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Economic Efficiency Analysis, Bureaucrats, and Budgets: A Test of Hypotheses

John B. Loomis

Economic efficiency has become more visible in national forest plans because of new planning regulations implemented by the Reagan administration. This paper investigates economic efficiency analyses and whether such information influences U.S. Forest Service decisions. The findings indicate that there are substantial errors in estimates of the net present value of wilderness and that there is no association between the sign of net present value and decision makers' recommendations about wilderness designation. These findings are consistent with the hypothesis that an economic efficiency information requirement will not insure its use in decision making unless the incentives facing managers change.

Key words: benefit-cost analysis, budgets, efficiency, Forest Service, net present value, public lands.

The New Resource Economics (NRE) bring the tenets of the Austrian school of economics and the public choice literature (Buchanan and Tullock) to bear on analyzing the behavior of such resource management agencies as the U.S. Forest Service (USFS) and Bureau of Land Management (BLM). This school of thought places heavy emphasis on the role of self-interest and incentives in predicting public land managers' behavior. Because public land managers cannot reap the "profits" of economically efficient management, it is believed that "bureaucrats may ignore or exaggerate the economic efficiency of the projects they administer" (Stroup and Baden). The corollary is that the public land managers' self-interest is directed toward acquiring the rewards he or she can capture, e.g., larger staffs and budgets (Johnson). This goal of greater staffs becomes feasible because of absence of property rights on the federal tax base as a funding source

(Stroup and Baden). As Simmons and Mitchell (p. 10) point out in their review of NRE, there has not been systematic empirical testing of many of these propositions in the natural resources setting.

Others (Krutilla and Haigh, p. 415) believe that administratively requiring an agency to develop information on the economic efficiency effects of its actions will go a long way toward improving consideration of efficiency in public land decision making even without a change in incentives. This "implementation framework" suggests that a broader set of factors, including self-interest, influence agencies' use of new technical information. A tenet of this view is that infusion of new information into the decision-making calculus is a long process of changing decision makers' perceptions of their solution set, and one should not expect immediate impact of new information. See Sabatier for a review of this literature.

In the case of the USFS, increased requirements to perform and use economic analysis can be found in the Resources Planning Act (U.S. Congress 1974) and the National Forest Management Act of 1976 (U.S. Congress 1976). In particular, both acts emphasize what Cortner and Schweitzer call "rational-comprehensive planning" at the national, regional, and

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The author wishes to thank George Peterson and Dennis Donnelly of the U.S. Forest Service for their comments on an earlier version of this paper. Suggestions by the referees have substantially improved the paper's orientation. What remains is the sole responsibility of the author.

local levels. Much research on the role of economic efficiency analysis in public land management either predates the implementation of these acts (Hyde; Wyckoff) or is based on a perception of how well the acts will be implemented (Cortner and Schweitzer) because until recently there were no completed plans or decisions under the new acts. Authors such as Wyckoff have stressed the need for research on allocational problems of public lands because little empirical research is available.

Smith has summarized the impact of the Reagan administration's increased emphasis on economic efficiency analysis for regulatory agencies (Executive Order No. 12291). However, this increased emphasis on economics has been carried over to national forest management by Reagan's first assistant secretary for agriculture, John Crowell (Crowell; U.S. Department of Agriculture). Still not studied is the effect the administration's emphasis on economic efficiency has had on selection of land use alternatives in national forest plans under Crowell.

This paper investigates the actual process the USFS used to determine whether or not to recommend seven roadless areas as wilderness. The specific issues to be analyzed are: (a) Does the economic efficiency information developed by the USFS follow the accepted practices of benefit cost analysis? That is, are sufficient resources devoted to developing information on relative values of all outputs and opportunity costs of all inputs? The hypothesis here is that USFS puts more effort into acquiring information on the benefits of development than on the benefits of wilderness, the net effect being an overstatement of development benefits relative to wilderness.

(b) Does information on economic efficiency influence decisions on wilderness designation? The hypothesis to be tested is whether new planning regulations, without manager incentive changes will result in an agency quickly adopting economic efficiency as its new objective.

(c) Last, do national forest managers select alternatives which maximize their budgets, as NRE would predict?

Case Study

The U.S. Forest Service, under the Colorado Wilderness Act (U.S. Congress 1980), is re-

quired to evaluate the suitability of fourteen roadless areas (wilderness study areas, or WSAs) for possible designation by Congress as wilderness. These studies are an outgrowth of the original Roadless Area Review and Evaluation (RARE I and II) process. The evaluation of seven wilderness study areas performed as part of two different national forest plans provides a unique means to test the three hypotheses listed above.

Evaluation Criteria Used

The U.S. Forest Service planning regulations (USDA 1982) require five factors as the minimum criteria for evaluation of WSAs. These include values of the area as wilderness, values foregone as a consequence of wilderness designation, proximity to other wilderness areas, manageability of area as wilderness, and anticipated changes in plant and animal species diversity. Economists would expect determination of values as wilderness and values foregone to involve a discussion of net benefits and quantification of opportunity costs. However, the two national forests studied in Colorado grouped the five factors into three criteria. The three criteria which the Pike-San Isabel and San Juan National Forests used to determine the "suitability" of an area for wilderness include capability, availability, and need (San Juan National Forest 1982a, b, c, 1983; Pike and San Isabel National Forests). None of these criteria specifically relates to economic values or opportunity costs of wilderness. As part of the overall environmental impact statement (EIS) on the forest plan, an economic efficiency analysis (what the USFS calls cost efficiency) is performed, but is not a required criterion, for judging wilderness suitability. Rather, efficiency analysis appears to be included as supplemental information in the EIS section on environmental consequences.

Quality of Information Provided

The economic efficiency analysis of the WSAs follows most of the standard conventions of benefit cost analysis as presented in U.S. Water Resources Council (1979, 1983), Sassone and Schaffer, and Howe. The comparisons are between the "with and without conditions"; net present value is calculated at two "significantly" different interest rates, and all resources

are compared (conceptually at least) in terms of net willingness to pay. Generally speaking, the data sources and assumptions are usually presented or references are made to where they can be acquired.

Upon deeper probing the reader finds errors and inconsistencies that, as predicted by Stroup and Baden (p. 44), often have the effect of overstating the net present value of managing roadless areas for timber rather than wilderness. For example, in the draft wilderness study reports published by San Juan and Pike-San Isabel National Forests (which accompanied the draft EISs), recreation outputs were valued at capacity levels rather than actual use or demand levels. The South San Juan Expansion Wilderness study area had actual nonmotorized recreation use of 5,200 days. Capacity was estimated to be 42,700 days for nonwilderness recreation and 15,600 days for wilderness (San Juan National Forest 1982b). Wilderness recreation emphasizes solitude and low density recreation use and so has a lower capacity than nonwilderness. As can be seen in table 1 (columns 2 and 3) valuing capacity instead of actual demand results in a large opportunity cost of displaced nonwilderness recreation and a negative net present value for wilderness.

Once this error was pointed out to the San Juan National Forest during the review process, USFS revised their analysis accordingly. Their corrected net present value figure is shown in columns 4 and 5 of table 1. As table 1 illustrates, correction of this error changes the net present value of wilderness from negative to positive. The error resulted in an underestimate of the benefits of wilderness by \$544,000. For the San Juan National Forest as a whole, the underestimate of wilderness benefits for the three WSAs was \$8.78 million because underestimates were much larger for the other two WSAs due to use of capacity instead of demand.

By comparison, the Pike and San Isabel National Forests did not see use of capacity as an error. In discussions with two analysts, they were reluctant to change from capacity to actual demand. The final EIS for the Pike-San Isabel National Forest used capacity instead of actual demand in the benefit cost analysis.

West Needle WSA

Unfortunately, the revisions to published draft wilderness reports that appear in the final en-

Table 1. Efficiency Analysis for South San Juan WSA (in thousands of 1978 dollars)

Resource	USFS Draft EIS ^a		USFS Revision	
	W	NW	W	NW
Timber	0	775	0	775
Water	12,846	13,050	12,838	13,042
Recreation				
Wilderness	1,699	0	970	0
Dispersed	0	1,740	0	473
Range	204	218	220	229
Total				
Benefits	14,749	15,783	14,028	14,518
USFS costs	1,079	1,989	1,078	1,988
Net present value	13,670	13,794	12,950	12,530
Incremental NPV of wilderness		-124		+420

^a Where W is wilderness designation, NW is nonwilderness, discounted at 7.125% interest rate.

vironmental impact statements continue to misrepresent costs and benefits. The West Needle WSA in the San Juan National Forest illustrates one such error. While corrections were made so that visitation was based on projected demand rather than capacity, a simplifying assumption was made in the final analysis. Unlike past evaluations, this latest revision more accurately assumed that a large portion of the existing recreation use of the West Needle WSA was made up of wildlife recreation, to which USFS assigns a higher value than general dispersed recreation (on average, an order of magnitude larger). By substituting wildlife recreation for most of the existing dispersed recreation, the current value of nonwilderness recreation is increased. The critical assumption is that nondesignation allows for actions that increase the amount of wildlife recreation, while wilderness designation allows for only wilderness-type recreation (no wildlife recreation, not even the current amount). Because wildlife recreation has an assigned value three to four times that of wilderness recreation, giving up existing wildlife recreation causes the opportunity costs of wilderness to be overstated and the net present value of wilderness to be an order of magnitude too low. The San Juan National Forest final EIS (1983, p. M-31) shows an economic efficiency loss to wilderness designation of \$1,804,000 (\$1,381,000 of

Table 2. West Needle WSA (thousands of 1978 dollars discounted over 50 years at 4%)

Resource	Corrected Analysis		USFS Final EIS	
	W	NW	W	NW
Water yield	14,307.00	14,307.00	14,307.00	14,307.00
Recreation use				
Wilderness	2,690.00	.00	3,773.00	.00
Wildlife/fisheries	2,999.00	4,467.87	.00	4,324.80
Dispersed recreation	.00	1,116.97	.00	1,081.20
Range	117.00	132.13	117.10	132.10
Timber	.00	.00	.00	.00
Total benefits	20,114.00	20,023.97	18,197.10	19,845.10
Total costs	388.00	232.00	388.00	232.00
Net present value (NPV)	19,726.00	19,791.97	17,809.10	19,613.10
Incremental NPV to wilderness		-65.97		-1,804.00

net benefits of resource development foregone, over and above the without condition, plus the loss of \$422,000 of benefits over the without condition from wilderness). This loss is a direct result of having the gain in wilderness recreation being offset by assumed loss of the more valuable wildlife recreation.

Table 2 illustrates the corrected analysis (columns 2, 3) and will serve to compare to the Forest Services final analysis (columns 4, 5). The figures in columns 2 and 3 assume a continuation of the "without" condition level of wildlife recreation (\$2,999) under the wildlife/fisheries recreation use category associated with the suitable alternative. This assumption is based on information contained elsewhere in the San Juan National Forest final EIS (1983, pp. M-22-23), which indicates wilderness designation is not detrimental to wildlife.

Wilderness recreation is assumed to fill the difference between overall wilderness recreation demand and current wildlife recreation use. The Forest Service's overall wilderness demand figures were used in performing these calculations.

What table 2 illustrates is that the benefits of wilderness are now \$20,114 and the costs are \$388 (both in thousands of 1978 dollars). The NPV of wilderness of \$19,726 is slightly smaller than the NPV of nonwilderness because of higher livestock forage production (range) and lower management costs. Comparing the two alternatives, the net present value of benefits would be \$65,970 less with designation. This conclusion contrasts with columns 4 and 5 in table 2 taken from the San Juan National Forest Service final EIS (1983, p. M-31), which shows the loss with wilderness

designation to be \$1,804,000. If wilderness recreation is more accurately valued, the net present value of wilderness is positive for West Needle. These issues will be discussed next.

Values Used in Planning

The USFS Washington, D.C., office provides a set of multistate region figures (known as Resource Planning Act values) for valuing outputs in forest planning. The local forest is allowed to deviate from approved regional values if there are defensible local values or if such values can be developed (Peterson).

In practice, higher local values for livestock forage production were developed (with the aid of an outside source) and used, rather than lower standard values. The San Juan National Forest also developed forest-specific values for timber. No effort appears to have been made by either the San Juan or the Pike and San Isabel National Forests to develop local values for wilderness or wildlife recreation (or to have outside specialists do the analysis, as was done in the case of livestock forage). The San Juan National Forest did not use more up-to-date and Colorado-specific wilderness recreation values even when such figures were available during the public review period (Walsh, Gillman, and Loomis). The regional average of \$8 per wilderness visitor day continued to be used instead of Colorado-specific values ranging from \$14 to \$22 per day. Pike-San Isabel National Forest authorities revised their non-wilderness-dispersed recreation values from the \$3 to \$5 per-visitor-day regional figure by including higher-valued hunting and fishing activities in with their definition of dispersed

Table 3. Comparison of Net Present Value and Recommendations (U.S. Forest Service figures in thousands of dollars)

Area		Draft			Final	
Name		NPV ^a	REC's		NPV	REC's
Piedra	W	24,591	Yes	W	-3,050	Yes
	NW	34,051		NW	-4,397	
West Needle	W	18,131	Yes	W	-422	Yes
	NW	2,218		NW	1,382	
South San Juan	W	21,616	No	W	-1,342	No
	NW	21,774		NW	-1,073	
Buffalo Peaks	W	16,600	No	W	17,800	Yes ^b
	NW	5,600		NW	16,100	
Sangre de Cristo	W	33,700	Yes	W	51,200	Yes ^b
	NW	18,200		NW	48,600	
Spanish Peaks	W	3,600	No	W	5,000	No
	NW	1,100		NW	3,600	
Greenhorn Mountain	W	5,000	Yes	W	6,300	Yes
	NW	1,600		NW	4,500	

^a NPV is net present value at 4%; W is wilderness; NW is no wilderness; REC's is recommendation.

^b Only partial designation recommended.

recreation (Pike and San Isabel National Forests, p. VI-51). However, the multistate average wilderness value of \$8 was not revised upward to include these same hunting and fishing values, values which are at least as likely to be provided if the area were designated as wilderness.

The effect of undervaluing wilderness recreation is to understate the benefits of wilderness preservation. For example, in table 2, if wilderness recreation benefits are based on the more conservative Colorado-specific value of \$14 per visitor day rather than the regional average of \$8, the present value of wilderness recreation benefits under the suitable alternative rises from \$2,690.00 to \$4,781.91 (both in thousands of 1978 dollars). This results in an increase in the incremental NPV of the wilderness alternative from -\$65.97 to +\$2,025 (both in thousands of 1978 dollars).

Evaluating How Economic Efficiency Analysis Influences Wilderness Recommendations

Table 3 summarizes USFS recommendations on wilderness suitability, as presented in their draft and final EISs. This table also displays their published estimates of net present value of wilderness and net present value of non-wilderness.

Table 4 presents a contingency table that provides a systematic way to evaluate whether

NPV appears to have any influence on the recommendations. If recommendations on wilderness strictly followed economic efficiency, all of the observations would be "yes" recommendations when NPV is positive and "no" recommendations when NPV is negative. As can be seen from table 4, there are some "yes's" when NPV is positive, but there are also three "no's" when NPV is positive and two "yes's" when NPV is negative. A chi-square test of the hypothesis of independence of recommendation and sign of NPV indicates that we should accept this null hypothesis of independence. With a calculated chi-square of .05, the acceptance of the null hypothesis occurs at the 99% level. Economic losses associated with disregarding the efficiency analysis in making final wilderness recommendations on these two national forests amounts to \$3.2 million (\$1.4 from not recommending economic areas and \$1.8 from recommending uneconomic areas). Considering that there are eighty-six other national forests in the western United States, economic losses could be well over \$200 million with a similar disregard for economic efficiency.

The pattern displayed in table 4 appears inconsistent with USFS discussions about how NPV is used in its decisions. Specifically, USFS planning regulations (USDA 1982), the EISs, and the regional foresters' "Record of Decision" refer to the partial nature of NPV as a measure of benefits (Rupp, p. 7; Torrence).

Table 4. Chi-Square Analysis of NPV and USFS Recommendations

		Wilderness Recommendations	
		Yes	No
Incremental NPV of Wilderness	Positive	7	3
	Negative	2	2

These regional foresters discuss the "non-quantifiable" benefits not accounted for in NPV. If this line of reasoning were adhered to with regard to wilderness, then one would not expect any "no" recommendations when NPV is positive because the EISs (San Juan National Forest 1983, pp. M-30, M-77) indicate that some of the benefits of wilderness are "non-quantifiable" and thus are omitted in NPV calculations. That is, if an area has a positive NPV, then when the nonquantifiable benefits are added, NPV must be even more positive, not negative. One would also expect fewer "no" recommendations when NPV is negative, for if NPV excludes some nonquantifiable benefits then it is possible that inclusion of these would result in positive "net public benefits" (Torrence, p. 17) even though NPV is negative.

Budget Maximization Hypothesis

One traditional prediction from public choice and New Resource Economics relates to incentives for bureaucrats to maximize their budgets. This hypothesis can be tested by evaluating the consequences of wilderness recommendations on USFS budgets. Specifically, USFS documents show their budgeting associated with designation or nondesignation of land as wilderness. If the budget-maximization hypothesis is the operating criterion, then recommendations made should maximize the national forest budget.

Comparing fourteen recommendations (7 areas in the draft EISs, 7 in final EISs), we find no strong evidence for the budget-maximization hypothesis. In eleven of the fourteen WSAs, wilderness would give the USFS a substantially smaller budget than development. Yet, in seven out of these eleven areas (64%) wilderness was chosen. In three WSAs, wilderness would result in a higher budget than

nondesignation. Here, two of the three are recommended for wilderness.

Discussion

In terms of this paper's first objective, it appears that information on economic values of outputs and opportunity costs of inputs in forest plans are incorrect because of failure to follow principles of economic theory or the use of assumptions that are inconsistent with other portions of the forest plan. The errors include valuation of capacity (or supply potential) rather than just units actually demanded. This error resulted in net present value of wilderness being underestimated by \$8.78 million in the San Juan National Forest alone. In addition, the analysis contains assumptions which are applied inconsistently between alternatives. For example, including the value of wildlife recreation in the without-wilderness alternative and then ignoring wildlife recreation in the with-wilderness alternative resulted in errors in net present value of an order of magnitude. Timber and range values are revised upward from regional values by replacing the regional average with local estimates, but no similar refinements are made in wilderness recreation values. Thus, the NRE hypothesis that USFS would overstate the economic values of development relative to wilderness appears supported.

With regard to economic efficiency becoming the dominant objective of national forest planning, the evidence presented here does not support such a view. Despite the greater emphasis on economic efficiency by the Reagan administration and in revised national forest planning regulations, it continues to be just one input into decision making by regional foresters and forest supervisors. Evidence is presented indicating no significant relationship exists between net present value of alternatives and decision maker recommendations. If we rely on the official estimates of NPV, we can get an estimate of the efficiency losses the U.S. Forest Service was willing to incur by disregarding economic criteria. Using the NPVs in the final environmental impact statements (column 6, table 3) efficiency losses associated with not recommending economic areas is \$1.4 million. Efficiency losses associated with recommending uneconomic areas is \$1.8 million. Total efficiency losses are \$3.2 million when

decisions depart from efficiency criteria in just two national forests.

If net present value does not explain wilderness decision making, what does? Traditional explanations of timber industry power apply, but not nearly to the extent they do in the Pacific Northwest because neither the Pike-San Isabel National Forest or the San Juan National Forest are major timber producers. Employment in southwest Colorado (San Juan National Forest) is dominated, in descending order, by tourism, agriculture, logging/sawmills, and mining (San Juan National Forest 1983, vol. 3, p. 12).

This leads us back to support for both the NRE and implementation schools of thought. Evidence presented here supports the NRE view that until incentives are changed to make economic efficiency in the manager's self-interest, nothing more than "lip service" will be paid to efficiency. However, we did not find support for the NRE corollary that public land managers would select alternatives that maximized their budgets.

The factors on implementation of technical information provided by Sabatier (1978) are also supported by the evidence. Immediate adoption of information on economic efficiency would not be expected because such information is often viewed as "complex and does not conform to decision makers' policy predisposition" (Sabatier, p. 406). With regard to decision makers' predisposition, Hyde suggested that it is the traditional orientation of the U.S. Forest Service that forests are to be actively managed rather than preserved as wilderness. While Hyde speculated that this might change with implementation of NFMA, even a quick reading of the 1983 San Juan National Forest plan shows little has changed. Forest management is largely described in terms of how timber harvests allow other resources to be managed for the public benefit.

Such predisposition runs counter to the administration's emphasis on efficiency analysis. As such, it may not be too surprising that the deputy assistant secretary for agriculture has supported the appeal of the San Juan National Forest plan by environmentalists on the grounds that insufficient attention was given to economic efficiency analysis in goal development and plan selection. He has sent detailed instructions to the San Juan National Forest to improve development and use of economic efficiency analysis in its revised final

plan. Given this high level of intervention on behalf of economic efficiency, the implementationists would predict there will be some improvement in the weight given to economic efficiency analysis in the new recommendations. Subjecting this prediction to testing must wait a year or more until the revision to the San Juan Forest plan is completed.

[Received June 1985; final revision received December 1986.]

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