Can Economics Be Used To Manage "Our" Forests (or does Smokey the Bear need to learn about multi-product cost functions)?

Multiple Use Management: The Economics of Public Forestland. *By Michael D Bowes and John V Krutilla Washington, DC Resources for the Future 1989, 356 pages, $40*

Reviewed by Daniel M Hellerstein

Whether seen on television news or in the comments appendix to a USDA Forest Service forest plan, the debate concerning the future of public forestlands is rarely trivial Conflicts as obvious as the choice between wilderness preservation and guaranteeing the supply of timber products, or as subtle as the tradeoff between old growth forest and enhanced streamflow, must be dealt with by the forest manager

Into this public debate, Michael Bowes and John Krutilla submit their book with the intention to

> bring to the economic analysis of multiple-use management of public forestlands an updated theoretical framework and an illustration of its applicability to the management of public forestlands

Given their stated goals, they succeed in producing a wide-ranging synopsis of current knowledge The breadth of material does not break new ground but will bring insight to most resource economists For readers with more general training, the depth and clarity of presentation unite to provide a good introduction to the topic of multiple-use management Perhaps, unavoidably, the trained natural resource economist may cry for greater rigor, while those with less economic training may become lost in formulae

The book starts with a concise history of public forestland management in the United States, followed by an overview of current outputs and management directions on Forest Service lands Here, the underlying theme of the importance of the wide range of outputs is introduced It is well recognized that the combination of poor timber productivity, spectacular scenic beauty, and ecological integrity in many of the national forests often dictates against a market-commodities emphasis In other words, the values of timber, minerals, and forage are often below the value of nonmarket commodities, such as outdoor recreation, wilderness preservation, enhanced streamflow and wildlife protection The trick is where and when to manage for these sometimes exclusive, but sometimes complementary beneficial products

As a first cut at the problem of multiple outputs, the book presents a variety of single-period models of forestland production The key problems are how to represent the many interrelationships between the various outputs, and how to use such a representation to maximize the flow of benefits from the land Bowes and Krutilla focus on cost functions as a tool for management, as does much of the modern literature on production economics

The cost function approach has many advantages Key concepts, such as the complementarity (jointness) or substitutability (nonjointness) of the production of various outputs, are readily expressed in terms of the cost function For example, if isocost curves for two goods, say timber and wildlife, can be shown to be convex to the origin, then production should be specialized, one should not attempt to produce both items on all land units Conversely, the combination of diseconomies of scale and complementarity may create situations where the production of one good increases the availability of other goods, for example, as when a limited timber harvest enhances wildlife habitat Again, the cost function can be used to show just what mix is optimal

An especially useful aspect of the cost function approach is the concept of separable costs, which is defined as the cost of producing some level of a single output while holding all other outputs constant Separable costs are key to correct analysis of a variety of policy debates In particular, the case of below-cost timber sales can be identified as one of separable costs

Bowes and Krutilla adequately present the somewhat imposing theory of joint production in the context of forestlands Readers without formal training in production economics, however, will need to study these models carefully The problem of a disparate audience is never easily solved, although a theoretical appendix would be appreciated by this reviewer

The chapter on dynamic models in expanding on these single-period models, is the heart of the book Building on Bowes' work at Resources for the Future, the authors address intertemporal management of a geographically diverse forest They start with

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Faustmann-type models, which are based on the timber value of a single stand, followed by a discussion of the Hartmann method of incorporating stand-age dependent amenity values into single-stand models An amenity value is a measure of the benefit of a nonmarket commodity, for example, the value of a scenic trail to hikers

Although single-stand models can illuminate the comparative statics of rotation length and the resulting harvest cycles the authors argue that focusing on single stands is a poor approximation to the real world Basically, a forest is more than a collection of independent stands In other words, a single clearcut can ruin a beautiful view Or, a single clearcut can create a valuable edge-effect habitat for a decade Complicating this dichotomy are the changes in the effect of a clearcut with the aging of the surrounding forest Add a number of other management options, and you approach the forest management problem

The authors tackle this problem with a multiple-stand, dynamic management model Besides the traditional timber yield function, they introduce an amenity function which yields amenity values (for nonmarket commodities) that are dependent on the particular state of the surrounding forest The concept of asset value (the "sale" price of the land) is used to facilitate presentation and exploration of the features of their model We find that the introduction of multiple sites can greatly affect the time pattern of management, and harvest rules can become very complex

My comments concerning the authors' multiple-output, single-stand models of forest management also apply to their multiple-stand models, that is, it's a tough problem, the authors provide an adequate introduction, but a supporting technical appendix would be useful

The second half of the book consists of several case studies, a critique of the budgeting process of the Forest Service and a discussion of methodologies for valuing recreational quality Although the case studies are meant as applications of the theoretical models, the authors make the usual compromises with data unavailability and computational complexity For example, amenity functions are simply unavailable, and they must use very rough approximations

In a sense the authors reveal their preference for theoretical research by first presenting the theoretical models, then approximating the models when it comes time to attend to the real world The applications-oriented reader may prefer to see what is reasonably done, supported by the hypothetical discussion of what could be done The book would benefit from a more careful linkage between the theoretical and applied models

A substantial portion of the benefits of national forestland is recreation use These lands vary greatly in characteristics that recreationists value, such as hiking opportunities Given an ability to modify the landscape, such as by building new trails, there may be considerable opportunity for land managers to increase social welfare Therefore, methods for valuing recreational "quality," not just the total quantity of recreational trips, are needed

The authors are to be commended for their attention to this issue of recreational quality Although their view is somewhat idiosyncratic, they generally succeed in placing a variety of valuation techniques in a broad theoretical framework They review both simple travel cost models and several hedonic techniques The reader should be warned that this is not a solved problem and that the differences among models can be subtle My muted praise stems from the authors' haziness, despite their concerted efforts, in explaining the behavioral and statistical differences among these models For example, their net hedonic model may be best described as a total expenditures model, in contrast to their gross hedonic model that is best described as an endogenous trip-quantity model In addition, the focus on quality valuation precludes discussion of recent advances in quantity-oriented measures of total site value

Bowes and Krutilla have produced a well-written overview of the tools available to economists interested in managing public forestlands The applied and theoretical analysis combine a sophistication of technique with an understanding of the breadth of the issues that are essential to improving Forest Service policies Perhaps, their greatest contribution is to re-enforce the importance of interactions from the joint aspects of production on a single site, to the prevalence of cross-site affects that, in turn, induces complicated intertemporal dynamics Although other critics might prefer a more poignant critique of current Forest Service policy, I recommend this book to a wide readership, with the proviso that some might be frustrated by unfamiliar economics, while some may thirst for more theoretical rigor