wanted to administer the system, had kept the wolf out. Well, they scored us again, I must tell you. The committee recommended initially that the park and the recovery area be elaborated beyond the park and the wolf reintroduced, then turned around and voted, in essence, conditions which make almost a mockery of the process of reintroduction of the wolf, and that now has put us back to step one, back to zero. This is a disappointment because it is hoped that in the national parks of this country, nature can reign supreme.

Two years ago, during the Yellowstone tires, I made a speech in which I said that the park would not be hurt, but would be renewed by the fires; that the fires would bring a whole new life to the park; and it has been rewarding, to say the least, to visit the park several times and to see that. You know, we need a return to the natural ethic. Not long ago, one of President Bush's junior aides, James Pinkerton, achieved a surprising amount of notoriety by suggesting that the country needed a new paradigm; no one was quite sure exactly what that meant, but the President used it in the State of the Union address. Paradigm, of course, is an example or a model, and has something to do with a different approach in a creative way of thinking. I'd like to use a similar term, a little more structured, in today's debate over the environment. I think it is time we establish a new environmental paradigm, a better, more ethical way of conducting our environmental agenda, a model by which we can commit ourselves to acting in concert with nature, not at cross purposes. An environmental ethic needs to take American traits into account, the deeply internalized American love for our environment, and our deep historic commitment to fairness and a high economic quality of life. Environmentalism must not degenerate into simply economic obstructionism; we have much more to offer than that. I believe there is a positive duty to devote much energy to help in the development of viable economic alternatives that are environmentally sound; that may not always be possible, but it often will be, if we are willing to make it a part of our thinking. We should present a creative, imaginative alternative so that those who have been perceived as just taking away will also have something to give in return. The Utah wilderness is as good an example as any, where this new emphasis could work.

Six years ago, we established in Utah a very small Forest Service wilderness before my return to Congress. Since my return, four years ago, I've been working to build political support in Utah and in Washington to establish what would be from my state the ultimate natural land bank, by placing ten percent of the state's land in BLM wilderness status. It is a different kind of wilderness in Utah; there are no trees; it is basically all red desert. From all that I've been able to ascertain in research, I sincerely believe that designation of Utah wilderness would not be economically harmful; it would probably be helpful to local economies. We will demonstrate that thesis in your meeting here, and I look forward, as I said, to receiving the benefit of your collective thoughts.

It has long been the contention of the environmental movement that environmental protection is compatible with sensible economic development; I believe that. But now is the time that we have to prove that assertion. Of course, we determined long ago that preservation of some of our most beautiful lands was worth the opportunity cost of not developing every acre. My conviction goes even farther; that the preservation of our most extraordinary lands on their natural estate is, quite often, their highest investment economically, as well as ethically. It is still the truth and will always be the truth, but we should also make an effort to reduce economic hardship, if, indeed, there is any, when we serve the greater good and preserve the best in our nation. We can work out solutions with logging. I'm involved with the Dixie Forest in southern Utah, trying to work out the problem where appeals are being made against every work plan of the Forest Service, trying to cut down the rancor between environmentalists and logging interests, trying to preserve the opportunity for economic growth in southern Utah; but with wilderness and with endangered species, with energy exploration, all of these areas are very important for compromise, careful compromise, so that the environmental value will be preserved. I have been thinking about this a great deal over the last few months. We will be increasingly required, obviously, to fully consider the human side of the wilderness equation. You may have seen the quote about me in Newsweek last week, from a man in Escalante, Utah, in the middle of my proposed wilderness area. To summarize real quickly, he said, "We'd like to hang him." That is not the kind of national press I normally look for, and I'm thinking

about getting a new press secretary, but it is a very natural outgrowth of the intense polarization and controversy surrounding my proposal for designating over live million acres of BLM wilderness. I told a man near Monticello two years ago, when he suggested the same remedy, that hanging a Congressman is not only personally repugnant, it is also a Federal offense.

I grew up in southern Utah, in Panguitch, a little town, an insular town, 1,500 people, all the people very much the same. They are all Republicans; all are Mormons; two people were once suspected of being Catholics. But it is a very, very small and very insular town; it is in the middle of the extraordinary red rock desert, where there are places more awesomely beautiful than the Grand Canyon, places that should be included in the most unusual wilderness country in the entire national system, which is approaching, as you know, 100 million acres in scope. As Bob Marshall said, What good is **1,000** freedoms without a wild place on the map to grow up in**?"** I want my grandchildren to have the same privileges I had, but now, because of a bit of resentment of environmentalists and wilderness, I have some relatives in that country who would barely admit to our common blood, they wonder how a good boy, a Mormon from Panguitch Utah, cannot only be a Democrat, but also a **preservationist.**

As we've all seen, this is not surprising. Support for the wilderness concept generally comes from the cities, not from rural America. Living in the wilds, the pioneer prizes only the works of man; that is inaccurate to a degree, because early Mormons spoke lyrically of red rock beauty, but they undertook to make the desert blossom like a rose. I propose to let the Utah desert blossom as a desert. But the relative popularity of the wilderness concept seems directly tied in the rural areas to the lack of local jobs, and in the cities to the crisis of suburban civilization. When the urban environment deteriorates, wilderness use increases; but rural America has always harbored deep suspicions about any regulation of their use of the land. In Garfield County, where I grew up, it is 89 percent Federally owned; to make things worse, the last few years have not been good for the economies in southern Utah, or for other small towns, most of them, in America. Traditional industries have suffered; the bottom fell out of the minerals market, along with oil and gas drilling in the nearly 80s; grazing became less economical; uranium became totally unmarketable, since its mining is much more costly in Utah than elsewhere in the world; timber operations are becoming less dependable. I was chairman on my high school class reunion last year at Panguitch. Only three, of the 37 who graduated 35 years earlier, still resided in the area. The one bright economic light is tourism, which, with its accompanying service industries, has increased remarkably; but there is a sincere reluctance on the part of local residents to accept the new opportunity; and all, or many, who condemn tourism make a living at it. Many residents continue to harbor the illusive, almost certainly unrealistic expectation that some day, somewhere, some exotic new mineral or inexhaustible source of a valuable old one will make the entire area prosper again; they complain that tourism brings only service jobs, at minimum wage. Because conditions are not satisfactory for any of these residents in southern Utah, they consider that my campaign for a. large wilderness and I, a local boy, who went East and worked for the Kennedys, have conveniently provided a focus for their frustrations and their deep fear of cultural extinction. My wilderness bill has become a boogeyman for southern Utahns and a scapegoat for rural economic woes. Are they justified in their fear of wilderness? Do we offer more than economic euthanasia to the communities of the West? I think we do; wilderness has become a dependable myth for explaining away current rural economic problems. Of course, the real reasons for Utah's economic difficulties go more toward international trade, the global mineral market, other economic shifts, such as developing new materials to replace traditional commodities, changing demographics, the traditional small town economic woes. The vast amount of de facto wilderness in southern Utah was imposed by economic reality; there is simply no profitable consumptive uses for the land, except some grazing, where hundreds of acres are required in a desert country to support a cow. More than a hundred years ago, a visitor on southern Utah told Ebenezer Bryce, for whom Bryce Canyon, 23 miles from Panguitch, was named, that he had an incredibly beautiful place to ranch; that may be true, Mr. Bryce responded, but it is one hell of a place to lose a cow.

One of the great myths surrounding wilderness designation is that wilderness is single use, as opposed to multiple use. Obviously, the law currently states that many vested opportunities can continue, even after wilderness designation. The most difficult challenge in promoting wilderness is to make the truth known, so unnecessary fears would be assuaged and legitimate concerns then can be addressed. We do not often deal with facts on the wilderness debate; we deal with perceptions and misconceptions. As Thoreau said, the frontier is wherever a man faces a fact, and that frontier has rarely been crossed in the discussions over Utah wilderness. This conference will be one step among many to dispel the half-truths and the misconceptions surrounding wilderness designation. It is a chance to spell out how wilderness can be a boon, not a bane to the distressed rural communities of the West. It wasn't long ago that I could be comfortable with simply establishing the correct environmental

position, in letting the economic chips fall as they may; but more and more, the political reality is, for those who want wilderness, that we must discuss economic alternatives as vigorously as we propose environmental protection. I can give economics more energy and I will; and, in doing so, we will all reap tremendous benefits, not just in public relations, but in depolarizing and rehumanizing the debate. Like it or not, we are all in this together - ranchers, loggers, hikers, four-wheelers, hunters, biologists, environmentalists, and lawyers. Wilderness areas will increase in relative value as other lands become developed. Routes or roads are everywhere, but roadless areas are few; at the same time, commodity extraction will become less important, as alternatives are devised and materials are conserved. Putting these trends together will mean that preserved wilderness will increase in value, while the market continues to decline for commodity extraction. There are cases where wilderness designation does represent a lost opportunity for development, although I think that will be rare in Utah. And in some cases, we will compromise the wilderness; that is the political reality of preservation politics. But the fact is that we've already decided, through intense national debate, that wilderness is worth some economic loss in foregone opportunities, because other opportunities and values are thus enhanced and preserved. The question was settled in 1964 with the passage of the Wilderness Act. Preservation of wilderness is essential for the preservation of quality of life; we must act to move wilderness values into the mainstream from the periphery in making new source development decisions. As a response to the efforts of my old colleague, Manny Lujan, to attempt to increase oil exploration in sensitive locations like the Alaska National Wildlife Refuge (ANWR), the question should not be "why wilderness," asked to people like us; it has to be "why not wilderness," asked to people like them.

The burden of proof must be shifted if we are to protect wilderness resources. The political hero of my youth, Robert Kennedy, for whom I worked, on whose staff I was privileged to serve, used to love to paraphrase George Barnard Shaw; that memorable phrase now seems appropriate, as we are trying to think ahead together about wilderness preservation: "Some men see things as they are and ask why," he would say; "I dream of dreams that never were and say why not?"; I dream of dreams that never were about preserving Utah wilderness and I say "why not?" It has to be there; we have the luxury; we can afford it. It is an absolute necessity to change America's public policy to provide first for equality in the law for non-consumptive users, all of us who love the land and who value natural beauty and natural creatures, and who believe that nature has given us incomprehensible loveliness; who believe that nature has given us far more than we can really comprehend, but has given us the sensitivity that we must protect it. All those who enjoy it, now must be willing to give of themselves to protect it. We can afford to change these destructive policies which glorify consumption on public land, and not permit less selfless lovers of the land equal protection and equal opportunity. Recreationists, as we define them, should not only have an equal place, they should really have priority, over those who get private economic gain. I do not seek to amend existing rights of individuals - mining, grazing, lumbering, whatever - but I speak of future policies which would serve the interests of all of the people.

Let me tell you about an example two years ago when a bill which would amend FLPMA, the Federal Land Policy and Management Act, was before my sub-committee of the Interior Committee. I offered an amendment to change the grazing board configuration to permit other users an equal place on that policy-making panel. No one else, of either party, from the West supported me, for political reasons that are obvious. But we can afford these changes; the financial costs are relatively small. The political costs can be paid, and are not usually fatal; they do appear high, sometimes, these political costs. But multiple use does not necessarily mean that every acre of land and every acre of water must be developed for as many uses as possible, with emphasis on private use for private enrichment. Much of our land and water can now be directed to uses which produce the greatest public value for consumers who don't consume, rather than those who know how to get the greatest private gain.

This is tough language for one from a Western public lands state, I know. Utah is, literally, two-thirds owned by the Federal government, and the people want to use it. The fact that the primary objective of public land laws in this country has been to encourage development of resources with the reward of private gain, appropriate in its time, and still appropriate in its proper boundaries, is the very reason that many of the public resource laws protect so poorly the rights of those recreational users who take only personal spiritual enrichment from America's natural beauty. So we must act to shift the burden of proof from those who seek to preserve public values, such as wilderness, to those who seek private gain from the beauty that belongs to all of us.

I am pleased, again, that you are holding this conference. It is critical to our success at preserving and maximizing the beauty, the natural richness that we have, and which Utah has in such great abundance. But the strongest arguments for wilderness preservation have not historically been based on

economics; the Wilderness Act did not get passed to make money. Other values were and are clearly predominant in this debate - the preservation of natural beauty holds its own irreplaceable value by itself; recreational values of wilderness are obvious; the protection of watershed is a benefit; so is the preservation of habitat for wildlife and fisheries. Air quality is even enhanced by the maintenance of forest preserves; the ever-diminishing genetic inheritance makes wilderness critical as a reservoir of biodiversity. Less quantifiable, but nevertheless real, absolutely real - so real that you can feel them at times - are benefits provided to the human spirit, both spiritual and psychological. The opportunity for solitude and refuge and vision in the Wilderness Act offers genuine therapeutic benefits in an increasingly arid and despoiled world; given all of these, I do stand as a supporter of wilderness. As Thoreau said, "I wish to speak a word for nature, for absolute freedom, and wildness." I also wish to speak a word for small towns; these two voices do not have to be separate. There is currently in my state, and in many others, too much tension, too much anger, too much mistrust.

I challenge the environmental community: help us to assuage the fears of local communities, to take them into account, and to help solve the problems which gave rise to those fears. Let us be willing to energetically promote environmentally responsible economic opportunities and the resolution of resource policy debates for higher humanitarian reasons, as well as political necessity. Let us show we care about the economic viability of rural America and commit ourselves to helping keep small towns alive; and as we preserve America's most spectacular natural gifts, caring concern can help lead us to success.

THE WILDERNESS DILEMMA: VALUE VS VALUES

W. Victor Rozek*

Let's start with some sobering facts and figures. These come from the World Resources Institute study "Promoting Environmentally Sound Economic Progress" by Robert Repetto:

> As we **enter** the last decade of the twentieth century, the pursuit of prosperity is influenced as never before by environmental realities. What is new is the growing realization that political and economic decisions - once made with an eye to particular regional or business impacts - must now be made with the earth in mind. The false dichotomy between commerce and nature is giving way as people come to see that development cannot be economically sound over the long term unless it is environmentally sound.
>
> Global environmental deterioration - a peripheral issue during most of the 1980s - is moving to the forefront of the political agenda of the industrial North.... Consider this century's explosive growth: world population has tripled, the global economy has grown twentyfold, and fossil fuel use tenfold. It took all of human history for the world economy to reach $600 billion in 1900, but it now grows by more than this sum every two years. Today's $15 trillion economy could multiply fivefold by the middle of the next century. The population curve is equally daunting. World population doubled from 2.5 to 5 billion between 1950 and 1987...and may not stabilize until it hits 14 billion.
>
> The basic reality is that the scale of human activity has grown so large that it is disrupting the planetary systems that support life.

Let's be clear on this. When we talk about environment, what kind of environment do we typically talk about? Why a fragile environment, of course. Well, nothing could be further from the truth. The environment has survived countless centuries of abuse: ice ages, periods of warming, floods, drought, volcanic eruption, meteor strikes, hurricanes, tornadoes, cyclones, earthquakes, and centuries of voracious human appetite. The environment is not fragile; it's hardy as hell. What is fragile are the conditions that support human life. The environment doesn't care whether this planet is populated by humans or thunder liirds or three headed tribolites. If we pollute it beyond its ability to support us, other creatures will evolve that thrive on carbon dioxide and industrial waste.

So here we all are at the National Conference on **the** Economic Value of Wilderness. How many of you would have come - or would have been allowed by your management to come, if the conference title had been the National Conference on the Aesthetic Value of Wilderness or the Intrinsic Value of Wilderness? Well, there you have it. That's precisely the problem: the economic value of wilderness. The featured belief of the industrial revolution. That's the paradigm: the belief that the primary and pivotal value of wilderness is always economic. That as much wilderness as we have lost and as little as remains, our decisions are based first on economics, second on social impact, and environmental concerns rate a poor and distant third. Wilderness can only have value if we either reverse the paradigm - as the World Resources Institute (WRI) study suggests - or if we develop new models that accurately cost the non-marketed, unpriced benefits of wilderness.

The inference here, of course, is that if we can figure out a way to "charge" people more for the use of wilderness than the resource miners can extract, then presumably we have an economic argument to preserve wilderness. That is a dangerously arrogant and vulnerable position - but quite consistent with the paradigm. Twenty centuries of Judeo-Christian ethics tell us that there are two basic units of measure on this planet: humans and resources. And resources are only measured by their value to us.

As applied to wilderness, the value of resources are measured by market forces. And those forces concern themselves only with extraction, production and consumption. How much does it cost to cut it down and haul it out, pump it from the belly of the earth, rip it from the mountainside and get it to market. The natural resource extraction industries - those wilderness-munching machines - do not concern themselves with the replacement cost of the resource. (Hell, even oil is renewable if you wait long enough.)

*General Manager, Native Forest Council, Eugene, OR 97404.

They benefit enormously from a faulty accounting system. Unlike other businesses, they zero-value their inventory. That's one way they can show enormous profits.

That is why, absurdly, we make no distinction in the value of a 2X4 that comes from a 40 year old tree and one that comes from a 400 year old tree. That is why the timber industry can replace that same 400 year old tree with a $1.85 seedling and call it square. The economic machine that we have operated for the past 500 years lives on growth, expansion, and consumption of virgin resources. It depends upon converting new territory into economic wealth. It's an ecosystem cruncher, always requiring new terrain. But we are near the end of frontiers, of virgin territory. We are perhaps the first generation that can clearly, albeit reluctantly, see we do not have limitless resources, limitlessly extractable.

Let's look at the last remaining 5 percent of our native forests. Are they birthright or boardfeet? Resource or remedy? Profits or priceless? Are they doing us any good just standing there in their splendid decadence? The enduring and essential values of native forests are screaming at us from clouded rivers, from dying fisheries, from denuded hillsides.

What is the value of clean air? Ask the people of Kuwait choking on the smoke of blazing wells. What is the value of pure water? Ask the people of Bangladesh who have none. What is the value of teening, healthy fisheries? The Columbia once boasted 20 million fish swimming upstream to their spawning beds each year (an annually renewable resource). The count is down to 2.5 million. With silt from clearcuts burying spawning beds, we have lost the sockeye on the Metolius, the fall chinook on the Willamette, and the coho on the Wallowa. In 1955 some 4,000 sockeyes journeyed up the Columbia to the Snake River. Last year two sockeyes made it. When you plan the next timber sale, how will you factor these values?

What is the value of a moderate climate? Six of the last ten years have been the hottest on record. Climatic severity and the force of natural disasters have increased. Listen to the screams. Our scientists tell us that global deforestation contributes mightily to the problem. Oregon is entering its fifth year of drought. Some are predicting that within the next 50 years the climate in central and northern Oregon, known for abundant rainfall, may closely resemble the desert climate of southern Oregon and northern California. Low altitude trees, accustomed to ample moisture, may not be able to adjust that rapidly to climatic changes and, stressed by chronic drought, may simply die. Will our forest managers be able to bend the ecosyste their will? Listen to the screams. We know tre attract moisture, like condensation on a glass of water. We know that 25-30 percent of all the 'rai in a forest comes from moisture in the atmosph condenses in the canopy and drops to the forest Yet the export siren howls most loudly; and, in feeding frenzy, we clearcut endless miles of our suspending all belief in cause and effect.

What is the value of a cancer cure? Just a few ago the yew tree was cut and burned as a weed Just another victim of clearcutting. We have sin found that a drug called taxol, made from the b the yew tree, offers cures for certain types of ca What other miracles does the forest hold? List the screams.

And what of biodiversity? If there is any single that runs through the scientific literature, it is t healthy ecosystem is a diverse ecosystem. Do w think we can go on indefinitely destroying the c products of tens of thousands of years of evolut replacing them with single-species tree farms, s them with herbicides to kill competing vegetati pesticides as a replacement for their natural im and fertilizers to cheat depleted soil? Do we re think we can go on doing that with impunity? to the screams.

Just in the last decade or two we have become with many new blessings of industrialization. warming, ozone depletion, acid rain, loss of biodiversity. These terms were virtually unkno a few short years ago. What new delights awa the next 20 or 50 or 100 years? To be sure, th screams are coming, and they will be much lo the ones we have so successfully ignored. Fac into your next timber sale.

Why is wilderness valuable? Because we've bi our ecological currency, and a depletion of ou ecological wealth should not be mistaken for i Because, as Dave Foreman puts it, wilderness repository of 3.5 billion years of shared travel we are damaging the gene pools of global life systems, perhaps beyond their ability to repair themselves. Because wilderness is the crucibl

Our technology thrusts ahead at mach speed, airship unaware of the destructive turbulence stream. It seeks to change the planetary body— from millenniums to milliseconds. But nature

John **McPhee** said it with eloquence.

> **Consider the six days of Genesis as a figure of speech for what has, in fact, been four billion years. On this scale, a day equals something like six hundred and sixty million years, and, thus, all day Monday until Tuesday noon, creation was busy getting the earth going. Life began Tuesday noon, and the beautiful organic wholeness of it developed over the next four days. At 4:00 p.m. Saturday, the big reptiles came on. Five hours later, when the redwoods appeared, there were no more big reptiles. At three minutes before midnight, humans appeared. At one-fourth of a second before midnight, the industrial revolution began. We are surrounded by people who think that what we have been doing for only one-fourth of a second can go on indefinitely. They are considered normal, but they are stark raving mad.**

Even if we stopped all environmentally damaging activity today, our children would still suffer our excesses. But surely we must move in that direction. The Native Forest Council has taken an uncompromising stand on the protection of our native forests because we have heard the screams. The patient is hospitalized and bleeding to death. We can't wait for every test result, every job guarantee, the pacification of every distressed community, the quarterly profitability of every corporation. The difference between genius and stupidity is that genius has limits. We have been taught all our lives that we are the crowning jewels of creation. Let us acknowledge our genius by acknowledging our limitations.

THE UNIVERSITY OF IDAHO TAYLOR RANCH WILDERNESS FIELD STATION

John C. Hendee, Jeffrey J. Yeo, Vito (Sonny) LaSalle, and James Akenson*

ABSTRACT

Under theWilderness Act-mandated conditions of naturalness and solitude, wilderness areas offer unique opportunities for research into natural and social phenomena. Since 1969 the University of Idaho has operated the Taylor Ranch wilderness Field Station in the heart of what is now the Frank Church-River of No Return Wilderness, the largest classified wilderness in the lower 48 states. The evolution of Taylor Ranch is described from exploration of the region in t1870s, the first homestead in 1900, acquisition by the University of Idaho in 1969, and subsequent development for research and education programs, including the addition of a former guest ranch building air-lifted seven miles by the I&ho National Guard in 1990 to create a new wilderness research and teaching laboratory. Also described are 25 years of research into wilderness wildlife habitat and behavior, vegetation response to natural disturbances, and baseline environmental monitoring and assessment. Recent efforts to strengthen and focus wilderness research and teaching at the station and general problems of funding wilderness research are reviewed as well as the growing value of wilderness for science and the need for programs to increase wilderness research.

INTRODUCTION

Wilderness areas contain the most natural, most protected places in our nation and thus provide unique opportunities to study and teach about natural systems and human responses to primitive conditions. Section 2(c) of the Wilderness Act acknowledges scientific and educational values broadly in defining wilderness as " undeveloped federal land. .. that. .. (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value" [P.L. 88-577 Sec. 2(c)].

The scientific values of wilderness areas were a recurring theme in the campaign to establish the National Wilderness Presentation System and were espoused by early leaders of the wilderness movement such as John Muir and Aldo Leopold. The central idea, which is even more important today, is that study of protected natural systems can reveal valuable knowledge that will be applicable everywhere, and by monitoring wilderness conditions we can learn about natural change and the extent to which human-caused changes are occurring elsewhere (Leopold, 1941). But the lack of dedicated wilderness research budgets, the remoteness of wilderness, and management regulations and policies limiting access and the means by which data may be gathered, have restricted the amount of research that has been conducted in wilderness. This is ironic, given that growing concerns about global change, endangered wildlife, critical habitat, and biodiversity make wilderness research toward understanding natural systems a higher priority than ever before.

Idaho, with more total classified wilderness and roadless land than any of the lower 48 states, has tremendous wilderness research and education opportunities. In 1969, the University of Idaho, at the urging of a young wildlife scientist, Dr. Maurice Hornocker, who recognized the potential value of a wilderness inholding to be used for research and education, purchased the 65-acre Taylor Ranch in the middle of the Idaho Primitive Area. The evolution of that inholding from homestead to its current status as the Taylor Ranch Wilderness Field Station of the University of Idaho Wilderness Research Center in the College of Forestry, Wildlife, and Range Sciences illustrates the value of a wilderness field station in facilitating wilderness research and education. It also raises questions about the development and use of a wilderness inholding, even for science and education, and the need to respect the naturalness and solitude of the surrounding wilderness.

*Dean and Professor, College of Forestry, Wildlife and Range Sciences, University of Idaho; Scientist/Manager, Taylor Ranch Wilderness Field Station and Adjunct Assistant Professor of Wildlife, College of Forestry, Wildlife and Range Sciences, University of Idaho; Forest Supervisor, Payette National Forest, Mccall, Idaho; Akenson was co-resident manager at Taylor Ranch from 1982-1990.

IDAHO'S TAYLOR RANCH WILDERNESS FIELD STATION

The Taylor Ranch Wilderness Field Station, in the heart of Idaho's Frank Church-River of No Return Wilderness[1], is a unique research and teaching facility. Situated on Big Creek, seven miles upstream from its confluence with the Middle Fork of the Salmon River, the ranch is located in a canyon bottom at 3,835 feet elevation, and is accessible by a 34-mile trail from the settlement of Big Creek, itself at the end of 87 miles of dirt road across the rugged South Fork of the Salmon River. Access by bush plane is permitted using the private air strip, a grandfathered use that predates the Wilderness Act ban on mechanized access.

History Prior to Wilderness Classification

The Taylor Ranch site where Pioneer Creek, Rush Creek, and Cliff Creek join Big Creek has been occupied by human beings for thousands of years. Archeological evidence indicates that aboriginal peoples resided nearby while hunting bighorn sheep and fishing in Big Creek. Nearby are the remains of Indian house pits and six miles downstream, near the confluence with the Middle Fork of the Salmon River, are impressive petroglyphs.

The first recorded white person to visit the vicinity was Dave Lewis, a Civil War veteran and packer and scout for the military during the Sheep Eater Indian campaign in central Idaho Territory. Lewis traveled the length of Big Creek for the military in 1878, and a year later was packing ammunition for a mounted company of military when they were ambushed by Sheep Eater Indians three miles upstream from Taylor Ranch[2]. The rock-lined ambush pit used by the "Sheep Eaters" during this battle is still visible. One soldier died as a result of this battle and is buried at "Soldier's Bar," two and one-half miles down-stream from the ranch. Dave Lewis probably made note of the attractive site near Pioneer Creek during his travels in the Big Creek Drainage, because 40 years later he would return to the site and play a major role in the region.

The first white residents at the Taylor Ranch site were Elix and Billy Bull, who staked a placer claim on Pioneer Creek and built a sod-roofed cabin in the fall of 1900. They abandoned their claim in 1902, heading for better prospects at Thunder Mountain. For the next eight years the cabin was unoccupied except for occasional hunters, miners, and trappers; but in 1910 John and Mary Conyer moved into the cabin from the old Caswell homestead six miles upstream. The Conyers ran cattle, built fences and a corral for their livestock, established a pasture hay field, and constructed a new cabin which is now the present day field laboratory. In 1918 the Conyers moved back to Cabin Creek to continue their cattle operation and Dave Lewis moved onto the site.

In 1918 Dave Lewis was in his early 70s. In addition to drawing a military pension, he made a living hunting cougars for bounty, guiding big-game hunters, trapping, and possibly a little prospecting. Probably the first big-game outfitter in the region, Dave had received national publicity for his cougar hunting prowess. "Cougar" Dave, or "Uncle" Dave as he was known, kept a dozen or more horses to support his hunting. He would meet his clients at Warren, the nearest railroad head 100 trail miles from the homestead at Pioneer Creek. At 70, Dave Lewis was still a tough frontiersman. Shortly after establishing residence at the Pioneer Creek homestead, some horse thieves thought they could take advantage of an old man and headed up Pioneer Creek with his entire string of horses, leaving Dave to pursue on foot. They were surprised when he met them at the top of the pass, peeling one of the thieves out of his saddle with his 44-40 carbine, later complaining he would have nailed them both if he had had his big gun.

As a well-known big-game guide, Dave Lewis introduced many prominent people to the wild, central Idaho region, including Idaho Governor H. C. Baldridge. While nearly 90 years old, Dave hosted a delegation of people who were evaluating whether the central Idaho tract should remain in a natural state for the benefit of outdoor enthusiasts and the wildlife inhabiting the area. Governor Baldridge expressed his first impressions of the Big Creek country while addressing the governor's committee on the proposed Idaho Primitive Area in December of 1930. Referring to his party's trip to the Dave Lewis ranch, Governor Baldridge stated[3], "It was the wildest country I've ever seen ... Few, if any areas in the United States, offer the opportunities of this section for hunting and fishing. The area comprises something over a million acres with perhaps 25 farms in the whole territory." The reference by Governor Baldridge to the 25 farms underscores the fact that area is wilder today than in that earlier era when many homesteads were located throughout the Salmon River country, many of them in the Big Creek Drainage where homesteaders subsisted or raised cattle to feed the men in the Thunder Mountain Mines.

In 1933 Jess Taylor made a pack trip into Big Creek. While hunting in the vicinity, he became acquainted with Dave Lewis and also noted the potential of the homestead as a guest ranch. In the fall of 1934 Jess purchased the ranch for $1,200, paying $500 earnest

money. The deed transfer was detained because Dave Lewis' legal administrator, Walter Estep, when returning from the ranch after witnessing the sale, was killed two and one-half miles upstream of the ranch by Frank Lobauer, at what is now known as Lobauer Basin. Rumors had it that Estep had been too attentive of Lobauer's wife. In 1935 Uncle Dave Lewis died at the ripe age of 93, after catching pneumonia from a drenching spring storm on the 34-mile ride from the ranch to Big Creek. Today, the 9,300 foot Dave Lewis Peak at the head of Pioneer Creek and a tributary stream of Rush Creek both bear his name.

Although legally owning the homestead, Jess Taylor moved to Boise in the fall of 1935 to begin a contracting business, and for years he **hired** a variety of caretakers to look after Taylor Ranch. In **1948,** Jess and his new bride, Dorothy, returned to pursue his dream of making the homestead into a guest ranch. In 1948 access into Taylor Ranch entailed a flight to Soldier's Bar and a two and one-half mile hike upstream to Pioneer Creek. But the Taylors meant business; they even flew a **500-pound** Monarch stove to Soldier's Bar and packed it on a horse to the ranch. A slip-scraper had been packed by mule from Big Creek in 1935; and with it, Jess and Dorothy converted a timbered, brushy flat into an air strip during **1948.** The first plane landed in 1949. Several buildings were constructed during the next few years. One client, writing about the Taylors, stated: "I watched them turn that land into a home in the wild. The cabins they built speak well of Jess'skills as a man and rugged individual. The only thing he couldn't change were the **rattlesnakes!**[4]"

As early as 1931, a telephone line ran down Big Creek to mines on Crooked Creek, and in the early 50s Taylor Ranch had a phone. The old oak-crank phone, and Dorothy's operator's license, are still hanging in their original place in the Taylor cabin back room. Some phone insulators are still visible along the Big Creek trail, but the advent of radio communication and the hassle of continual phone line repair ended the back country phone network in the early 60s.

The mid-50s to early 60s were prime years for the Taylors' outfitting business. Jess kept mowing machines on both sides of Big Creek to make hay for the livestock. Each March, Jess and Dorothy arrived at Taylor Ranch from Boise to prepare for the steelhead season. The fall **salmon** season and big game hunting were concluded prior to their departure for the winter. One fall Jess caught a **35-pound** salmon in the big hole about a mile downstream. During the 30s and early **40s,** mail was brought by dog sled down Big Creek as far as Cabin Creek, but dog sleds were replaced by air service in the 50s. For awhile the Taylors hiked the seven miles weekly to Cabin Creek for mail, until Jess successfully lobbied for mail service by plane to Taylor Ranch in the late 50s.

During the 50s and **60s,** Jess supplemented his income doing contract trail work for the Forest Service, and he worked the Rush Point and Cliff Creek trails into their present-day layout. Also during this era, the old suspension bridge at the mouth of Cliif Creek was replaced by a steel span bridge, with bridge segments flown to Taylor Ranch. Steel span bridges were also installed downstream across lower Big Creek and across the Middle Fork of the Salmon River at the confluence with Big Creek. Most packers were happy to see the old swinging bridges replaced, and so were their mules!

Transition: Guest Ranch to Research Station

Wilderness research at Taylor Ranch began in 1964 when Maurice Hornocker, then a graduate student at the University of British Columbia, made arrangements to use Taylor Ranch as winter headquarters for the first major study ever done on mountain lions (Hornocker, 1967). Between 1964 and **1967,** Maurice and his local professional houndsman, Wilber Wiles, captured numerous big cats drawn to the Big Creek basin by the wintering big game herds. They even kept captive mountain lions in a pen constructed along Pioneer Creek. Hornocker and his research drew national attention and were the subject of a National Geographic film documentary in 1973. But the most important result of Hornocker's research was to change the status of mountain lions in Idaho from that of bounty animal to big game species.

In the mid-60s the Taylors listed the ranch for sale and put their outfitting business on lease. It was then that Maurice Hornocker convinced both the University of Idaho and Jess Taylor of the potential value of the **65-**acre Taylor Ranch as a wilderness research field station. Consequently, the ranch was purchased by the university in **1969** for $100,000. It was anticipated that if the university invested several years of operating funds, the field station would become self-sufficient, funded by research grants. That vision has not been realized.

From 1970 to 1982, the ranch was operated by various outfitters under arrangements with the university to provide support for research. During this period, a cook house was built, a pack shed and storage shed were added, and then finally a bunkhouse adjacent to the cook house.

Periodically, more research projects were developed by faculty to take advantage of the new wilderness field station. During the 70s, Dr. Maurice Hornocker supervised two graduate students in major studies staged from Taylor Ranch. John Seidensticker studied mountain lion home ranges in the first radio-telemetry study of cougars (Seidensticker, 1973), and Jim Claar looked at big game winter range conditions and utilization (Claar, 1973). In the summers of 1975 and 1976, Dr. Mike Falter and his graduate student, Ed Buettner, studied aquatic biology of highland streams near the ranch (Buettner, 1977). In 1978 John Hartung, a graduate student of Dr. Jim Fazio, documented the historical resources along the length of Big Creek and its major tributaries (Hartung, 1978).

From 1975 to 1980, ten undergraduate student research projects were conducted under faculty guidance. Students were selected based on their submitted proposals, and topics ranged from surveys of raptors and rattlesnakes to the ecology of grouse and small mammals. All but one of the projects focused on wildlife. Eleven reports resulted from the ten studies, with two undergraduates subsequently publishing articles based on their experiences at Taylor Ranch in professional journals (Elliot, 1977; Thurow, 1978).

1980–1990: Wilderness Classification and Increased Research

The Central Idaho Wilderness Act of 1980 (P.L. 96-312) established the River of No Return Wilderness of 2.2 million acres surrounding Taylor Ranch and the Big Creek drainage. Aircraft landings at existing air fields would continue as uses predating the Wilderness Act. With the added protection of wilderness classification, and a growing research program, the university made additional commitments. In 1982 Jim and Holly Akenson were hired as year-around Taylor Ranch co-managers and the outfitter's lease was terminated. A management plan was written, including a policy of only research and business-related landings for the airfield (University of Idaho, 1988). Mules and a string of horses were acquired and a national weather service recording station was established at the ranch.

With year-round support at the ranch, and the growing interest by faculty, research in the adjacent wilderness increased. In the early 80s Greg Hayward and Pat Hayward, under the direction of Dr. Oz Garton, carried out studies of habitat partitioning and use and population biology of forest owls. This major research effort led to the discovery of a new breeding species and expanded knowledge of the boreal owl, which is now a key indicator species for high elevation spruce-fir forest?. Also during the early 80s, Gary Koehler, under direction of Dr. Maurice Hornocker, investigated the ecology of bobcats (Koehler 1987, 1989). During the three years of this study, Koehler and his crew covered immense distances, capturing and tracking the radio-instrumented bobcats, a distance estimated as equivalent to traveling to San Francisco from Taylor Ranch and back. During the same era, Sue Tank investigated habitat relationships of wintering passerines under Dr. Winifred Kessler (Tank, 1983; Tank and Sidle, 1986).

In 1983 Dr. Frank Leonhardy began a major archeological investigation of the settlement and subsistence patterns of Sheep Eater Indians, including excavation of a cluster of house pit sites half a mile downstream from the ranch (Leonhardy, 1985). One of Leonhardy's graduate students, Fred Thomas, completed a master's project on the utilization of mountain sheep as a food source and hunting strategies used by the local Sheep Eater Indians (Thomas, 1984). Gary Koehler completed field work on the bobcat study in 1984 and then moved into a re-evaluation of the mountain lion population study for Dr. Maurice Hornocker. During the winters of 1985 and 1986, a team of biologists and houndsmen, led by Howard Quigley from Hornocker's Wildlife Research Institute, captured 21 mountain lions (Quigley, Koehler, and Hornocker, 1987). In the mid-80s, two bighorn sheep studies were implemented under Dr. Ernie Ables by graduate students Jim Bennett and Holly Akenson, whose master's thesis will report on behavior and relationships of bighorn sheep, mule deer, and elk on Big Creek winter range, based on observations from Taylor Ranch with a spotting scope.

In 1986 a student internship program was initiated, which provided summer learning opportunities for undergraduate students who assisted on research projects and did ranch work. Since then, student interns have helped perform ranch maintenance and collect data on noxious weed surveys and range condition transects, small mammal sampling, and campsite inventories, while learning wilderness skills and appreciation. With help from the interns, a major study of monitoring wilderness conditions and experiences was carried out, partly near Taylor Ranch but in other wilderness areas, too, by Linda Merigliano under supervision of Dr. Ed Krumpe (Merigliano, 1987, 1989; Krumpe, 1985; Merigliano and Krumpe, 1986).

To expand support for the growing research program, a pole barn was constructed to store hay for the mules and string of horses, and the old cabin built by the Conyers in 1911 was converted into a field laboratory. By this time the Taylor Ranch field station was attracting national attention. A documentary of

research activities at the field station and the isolated lives of resident managers Jim and Holly Akenson was aired on many public broadcasting stations around the country, and the magazine ***I&ho, the University*** featured stories on Taylor Ranch (Savage, 1986, Pritchett, 1986; Akenson and Akenson, 1986; Moors, 1989). During late winter of 1987, ABC filmed Dr. Maurice **Hornocker** and his staff catching a mountain lion near the ranch. Subsequently, this research was featured on ***Good Morning America.***

By the late **80s,** summers at the ranch became very busy with research projects and the intern program. Dr. Jim Peek established vegetation plots and transects and remeasured several old **exclosures** for a continuing range utilization study which will provide an important record of plant and animal response to removal of grazing several decades ago (Peek, 1988). Drs. Steve Bunting and Penny Morgan evaluated the spread of spotted knapweed; Dr. Wayne Minshall and graduate students from Idaho State University surveyed aquatic invertebrates on Big Creek and assessed the responses of streams to major wildfires in 1988; and an automated meteorological and atmospheric monitoring station was established in cooperation with the Idaho National Engineering Laboratory. Responding to alarm over unexplained bighorn sheep die-offs in the northern Rockies, a major bighorn sheep study was initiated in 1988, in cooperation with Idaho Fish and Game, to study wilderness herds in Big Creek, where there is no contact with livestock and little disturbance by people.

By the summer of 1990, the physical capacity of the ranch was often saturated, despite strict observance of the policy that air field use was allowed only for university business, research, or education. About 30 wilderness resource projects had been completed or were in progress and summers were busy with a **three-**week field course, the student intern program, ranch maintenance, and research projects to be assisted. In 1990 Dr. Jeff Yeo hosted two sections of ***12*** students each from San Francisco State University's **Wildland** Studies Program, with several students turned away because of wilderness and housing limitations. Some international visitors interested in wilderness research were hosted, including delegations from South Africa and the Soviet Union.

The costs of operating Taylor Ranch have been a continuing concern. Limited funding for wilderness research demanded scientists with creative approaches and a strong desire to work in wilderness. Most research was "recruited" by urging faculty with funding to use the vast wilderness laboratory that was accessible from the ranch, Initial budgets for operation and maintenance of the Taylor Ranch field station averaged $10,000 per year, climbing to about $29,000 by 1986, and falling under recent cuts to about $25,000 today. These monies must cover all expenses, including airplane charter, propane, mail, food, and supplies, which must all be flown in, building maintenance and repair, and livestock expenses. Support for student interns and research costs not covered by outside grants and contracts must come from other budgets.

Getting **Ready for the Future: 1990 and Beyond**

During the summer of 1990, with resident co-managers Jim and Holly Akenson planning to leave for other career opportunities, some major changes were initiated to reduce costs and further strengthen wilderness research and education programs. The position of **field** station resident manager, a job shared by Jim and Holly the past eight years, was upgraded to that of scientist/manager and Dr. Jeff Yeo, a wildlife biologist, was hired for the position. Horses and mules at the ranch were reduced from nine to four, to be kept at the ranch during summers only, thereby reducing the need for putting up so much hay. Education would play a bigger role, including University of Idaho sponsorship of the "Field Research in Wilderness Ecology" course taught the previous year by Dr. Yeo. The intern program would continue, but focus even more on initiating long-term field studies and providing research assistance.

A major change during 1990 was the addition of a building moved from the former Lanham Guest Ranch seven miles upstream at Cabin Creek. The Lanham Guest Ranch was purchased by the Forest Service in 1974 as part of their effort to buy up wilderness inholdings. Their original plan was to destroy the cabins on-site to restore wilderness naturalness and solitude. But strong sentiments by Big Creek residents and others opposing destruction of the attractive buildings had prevented action the past fifteen years, during which the cabins stood locked and empty. In the summer of 1986 the **Hendee** family camped in the cottonwoods in front of the buildings and lamented that one of the nicer buildings wasn't located at the Taylor Ranch field station, where it could be used to support research and education. After further investigation of the feasibility of moving one of the nicer buildings, a 61-foot by 24-foot log structure, to Taylor Ranch, the move was proposed to the Forest Service. Payette National Forest Supervisor Vito **"Sonny" LaSalle** liked the idea and initiated the extensive environmental analysis that would be required to move the building and naturalize the Cabin Creek site.

The initial idea was to dismantle the cabins log by log and float them a mile down Cabin Creek to Big Creek, and then six miles downstream to Taylor Ranch. Unfortunately, the logs were connected by steel pins and, thus, entire wall sections had to be kept intact. The Forest Service and the university approached the Idaho National Guard to see if they could move the cabin as a community service and training exercise. After General Manning of the National Guard visited the site with Governor Cecil Andrus, the project was approved (Movius, 1991). During a three-week period in July 1990, the cabin was disassembled, transported by forklift and mule wagon to the Cabin Creek air strip, and then air-lifted to the meadow at Taylor Ranch, where it was reconstructed. The goal was to complete the project with minimum use of mechanized equipment, although some use of a reciprocating saw was needed to cut spikes, and a forklift was used to transport a few sections of wall about 1,000 feet to the air strip because they were found to be too heavy or awkward for transport by mule wagon.

Everyone connected with the airlift was concerned about the temporary impact on wilderness solitude and wildlife. Between June 20 and July 11 there were 58 helicopter or **fixed-wing** landings associated with the project. The idea behind the project was that the **long-**term benefits to wilderness, from the research that would be enhanced by the expanded facilities at Taylor Ranch, would outweigh the temporary impacts. When a bull moose trotted from the old Lanham Ranch site at Cabin Creek just as a Forest Service and university team approached for a final inspection, it seemed like a good omen. Today the Cabin Creek site is restored to its pre-1940 condition, and the new Wilderness Education and Research Laboratory provides classroom, laboratory, kitchen, and sleeping quarters for four at the end of the meadow at Taylor Ranch.

Future Plans for Wilderness Research and Education

The Taylor Ranch Wilderness Field Station sits in the middle of the largest wilderness complex in the lower 48 states. Big Creek and three side streams cross the property and **only** occasional hikers pass the ranch on the Big Creek Trail, although outfitter spike camps in the surrounding high country are full of hunters during deer and elk season. Adjacent big game herds spend all their seasonal cycles in the wilderness, affected only by the fall hunt and natural predators and influences. Future research at Taylor Ranch will continue to take advantage of these natural conditions, with a focus on environmental monitoring and assessment. The weather station, air quality monitoring station, and, in the future, water quality monitoring will provide more information on environmental influences. Such information will support studies of response to natural events and will provide a point of reference for continuing studies of vegetation, fire, and wildlife populations and behavior. Long-term monitoring, baseline studies, and comparative studies with managed situations are anticipated. The **field** station will be a staging area as much as possible for research and education conducted in the surrounding wilderness, and not concentrated just at the ranch.

Because we want to respect the spirit of wilderness, we struggle with questions such as: Is it proper to use a chainsaw on the property to cut a winter's firewood supply? What about propane refrigerators for food and to preserve scientific samples? Is solar electricity appropriate for the specimen preparation laboratory? Is solar electricity preferable to a low-head hydro source from one of the streams? What about microwave transmission of data — or even the **battery-**operated air quality and weather monitoring stations? These are the issues we struggled with in the university wilderness research center" plan (University of Idaho, 1988). Even on a private wilderness inholding, we need to strike a balance between the spirit of the wilderness and the use of modern scientific techniques to discover her secrets.

But where do we draw the line and provide research support that will attract good scientists and allow them to do competitive work at an affordable cost? The answers are not easy. But we will draw the line to feature studies that deoend on wilderness conditions that are not available in managed environments **(Hendee,** Schoenfeld, and Peek, 1981). Guidelines for research in the surrounding wilderness are outlined in the Frank Church-River of No Return Wilderness Management Plan (USDA, 1985). These guidelines encourage research, but restrict permanently established or instrumented sites, even for long-term monitoring.

Funding Wilderness Research at Taylor Ranch and Elsewhere

We are proud of the impressive list of studies that have been staged out of Taylor Ranch. But it's not really a research program, although Hornocker and colleagues made major contributions to knowledge about cougars and bobcats, as did Garton and the **Haywards** on owls. It's more a collection of studies, opportunistically implemented by faculty who were interested and had funding. A research program requires base funding for continuing studies, and there is a great need for such funding to support wilderness research programs at Taylor Ranch and elsewhere.

We have a diverse National Wilderness Preservation System: more than 90 million acres of the most natural remaining areas in our country, managed by four Federal agencies and located in every region and 44 states. The nation needs a national wilderness research program directly applicable to all these agencies and all wilderness. There is such a program for forest management research. A new funding program for wilderness research could be established, following the model of the McIntire-Stennis program that funds forestry research in the nation's land grant universities by allocating money to each state according to its timber inventory and harvest. A new program might allocate wilderness research funds to states according to their acreage of classified wilderness (Hendee, 1989), or perhaps a new Federal block grant program could support wilderness research. Research could be directed toward environmental monitoring and assessment or visitor management studies to harvest the scientific values of our wilderness system and to support its management. We need a wilderness research funding system so that facilities like the Taylor Ranch Wilderness Field Station and the scientists who would go there to study can achieve their potential for discovering the scientific secrets that wilderness holds.

CONCLUSION

The history of Taylor Ranch mirrors the evolution of society's view of wilderness. In the early part of this century, Dave Lewis homesteaded the site that is now Taylor Ranch. He supported himself in part by killing mountain lions for bounties. In the middle part of this century, Maurice Hornocker developed the first major study of mountain lions, which put an end to the Federally-subsidized bounties paid for killing mountain lions in Idaho. Now in the last part of this century, we are starting to focus on more than just single species, to focus on whole communities and landscapes, a focus on the wilderness resource. This is the next wilderness frontier - research and monitoring to discover more about natural systems and how to protect them, and what they have to tell us about what we're doing to the rest of the world.

REFERENCES

Akenson, J.; Akenson, H. 1986. Selected journal entries. Idaho The University. 4(2):18-20.

Bloedel, E.E.; Bolle, A.; Briggle, W.J.; Christie, B.; Elser, A.; Frome, M.; Kelly, J.M.; Krumpe, E.E.; Miller, M.; Plenert, M.; Williams, R. (n.d.). Wilderness management - A five-year action program. Unpub. Moscow, ID: University of Idaho. 12pp.

Buettner, E. 1977. Ecology of selected streams in the Idaho Primitive Area. Moscow, ID: University of Idaho. 56 pp. Thesis.

Claar, J.J. 1973. Correlations of ungulate food habits and winter range conditions in the Idaho Primitive Area. Moscow, ID: University of Idaho. 85 pp. Thesis.

Elliot, C.L. 1977. Easternmost record of the band-tailed pigeon in Idaho. West Birds. 8:107.

Frome, M. (ed.). 1985. Issues in wilderness management. Boulder, CO: Westview Press. 252 pp.

Garton, Edward 0.; Hayward, Patricia H.; Hayward, Gregory D. 1989. Management of prey habitats and populations. In: Proceedings western raptor management symposium. Washington, DC: National Wildlife Federation. 298-304.

Hartung, J.W. 1978. Documentation of historical resources in the Idaho Primitive Area, Big Creek drainage. Moscow, ID: University of Idaho. 162 pp. Thesis.

Hayward, G.D. 1983. Resource partitioning among six forest owls in the River of No Return Wilderness, Idaho. Moscow,ID: University of Idaho. 132 pp. Thesis.

Hayward, Gregory D. and Edward 0. Garton. 1983. First nesting record for boreal owl in Idaho. Condor. 85:501.

Hayward, Gregory D.; Garton, Edward 0. 1984. Roost habitat selection by three small forest owls. Wilson Bulleton. 96(4):690-692.

Hayward, Gregory D., Hayward, Patricia H.; Garton, Edward 0. 1987. Movements and home range use by boreal owls in central Idaho. In: Proceedings - northern forest owl symposium. Winnipeg, Manitoba.

Hayward, Gregory D.; Hayward, Patricia H.; Garton, Edward 0.; Escano, Ronald. 1987. Revised breeding distribution of the boreal owl in the northern Rocky Mountains. Condor. 89:431-432.

Hayward, Gregory D.; Garton, Edward 0. 1988. Resource partitioning among forest owls in the River

of No Return Wilderness, Idaho. Oecologia. (75):253-265.

Hayward, G.D. 1989. Habitat use and population biology of boreal owls in the northern Rocky Mountains. Moscow, ID: University of Idaho. 113 pp. Dissertation.

Hayward, Gregory D.; Hayward, Patricia H.; Garton, Edward 0. 1991 (in press). Habitat use and population biology of boreal owls in the northern Rocky Mountains. Wildlife Monographs (in press).

Hendee, J.C. 1989. A futures agenda for wilderness in the natural resource professions. In: Proceedings, 1989, Society of American Foresters annual convention. Spokane.

Hendee, J.C.; Schoenfeld, C.; Peek, J. 1981. Wilderness wildlife: Research opportunities and limitations in designated wilderness areas of the United States. Kyoto, Japan: IUFRO World For. Congress. 11 pp.

Hornocker, M.G. 1967. An analysis of mountain lion predation upon mule deer and elk in the Idaho Primitive Area. Wildl. Monogr. 21. 39 pp.

Koehler, G.M. 1987. Demography of a low productivity bobcat population. Moscow, ID: University of Idaho. 27 pp. Dissertation.

Koehler, Gary. 1989. Demography of a low productivity bobcat population. Journal of Wildlife Management. 53:197-202.

Krumpe, E. E. 1985. Wilderness monitoring. Moscow, ID: Wilderness Research Center, University of Idaho. 33 pp.

Krumpe, E. E. 1990. A legacy of wilderness management: A link between two national wilderness management conferences. In: Lime, D.W., ed. Managing America's enduring wilderness resource. conference proceedings. 1989 September 11-17; Minneapolis, MN; 34-37.

Leonhardy, F.C. 1985. Archaeological excavations in the River of No Return Wilderness area. Unpublished, presented at the NW Anthropological meetings, on tile: Moscow, ID: University of Idaho Wilderness Research Center. 6 pp.

Leopold, A. 1941. Wilderness as a land laboratory. The Living Wilderness. 6(3):3.

Merigliano, L. L. 1987. The identification and evaluation of indicators to monitor wilderness conditions. Moscow, ID: University of Idaho. 273 pp. Thesis.

Merigliano, L. L. 1989. Indicators to monitor the wilderness recreation experience. In: Lime, D.W., ed. Managing America's enduring wilderness resource. Conference proceedings, 1989 September 11-17; Minneapolis, MN: 156-162.

Merigliano, L.L.; Krumpe, E.E. 1986. Scientists identify, evaluate indicators to monitor wilderness conditions. Park Science. 6(3):19-20.

Moors, D. P. 1989. Testing the limits: Have we gone too far? Idaho The University. 7(2):16-21. [Soviet visit to Taylor Ranch.]

Movius, Andrew. 1991. 248th: Mountain cabin movers. Field Strip. Idaho National Guard. XI(2) Winter 1990-91:18-19.

Peek, J. M. 1988. Vegetation studies in the Middle Fork, Salmon River, June 1988. Unpublished report. Moscow, ID: Department of Fish and Wildlife Resources. 27 pp.

Pritchett, J. 1986. UI anthropologist tracks Idaho's shadowy people. Idaho The University. 4(2):16-17.

Quigley, H.; Koehler, G.M.; Hornocker, M.G. 1987. Mountain lion population dynamics over a 20-year period on Big Creek in central Idaho. Unpublished report. Moscow, ID: Wildlife Research Institute, University of Idaho.

Savage, G. 1986. Taylor Ranch. UI's unique wilderness resource. Idaho The University. 4(2):13-21.

Seidensticker, J.C. 1973. Mountain lion social organization in the Idaho Primitive Area. Moscow, ID: University of Idaho. 146 pp.

Tank, S.L. 1983. A winter passerine ecology study in the River of No Return Wilderness, central Idaho. Moscow, ID: University of Idaho. 146 pp. Thesis.

Tank, S.L.; Sidle, W.B. 1986. Habitat relationships of wintering passerines in the River of No Return Wilderness area of central Idaho. Northwest Sci. 60(4):238-242.

Thomas, F.S. 1984. Mountain sheep and mountain sheep hunters. Moscow, ID: University of Idaho. 96 pp. Thesis.

Thurow, T.L. 1978. An ecological and taxonomic investigation of *Peromyscusmaniculatus serratus in* Idaho. Great Basin Nat. 38:469-472.

U.S. Public Law 88-577. Wilderness Act. Act of September 3, 1964. 78 Stat. 890.

U.S. Public Law 96-312. Central Idaho Wilderness Act of 1980. Act of July 23, 1980. 94 Stat. 948.

University of Idaho. 1988. Management Plan for the UI Wilderness Research Center and Taylor Ranch Wilderness Field Station.

USDA Forest Service. 1985. Management plan for the Frank Church-River of No Return Wilderness. McCall, ID: Payette National Forest. 118 pp. (plus Appendices).

ENDNOTES

1. More detail about the FC-RNR Wilderness is found in the management plan for the area (USDA Forest Service, 1985).

2. James Akenson, who was co-resident manager of Taylor Ranch from 1982-1990, presents more detailed history based on oral histories of early Big Creek residents in "90 Years of Taylor Ranch History," a 40-page draft manuscript on file, University of Idaho, College of Forestry, Wildlife, and Range Sciences, Moscow, Idaho 83843.

3. Cited in Akenson's report described in endnote 2.

4. Cited in Akerson's report described in endnote 2.

5. During this era, Dr. Ed Krumpe assumed leadership of the university's Wilderness Research Center, including the Field Station, and initiated additional wilderness activity. He convened a national wilderness management conference, attracting 400-plus managers from all four Federal wilderness managing agencies, including a field trip for some to Taylor Ranch. The conference led to the first national wilderness management plan, prepared from input by conference working groups and uniting all the agencies in commitment to wilderness management priorities for the first time (Bloedel et al., n.d; Frome, 1985; Krumpe, 1990).

6. The wilderness studies of owls by the Haywards and Garton are reported in many scientific publications: Hayward, 1983, 1989; Hayward and Garton 1983, 1984, 1988; Garton, Hayward, and Hayward, 1989; Hayward, Hayward, and Garton 1987; 1991; Hayward et al., 1987.

THE ECONOMICS OF WILDERNESS RECREATION: RESEARCH IN THE SOUTHEASTERN FOREST EXPERIMENT STATION

H. Ken Cordell and Claire Payne*

Since the 1920s the Forest Service has had a charge in conducting a nationwide research program. Across all forests and range lands, public or private, any kind of forest or range land management problem is within the purview of the program - that includes wildlife, water management, and a whole series of problems. The Forest Service has experiment stations and research locations throughout the country, and a considerable amount of our work is done cooperatively. Wilderness research and backcountry research have been going on since the 1960s; historically, the Intermountain Forest and Range Experiment Station in Missoula, Montana, the Northeastern Forest Experiment Station at the Durham, New Hampshire laboratory, and some other locations took the lead in wilderness research. Then, in 1981, we in the Athens, Georgia, laboratory of the Southeastern Forest Experiment Station joined in that effort and began to assess the demand and supply of wilderness, along with our mission of assessing demand and supply of recreation. Very important to this process is that all of our research units work with universities and other agencies in doing this work cooperatively. Frequently, research publications are co-authored with people who are from universities all across the country, and, in fact, often worldwide.

In the Forest Service, passage of the Renewable Resources Planning Act (RPA) in 1974 provided additional emphasis for us to get better information about wilderness. Then the RPA assessment program was amended in 1976 with the Forest Land Management Act. Basically, the law set out a mandate for us to look nationwide at all of our resources and the uses of forests and range lands. We are assigned in Athens to do the assessment of outdoor recreation and wilderness. Over the years as we have been doing the RPA assessment, we have become especially aware that a lack of information exists, coupled with a void of background theory and methods for doing an adequate job of representing the importance of wilderness as one of our resources. In the past wilderness was emphasized as a recreational resource; we know a fair amount about some of the interactions between people as they use that wilderness resource and how the resource responds. We've got some handles on some of the management tools that we need to evaluate human impact in social interaction situations; but we need to think about a full spectrum of uses and values, not just recreation. Wilderness encompasses a wide range of uses and values, including subsistence, preservation, education, and human development. All of these add to the argument for the importance of wilderness resources. We in Forest Service Research need to be responsive to this need, to help define the kind of uses and values, the importance of those uses and values, and how they add up as a package that we need to be using and thinking about when we are making financial allocations and management decisions. Currently the lead for wilderness research in the Forest Service is with Missoula at the Intermountain Experiment Station and with us in Athens, Georgia.

To pick up on the theme of the conference, economics, I want to emphasize that we really don't want to lose our emotional connections with wilderness. Wilderness, like other resources, is multi-dimensional. Considering a resource as huge and as important as a wilderness area requires referring to the human ecology paradigm, which fully recognizes social, environmental, natural resources, and economic dimensions. Economists can't answer all the questions; we can't provide all the information that is needed for making decisions. But I would advise that if those who speak for commodity interests - which also are a part of that land out there - are going to argue on the basis of the economics of market value, of numbers of dollars pumped into an economy, or any of those other kinds of arguments, we'd better be prepared to do the same to the best of our abilities, in order to best present all the other dimensions of wilderness.

I would like to speak also for credibility. This issue has been an element of a couple of presentations at this conference, both from people who are on the research side of it, the economists, and people who are on the management side of it, those who are on the firing line, making the decisions, I would ask that you let us, as economists, work with our tools, on our

*Project Leader and Outdoor Recreation Planner, respectively, Outdoor Recreation and Wilderness Assessment Research, Southeastern Forest Experiment Station, Athens, GA 30602.

theories, on our methods. I would like to ask that you let us do our job, so we can put up these kind of things and go through our analyses, and think about empirical procedures and substitutes and market-clearing prices. We need to draw from all these tools. We like to brag about them sometimes, even get carried away with them; but keep in mind that this is something we don't do only for our business (admittedly, we do get into these because they are fun). But from the perspective of an economist and a researcher, there is a very critical and essential point to all this, and that is the word "credibility." We have a process that we go through when we are doing research, where we are really always checking one another's work. We are tying back to the existing method and theory and the reason why this is important, and the reason why you want us to do that is that it gives credibility and validity to the economic numbers that come out of the studies that then, hopefully, go into decision-making. I would argue, too, that I don't necessarily agree with my friend and colleague, Linda Langner, that economics doesn't make a **difference.** I think it makes an extreme difference. Pm seeing a lot of cases where decisions come out differently with or without economic numbers; and she and I, in a very friendly way, can have our disagreements about that.

Wilderness research at the Southeastern Station encompasses a number of areas. Fist, we are assigned the national responsibility for the wilderness assessment, the national assessment that we perform every ten years. We need to do as good a job as is humanly possible in representing the full dimension of the uses and values of wilderness. Our second assignment is research on the full spectrum of uses and values of wilderness; we don't only look at economics, but also at social and psychological components. Thirdly, we are assigned to look at the community and regional economic impacts of designation and management that might occur given the passage of a state's wilderness bill and the impacts if designation does not occur. The research and the RPA assessment are accomplished cooperatively; we work very closely with others. Several of these very important partners are the National Forest System within the Forest Service, the Bureau of Land Management, and the University of Georgia.

The economic research that we in the Southeastern Station would like to undertake - and we are not necessarily going to research all of these issues - would basically consist of three avenues of looking at the economics of wilderness. One would be the values, many of which we have addressed at this conference. We would like to not only do this work internally, but also with others who often have much more expertise than ourselves. We are working to develop very focused and insightful methods to assess the value of recreational use, the various kinds of recreational use, and the non-use amenities - those things that sort of spill over outside the boundaries of wilderness areas; and, in many ways, are valued by people who may or may not ever actually be an on-site wilderness user. Also we can analyze property values, educational experiences, and the contributions of scientific research in the unmolested research environment of wilderness. An adjunct to this is the research we are undertaking in tropical forestry in Puerto Rico. One of our goals in this area is to discover the differences and similarities of cultural diversity as they apply to the valuation of wildlands and wilderness.

The second of these general views is to look at local economic growth. Or, if you want to look at it in a different way, the jobs, the income, the tax revenues, other things that occur as a result of wilderness designation and the ways the wilderness is managed. Some of these are very direct; people come into an area and spend their money, people who are actually wilderness visitors. Some of these are fairly indirect, and sometimes very hard to measure, such as what occurs with wilderness being a back-drop to attract tourists into a particular area. But there are costs, as well, and we like to look at the balance sheet, not only at the contributions to local economies, but perhaps at some of the costs of providing extra public services. In addition to that, value and growth trade-off need to be considered, to provide a package of information and perhaps a framework within which people **can** examine these issues. For example, if there is a significant amount of development due to the tourist industry, and if that development is very visible, perhaps there is an aesthetic loss. What is the value of that aesthetic loss? Value trade-off is inherent in attracting more and more people, through congestion, not only in the wilderness area, but in all of the aspects that contribute to getting people to the wilderness area itself and the experiences that people have. Another area to explore is the opportunity costs of the unrealized resource extractions and the uses foregone after wilderness designation.

Finally, our experience in Athens has shown us the value of working on conferences such as this to bring together managers, administrators, researchers, educators, students, and interested citizens. It is clear that we all have a stake in wilderness, and these opportunities to exchange information and ideas and to build relationships enhance the possibility of our working together effectively.

THE FRANK CHURCH WILDERNESS NATIONAL FOREST: A PROPOSAL

William A. Worf*

Congress passed the Wilderness Act in 1964 "to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not **occupy** and modify all areas **within** the United States" (emphasis added). The Act established a national policy "to secure for the American people of present and future generations the benefits of an enduring resource of wilderness." The National Wilderness Preservation System has grown from its 1964 nucleus of 9.1 million acres to about **91,000,000** acres in more than 500 separate wildernesses. It will continue to grow.

The Forest Service, as one of the leading wilderness agencies, has a heavy responsibility to guarantee that the wilderness entrusted to its stewardship endures. It will soon have about 20 percent of the National Forest System within the boundaries of designated wildernesses. Redeeming that responsibility will not be easy nor cheap. The agency's challenge is to determine the most efficient way to meet its responsibility.

Because of the accident of geography, many of these wildernesses lie across boundaries of several ranger districts, national forests, and even regions. This creates special problems in trying to manage the wilderness as a unit. The most striking example of this situation is the 2.4 million-acre Frank Church- River of No Return Wilderness (FCRONR) in Idaho. It is located within 12 ranger districts, six national forests, and two regions (see Figure 1). Citizens have been concerned that coordinated stewardship is lacking on this magnificent wilderness. No single person, other than the Chief, can speak for the FCRONR as a whole. There are significant differences in how policies are applied in different districts and forests. An example of this inconsistent administration involves the Wild River corridor along the main Salmon River. The upper portion of the river is administered by the Salmon National Forest in Region 4, while the lower portion is administered by the Nez Perce National Forest in Region 1. When the Central Idaho Wilderness Act was passed in 1980 there were live commercial hunting camps within the river corridor - two on the Nez Perce and three on the Salmon portion. The supervisor of the Nez Perce considered these camps inconsistent with the "essentially primitive" objective for Wild River shore lines. He worked with the permittees and relocated the two camps under his jurisdiction. The supervisor of the Salmon, on the other hand, allowed the camps under his jurisdiction to be made incrementally larger and more permanent. Early in 1988 he gave verbal permission to one permittee to convert his camp to a permanent resort or private camp. It consists of modern wood frame buildings with concrete foundations, electric power, sewer system, and water system. There was no public involvement before the verbal permission was given.

In 1989, Congressman Stallings of Idaho asked the Forest Service to review its administration of the FCRONR and develop a plan to overcome citizen concerns. A Forest Service Task Force was set up to explore the issue. It confirmed that there were problems and recommended changes on a trial basis, including the consolidation of wilderness administration on fewer national forests and ranger districts. During this trial period the number of national forests involved has been reduced from six to four and ranger districts from 12 to six (see Figure 2). Under the old arrangement, 20 line **officers,** 20 primary staff, and a number of sub-staff have spent part of their time involved in administration of the FCRONR. Under the trial plan, that number will be reduced to 12 line officers and 14 primary staff. According to the report, with the old organization, only one person spends 100 percent of his/her time working for the FCRONR, while a few others spend 70 to 80 percent of their time on wilderness administration. Under the trial structure, one additional person will be spending 100 percent of his/her time on wilderness stewardship. Coordination will be enhanced by designation of a lead supervisor and appointment of a full time coordinator who has no line authority. The plan also mandates a series of coordination meetings. The following is Wilderness Watch's analysis of the plan.

1. Accountability and Responsibility

The FCRONR is one wilderness, designated by one Congressional act, with some unique provisions. It must be managed in accordance with a single management plan. For this reason, we believe one person must have responsibility and authority to:

*President of Wilderness Watch, Milltown, Montana, 59851.

develop programs and action plans; set priorities; and evaluate accomplishments on the entire wilderness. That same person must be accountable for the condition of the wilderness and for responding to the needs and interests of the various publics. The trial organization structure falls short in this area. There is no line officer below the Chief who has authority over the entire FCRONR. It is inconceivable that he will have the time to redeem that responsibility.

2. Efficiency

The recommended structure provides for three separate committees aimed at achieving coordinated management over the FCRONR. It also spells out the minimum number of meetings that will be held by each committee. These meetings will be a tremendous drain on the energy of the involved managers and on the funds available for administration. However, they will produce little in the way of on-the-ground results. Following is our analysis of the costs.

Lead Working Group. This group must hold a **minimum** of four meetings. It is likely that, on the average, one special meeting will also be needed. It is also likely that a number of people, other than the permanent members of this group, will have to be involved in each meeting. These may include the forest public affairs officers (PAO), wildlife biologists, fire specialists, administrative officer, and others. The meetings will involve at least eight hours and each participants will average another eight hours in preparation, travel time, report writing, etc. My experience tells me the total cost of each meeting (salary, travel, per diem, supplies, clerical support, etc.) will be at least $10,000, for a total of $50,000 for the five meetings.

Directors. Permanent membership in this committee is seven. It must meet twice a year and will undoubtedly need at least one special meeting. No director meeting should be held without district ranger participation and participation by the regional wilderness specialists. There will also have to be participation by some specialists. It appears total participation at each meeting will average 12 persons. the time required will be 16 hours per meeting, plus eight hours for travel and preparation. The cost per meeting (salary, travel, per diem, etc.) will be about $11,000, for a total annual cost of $33,000.

Managers' Meeting. This will be one annual meeting that will involve a minimum of 30 Forest Service employees, plus members of the public and other agencies. The meeting should probably last two days. With travel and preparation time the total cost of each meeting (salary, travel, per diem, clerical support, meeting room, etc.) will be at least $25,000.

The total cost for all these coordination meetings will be about $110,000 and will involve the expenditure of about 2,000 person hours.

The trial plan should result in improved consistency and coordination. However, we believe there is a more effective and efficient alternative. The administrative unit boundaries should be adjusted to allow creation of the Frank Church Wilderness National Forest (FCWNF) with boundaries essentially consistent with the boundaries of the FCRONR. The forest supervisor would report only to the regional forester in Ogden, There should be six ranger districts (see Figure 3). One of these ranger districts should be headquartered so as to be accessible by visitors who enter from Montana. The supervisor and district rangers would spend full time thinking and working for stewardship of an enduring resource of wilderness. The number of line officers involved directly in the administration of the FCWNF would be reduced from 12 to seven and the $110,000 currently committed to coordination meetings would be available for direct stewardship work. We propose that the non-wilderness portions of the Challis National Forest be moved to the Salmon, Targhee, and Sawtooth National Forests, and that the FCWNF be headquartered in Challis, Idaho. There would be the same number of national forests as presently exist and no new forest headquarters would be needed. Funding currently being allocated to wilderness by the six national forests (including general administration, fire, wildlife, recreation, trails, etc.) would be consolidated and allocated to the new national forest. Specialists' time would be similarly consolidated. There will need to be similar actions at the ranger district level.

We believe the benefits of our proposed organization are obvious and irrefutable. The energy of every person on the FCWNF would be focused on the stewardship of the FCRONR Wilderness. Career ladders for wilderness professionals wold be enhanced. The public would have one person to deal with regarding the entire wilderness and one person would be accountable for the health of the wilderness resource. However, Forest Service personnel have pointed to several perceived disadvantages of our proposal. The following is a listing of these, together with our comment:

At the present time **many people on each of six national forests have at least some role in administering the FCRONR. This helps to keep them aware of the meaning and value of wilderness. Under the Wilderness Watch's proposal, they might tend to**

turn away from the wilderness because it's "someone else's job."

Comment. In theory that may be true. However, in actual practice, very few people on these six national forests have wilderness as a major part of their job. It's simply an added duty. There are few aggressive champions of wilderness. With our proposal, everyone from the supervisor on down would be full time champions of the wilderness. A major part of their responsibilities would be to promote understanding and support for sound wilderness stewardship. That effort would be aimed at all people on adjoining national forests, as well as the public. We believe wilderness would have a higher profile in the Forest Service - not a lower one.

Having both wilderness and non-wilderness lands on the same unit is good because many activities outside wilderness affect the wilderness resource.

Comment. Twenty-seven years' experience has demonstrated that people with primary responsibility for resources outside of wilderness tend to overlook the wilderness implications of actions taken outside. The full time wilderness professionals of the FCWNF would be better able to recognize these potential relationships and work with adjacent supervisors and rangers to make the best land management decisions.

An all-wilderness national forest or ranger district might not be able to afford all of the specialists that are needed to properly manage the wilderness.

Comment. That is also the situation on many smaller units today. It is common for two national forests to share a specialist. The same could happen with an all-wilderness unit.

There is not enough funding to support an all-wilderness national forest.

Comment. We do not agree. The Forest Service response to the recent GAO report on wilderness expenditures pointed out that a great deal of money, other than wilderness recreation money, is spent to the benefit of wildernesses. This includes general administration, trails, wildlife, range, watershed, fire, minerals, and cultural resources. We agree that wilderness should receive more funding from Congress. However, if all funds supporting management of the FCRONR Wilderness are aggregated into one unit, our proposal can be implemented without additional funding. The result would be improved effectiveness through greater efficiency.

Some Forest Service people have told me that if we set up wildernesses as separate administrative units we would be setting the stage for action to take them out of the National Forest System and establish a separate agency - The National Wilderness Service.

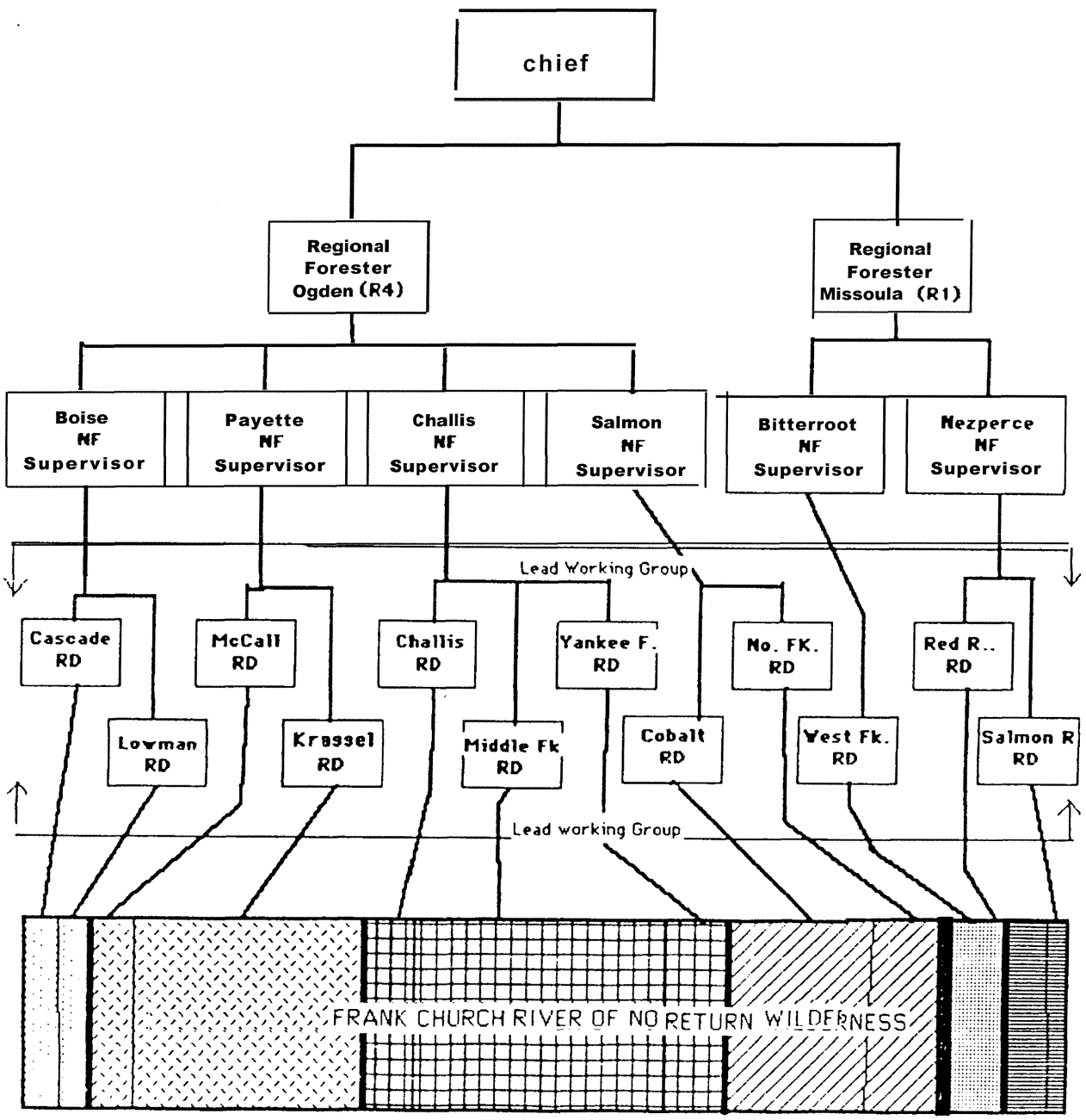
Comment. The only valid reason for a separate "Wilderness Service" would be to achieve proper stewardship of an enduring resource of wilderness. The best defense against such a move is for the Forest Service and other agencies to apply the best possible stewardship to the wildernesses under their jurisdiction. On the other hand, if the public continues to perceive that administration of the individual wildernesses is fragmented and less than the best, it will demand corrective action. That could lead to pressure to take the wildernesses away from the currently responsible agencies.

In summary, 27 years of experience in watching the administration of wildernesses has convinced me that we will never achieve the kind of stewardship these special lands need with a fragmented (management by committee) approach. Each wilderness (or group of contiguous wildernesses) must be managed as a single unit, with consistent policies and stewardship action throughout. There must be one person with the authority and responsibility to develop and implement a plan for the unit. That person must have authority to set priorities, request funding, and hiie and fire the staff. That person must be fully accountable for maintaining the enduring resource of wilderness. And, finally, that person must be able to focus on his/her wilderness stewardship responsibilities without pressure to produce non-wilderness outputs.

Figure # 1

FRANK CHURCH RIVER OF NO RETURN WILDERNESS
Administrative **Structure**

February1?, 1990

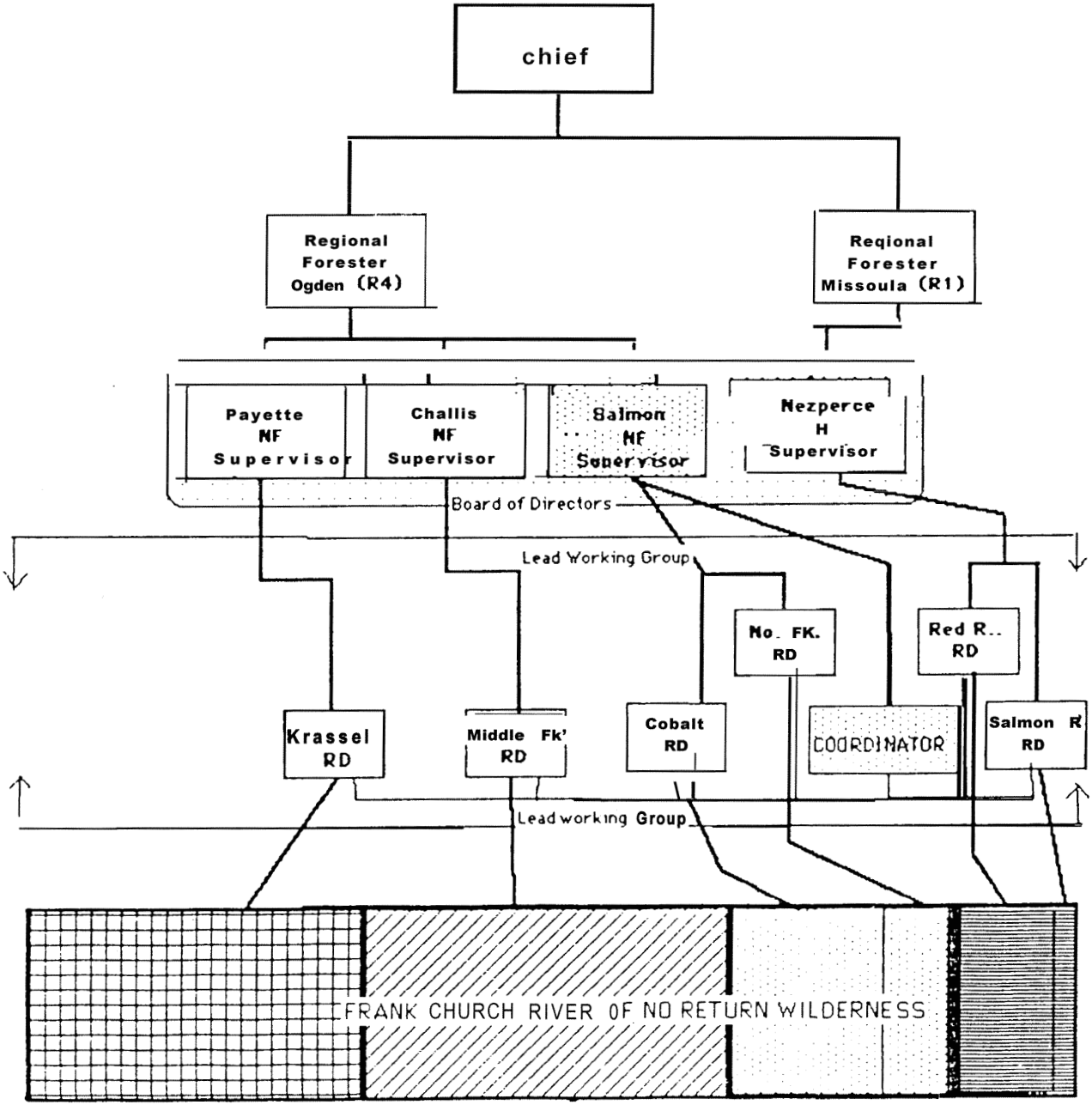


By. Bill Worf

Figure #2

FRANK CHURCH RIVER OF NO RETURN WILDERNESS
Current Administrative Structure

May 11, 1991

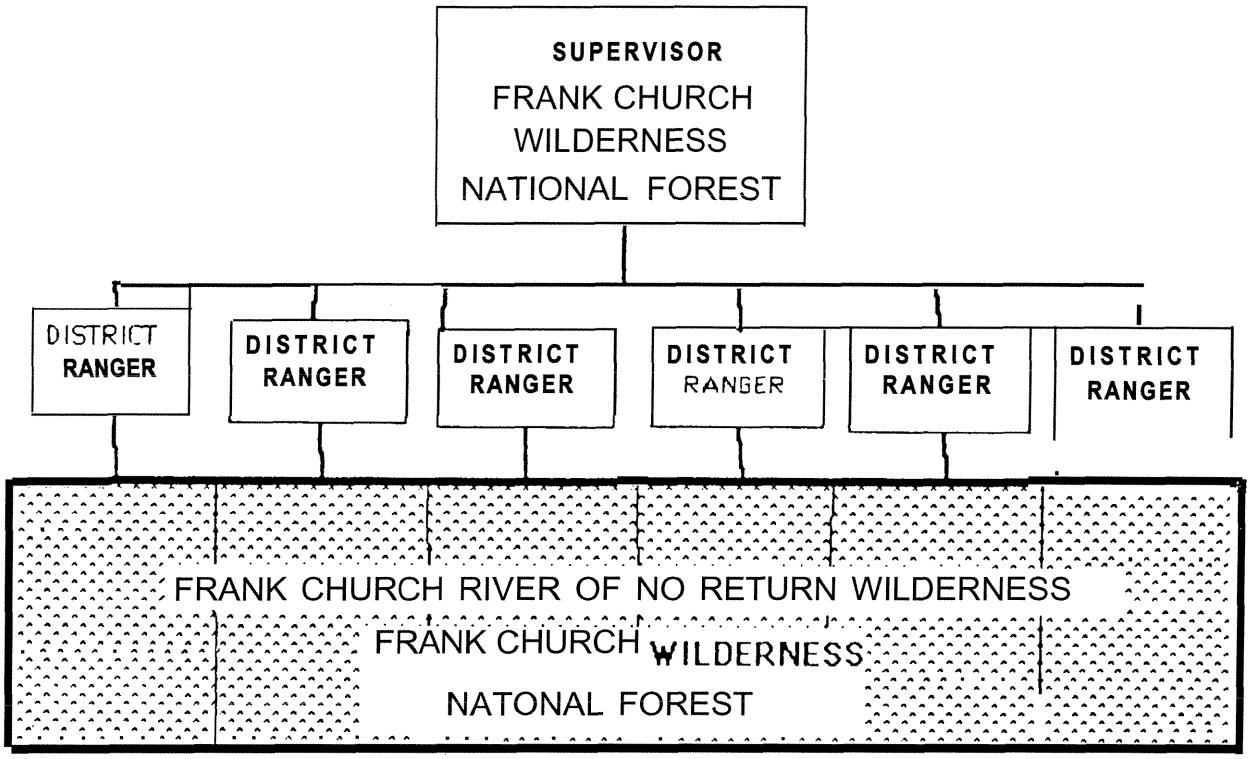


Schematic Representation of FCRONR Management Structure

May 10, 1991

By Bill Wurf

Figure 3



Prpposed **organization for the Frank Church Wilderness National Forest**

Presented for Wilderness Watch

By

William A Worf, Presidant

at

Jackson, Wyoming

flay 10, 1991

Payne, Claire; Bowker, J.M.; Reed, Patrick C., **comps.** 1992. The economic value of wilderness: Proceedings of the conference; 1991 May 8-11; Jackson, WY. Gen. Tech. Rep. SE-78. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 330 pp.

Thirty-six papers address the key economic issues surrounding wilderness, including improving the knowledge of the direct and indirect benefits and costs of wilderness uses, the effects of designation and management on the economic condition of surrounding communities, and alternative economic measures of wilderness value. Sections relate to economic values and leading current standards by which the nation's land management decisions are made: recreation and wildlife; economic methods and techniques; international case studies; nonconforming opportunity costs of wilderness; local economic impacts; economic value in decision making; the noneconomic benefits of wilderness; and special reports. The papers illustrate advances in measuring components of both direct and indirect, consumptive and nonconsumptive benefits attributable to wilderness, specific wilderness sites, and particular aspects of individual wilderness areas, as well as benefits and costs to society of maintaining and expanding the NWPS.

The Forest Service, U.S. Department of Agriculture, is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives-as directed by Congress-to provide increasingly greater service to a growing Nation.

USDA policy prohibits discrimination because of race, color, national origin, sex, age, religion,.or handicapping condition. Any person who believes he or she has been discriminated against in any USDA-related activity should immediately contact the Secretary of Agriculture, Washington, DC 20250.