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THE ROLE OF ECONOMIC ANALYSIS IN PUBLIC RANGE MANAGEMENT*

B. Delworth Gardner**

Introduction

Economic analysis has a vital, if not indispensable, role to play in the management decisions of the Bureau of Land Management (BLM) if the national welfare is to be served effectively. This rather sweeping conclusion is justified by the nature of the management problems faced by the BLM and by the unique view of the world provided by the field of economics.

The approach of this paper will be to describe briefly some of the intellectual bases of economics and then to apply them to the more significant management issues faced by the BLM: land use planning, multiple use philosophy, grazing fees, and range improvement analysis. This discussion is meant to be an overview of a rather wide spectrum of issues, and not a detailed, complete and, therefore, satisfying treatment of any of them. Following papers in this workshop, as well as those in other workshops in this series, will provide needed depth in an empirical problem-oriented context.

Another goal of this paper is to identify significant economic problems that presently are receiving inadequate attention by the BLM, or by anyone else for that matter.

Finally, in the last section of the paper, the BLM's capability to make the envisioned analyses will be investigated and a few recommendations will be advanced.

Economics and Societal Welfare

Let us begin by attempting to circumscribe economics as it is commonly understood. What

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distinguishes it from other academic disciplines and fields of learning? What are the central human problems that it attempts to elucidate and solve?

Jacob Viner, a celebrated economic theorist and historian, once equipped that "economics is what economists do." This statement is circular and not at all helpful in delimiting the boundaries of economics. It may be quite revealing, however, in hinting that economists have broadened their interests considerably through time as the discipline has matured, and as economists strayed into the sacrosanct domain of other fields such as political science, sociology, psychology, anthropology, engineering, and even biology. It might be added that economists have not generally been welcomed with open arms by these disciplines as they have employed their maximizing behavioral models, founded on "unrealistic" assumptions of happiness seeking consumers and profit maximizing firms.

Foremost, economics is a positive science that attempts to explain the behavior of economic agents, i.e., the domain of "what is." Implications of economic theory are tested in the empirical realm to determine the validity of the theory. But economics is also a normative science—a body of knowledge about "what ought to be." In this realm, economics prescribes behavior that is required to reach certain goals deemed to be desirable, e.g., efficient resource allocation, full employment, price level stability, etc.

Perhaps the definition of economics that is most widely used in our textbooks nowadays is the one advanced by Robbins five decades ago; namely, the economic problem involves the allocation of scarce means among alternative or competing ends (Robbins, 1932).

As James Buchanan elaborated (Buchanan, 1979), "the problem is one of allocation made necessary by the fact of scarcity, the necessity to choose." Ever since Robbins' seminal work, economists have devoted much energy to the problems raised by scarcity, broadly considered, and to the necessity for the making of allocation decisions.

In his critique of Robbins, Buchanan believes that the discipline has veered off track in viewing economics as a set of problems centering on allocation. Buchanan's view is that economics is a characteristic form of human activity that occurs in a "whole network of evolving exchanges, bargains, trades, side payments, agreements, and contracts," where there are gains to be made from mutually beneficial trade. Buchanan further argues that the emphasis on allocation as the problem has led us to optimization models that amount to little
more than exercises in applied mathematics where the major improvements of late have come in the form of computing techniques and the mathematics of social engineering. Buchanan's sense is that economics should concern itself more with the positive behavior of economic agents as they interact to solve society's economic problem. In short, economics should be concerned more with testing behaviorist hypotheses and less with generating normative rules for maximizing this and that.

Politics is also vitally concerned with resource allocation and thus overlaps with economics in its traditional concerns. Buchanan provides a useful distinction:

Economics is the study of the whole system of exchange relationships. Politics is the study of the whole system of coercive or potentially coercive relationships. In almost any particular social institution, there are elements of both types of behavior, and it is appropriate that both the economist and the political scientist study such institutions (Buchanan, 1979, p. 34).

An implication of the discussion above deserves emphasis and elaboration at this point. If economics is concerned with exchange and trade, it is apparent that more than dollar-value variables are relevant in the choices to be made. The terms of trade incorporated in a given choice will almost always include a host of nonmonetary factors: freedom, comfort, altruism, fidelity, beauty, etc., which impinge on the exchange transaction. To the extent that these attributes can be defined and measured they constitute no problem in terms of explaining positive behavior. They do, however, create some considerable consternation to the economist who is working with normative optimization models. These models maximize or minimize monetary variables such as profits, costs, or rents and if the causal variables are not quantifiable in these terms they are difficult to include in models of this kind.

I believe that there is a wide agreement among economists, however, as to what are the two most significant economic issues: economic efficiency and distributional equity. Under the economic optimization paradigm, efficiency means getting the most output from the limiting resources, using the "best" combination of inputs—employing inputs in their highest valued uses. Nearly all productive activity, however, eventuates in both "goods" and "bads;" the "goods" consisting of consumable products that add to human satisfaction and
the "bads," generally in the form of waste, that detract from it. The allocative goal of productive activity for a given time period is to maximize the net benefit from the "goods" and the "bads;" and at the same time, to leave the resources unimpaired in their productive potential. If there is to be efficiency, then returns to like units of outlay must be equalized at the margins—that is, efficiency requires that inputs be used up to the point that their value in use (their contribution to output) exactly equals what they are paid.

In the case of temporal allocation of capital stock resources, the goal to be sought is to allocate resources through time such that the net worth of the capital stock at any moment of decision is a maximum. It is important to recognize that the stock of capital includes resources in the natural environment such as land, water, air, trees, renewable vegetation, etc.

Which brings us to an all important concept in economics that lies at the heart of allocative efficiency: opportunity cost. The opportunity cost, or simply cost in its economic meaning, of producing commodity X is the value of the resources (inputs in production) used to produce X in their best alternative employment (i.e., where they could have been used to produce something other than X). Thus, the cost of using resources in the public sector is their highest valued employment in the private sector. Or, the cost of using range improvement funds in spraying brush is the foregone value of forage that could have been produced by spending the funds for reseeding, if reseeding represents the most productive alternative use of the funds. The applications of the concept are nearly limitless, and opportunity cost more than any other concept represents the way an economist views the world.

Economic theory posits a relationship between output and the inputs used in the production process that can be represented as a frontier constituting the best that can be done with the resources and technology available. Allocative efficiency is concerned with the choice of the best point on the production frontier. Leibenstein (1966) has argued that allocative efficiency is not so important in reaching maximum production as is a notion he calls X-efficiency. Rather than shifting resources about from uses and time periods of lower net value to higher ones until net returns are equal, X-efficiency measures actual economic performance compared to the theoretical frontier. That is, it attempts to account for the disparity between actual output and potential output that would result from the best technology available and the most ideal institutional environment and
incentive structure in which economic choices are made. In explaining the real growth in the economy through time, X-efficiency is alleged to swamp allocative efficiency in importance. The evidence is not all in, however, and economists will continue to study and debate these issues.

Equity in the distribution of income and wealth is the second great issue in economics. What factors determine the distributational shares of economic product captured by various economic agents who contribute to economic output? Property rights are obviously critical. Some government policies that affect this distribution, such as the progressive income tax, were designed to redistribute income and wealth more equally.

In the context of this discussion, two points are worth noting. In terms of a positive analysis of "what is," equity problems are just as amenable to scientific analysis as are efficiency problems. That is, it is no less scientific to analyze the impact of the BLM's grazing fee policy on the distribution of rancher incomes than it is to analyze its impact on the allocative efficiency of forage among ranchers. But there is a basic difference between efficiency and equity criteria in the normative sense of "what ought to be." By definition, allocative efficiency is "good." More net output of a useful product must be better than less. In the case of equity, however, it is impossible to prove that one income distribution is "better" than another without making interpersonal comparisons of levels of satisfaction. But because satisfaction is personal and subjective, there is no objective way of demonstrating that a more egalitarian distribution is better than one less so, although it is often assumed to be so.

For our purposes here it is sufficient to differentiate between efficiency and equity problems and to indicate that both are legitimate subjects for economic inquiry. The more normative equity issues, however, tend to be more political since they cannot be settled by positive analysis. In addition, they are very visible. In fact, politics is chiefly concerned with power brokering as groups attempt to increase their share of economic product in a largely zero-sum game. Zero-sum means that transferring income does not change the total income to be allocated. Anderson and Hill (1981) have argued that income transfer is a negative-sum game since resources are required to effectuate the transfers. Achieving greater economic efficiency permits the game to be positive sum so that at least theoretically (assuming some scheme to compensate losers) some economic agents can be better off with none left worse off.
Tradeoffs between efficiency and equity create some difficult management problems for government agencies such as the BLM. Pressures mount for policies to achieve equity goals. The rub is that often, if not always, these policies tend to be inefficient. How much net economic product is sacrificed in the struggle for larger income shares by special interest groups? Can't the equity goals be reached in ways less injurious to efficiency and thus leave all better off? In my view, these are the most compelling questions that require answering by competent economic analysis, either done in the agency itself or hired externally. These questions of efficiency and equity will recur time and again in the following discussion of Bureau management and policy.

Economics and Management Issues Facing the Bureau of Land Management

Some historical perspective of public land disposal and management would put the current set of issues in a useful context but space and time constraints will not permit. Besides, Robert Nelson in the Office of Policy Analysis (Nelson, 1980) is well underway with a project to provide this perspective. The Bureau is operating under a new and different set of statutory and administrative guidelines now than was the case prior to the passage of FLPMA in 1976. Let us proceed by identifying some of the critical economic issues faced by the Bureau under the current legal and administrative mandates and discuss the efficiency and equity implications.

Jurisdictional Control and Ownership of Public Lands

The Federal Land Policy and Management Act of 1976 (FLPMA) has been called the BLM's Organic Act. It provided legislative recognition that BLM is more than a custodial manager of the nation's largest block of the public lands until they are finally disposed of. The Act mandates that the public lands will be retained in federal ownership unless it can be shown that disposal would serve the national interest.

It is ironic that despite FLPMA, the greatest challenges to continuing federal control and ownership of the public domain lands have occurred since 1976. Most of the significant public land states have recently passed "Sagebrush Rebellion" laws proposing to shift ownership and control of the public lands to the states. Two states, Utah and New Mexico have published studies (Le Baron et al., 1980) that indicate that state management of the public lands may indeed be feasible. Other states are sure to follow with similar
studies, if they have not already, and they are likely to reach similar conclusions. The issues are complex and the empirical problems of measuring costs and benefits of state management are formidable. Because the "economic rents" from energy development are so huge, the stakes are high and it is not clear at this point exactly how or when the issue will be settled.

Other arguments can be advanced for transferring ownership and control of the public lands to the private sector (Baden and Stroup, 1973). There is much appeal in the assertion that the private market is the most efficient mechanism ever invented by man to channel productive resources into those uses most satisfying to consumers and to induce the supply of optimal quantities of productive resources to profitable production. Government enterprise has been shown to be notoriously inefficient on both counts since the rigors of market competition do not penalize inefficiency.

Much work remains to be done by economists on these questions. The efficiency questions are paramount. What are the outputs that might be produced on the public lands and what are they worth? How does "value" get established if competitive market prices are unavailable? What inputs are needed to produce the outputs, and what net benefits are foregone if these inputs are used on the public lands rather than elsewhere in the economy? What outputs and inputs are incapable of being "priced" according to their "social" value, and can public or private enterprise best account for these "externalities"? Externalities are unpriced effects on third parties not accounted for in negotiated market transactions. What outputs, if any, would not get produced at all by the private sector since they are "public" goods and thus it is impossible to restrict their consumption in an exchange market? How inefficient is the legislative budget process in providing capital and human resources in optimal quantities for efficient development and management of the public lands? And how serious are allegations of "government failure," i.e., the lack of incentives in government enterprise for bureaucrats to acquire management expertise, or to invoke management and production decisions that satisfy the interests of clientel groups rather than those of the bureaucrats? These are only a few of the questions that economists must ask and answer if public decisions on the ownership and management of the public lands are to be informed and efficient.

Likewise, the equity questions in state vs. federal ownership are of tremendous concern. Many fear that state governments would prove to be far more susceptible to influence peddling by powerful economic
interests than is the federal government and, therefore, would shift resource use to favor those interests. Is it true and, if true, is it bad? Others believe that local interests should be given greater weight in management decisions than they are now and that local managers, responsible to a local constituency, are likely to make better decisions than those whose constituency is nationwide. After all, it is in Washington where the major centers of power are, and it is there where lobbying has reached such high intensity. This does not suggest that lobbying per se is all bad, but there is no doubt that users of the public lands have very disparate representation by lobbyists in Washington. These questions are far from settled and much more solid research needs to be done by social scientists of all stripes, but especially by economists.

**Land Use Planning and Multiple Use Management**

FLPMA specifies that the Federal lands are to be managed under multiple-use principles and in a manner which will protect the quality of the resources and the environment. While the act may have established the legitimacy of multiple use as a legal and a management principle, and thus may make it more difficult for politically potent groups to obtain exclusive use privileges, there are many unresolved operational questions about multiple use that require answering before implementation of land-use plans.

Recognition needs to be given to the fact that the BLM's management problem is more than one of allocating forage among competing uses. Many uses of the public lands are only indirectly related to forage availability, if at all. Mineral and energy production below the land surface are obvious cases in point. So are preservation of historical sites and endangered species and some forms of recreation. What are the useful products, broadly construed to include amenities, that can be produced on the public lands? What are the resources required to produce them? Are they competitive for resources or do they complement each other? What are their "values" to users? How does production affect the resource base in terms of its potential for future productivity? All of these questions must be answered before an "efficient" mix of products can be determined, and before the "efficient" quantity of the mix can be established.

Posing these questions this way raises an even more fundamental issue: how relevant is an efficiency criterion in the first place as a guide for resource use decisions on public lands? My own view is that it is highly relevant. In the first place, efficient
production maximizes the difference between the value of output produced by scarce resources and its costs. An ethos exists in our society that this is a good thing. Perhaps even more important is the requirement that production pass a benefit-cost test; this imposes a certain rigor on the planning process itself. If not maximum net output, then what level? Who is to decide and by what standards? Are we to leave the resource-use decisions to the whim of the land manager without firm management criteria and accountability? To do so opens Pandora's box and subjects him to pressure, cajolery, and threats that are inimical to effective management.

As for multiple use, it is a term that may have some rhetorical or legal value but is rather amorphous in its implementation unless guided by efficiency criteria. It suggests that more than one user or class of users have valid claims to land use. Thus, user classes that are themselves struggling for survival on a given parcel of public land such as miners, energy producers, or ranchers love the term. But multiple use is of little help to the managers in deciding the optimal mix of many uses that are competitive for resources in one way or another. Efficiency criteria that prompt resource shifts from uses of lower marginal social value to higher ones obviously constitute a planning tool that gives unambiguous directions to resource allocation so long as the requisite information on what the values are is available. Of course, other criteria could be and are used in place of efficiency criteria, if the latter are considered too narrow or too crass or whatever. My point is that efficient management would be promoted if the criteria were unambiguous and that multiple use is anything but clear and unambiguous.

Vegetation Allocation, Range Improvement, and User Fees

In principle, the forage allocation decision has the same efficiency and equity dimensions as the land allocation decision. Forage is allocated to livestock, wildlife, small mammals, insects, watersheds, etc. In some cases, market prices exist that reflect use values rather well and in other cases they do not. Economists have made progress in simulating market prices for some uses such as wildlife and watershed where products and yields are well defined, but to my knowledge have made little progress in valuing forage going to small mammals, insects, and especially endangered species. Professor Dyer's paper at this workshop discusses this issue.
It is in the area of grazing of livestock that efficiency and equity conflicts are especially evident, and special attention will be given to this use primarily because the regulations are well developed and several studies have been made.

Grazing regulation #4110.1 specifies that "to qualify for grazing use on the public lands an applicant must be engaged in the livestock business, (and) must own or control land or water base property . . ." It is difficult to quarrel with the requirement that an applicant must be engaged in the livestock business since almost by definition a livestock grazer would be in the livestock business in one way or another. It is the "ownership of base property" requirement that creates an efficiency-equity conflict. This is the well known "commensurability" requirement that is more explicit in the eligibility prerequisites of the Forest Service than those of the BLM. This requirement eliminates from consideration for permits the "itinerant" stockman who may own no base property but may be very efficient in the use of the forage. It also effectively eliminates any rancher who may not be fully commensurable in the eyes of the federal range manager.

My own research (Gardner, 1962a) many years ago showed that this policy is inefficient and has misallocated forage among ranchers. Then why has the policy persisted for over 40 years? I believe it is because of a mistaken view that only base property owners are bonafide stockmen; that if this eligibility requirement were eliminated the industry would be somehow unstable.

The question of stability of the industry is raised in regulation 4110.2-3 in connection with the transfer of grazing preferences; "Approval of the transfer shall not disrupt the stability of the livestock industry in the general area within which the public lands involved are located." No hints as to what is meant by "stability" are given. We can assume, I believe, that it is the wealth positions of livestock operators and those that sell inputs to the industry and market and transport the output that are being protected by this regulation. If so, it is a regulation that is oriented around equity concerns rather than those of efficiency. In any case, I know of no empirical evidence that eliminating the current eligibility requirements would create an unstable industry or local economy.

Let me now turn to the issue of the level of the grazing fees. Until recent years the fees were set well below the value of the forage. Were there no eligibility requirements for obtaining grazing privileges, the demand would have exceeded the supply. Therefore, some rationing mechanism had to be employed
to allocate the forage and the eligibility requirements were imposed. It is easy to rationalize the requirements that were selected. Conflict would be minimized by allocating the privileges to the ranchers who grazed the land before the Taylor Act was passed, and it was they who generally had the local base property.

There can be no question that the old Grazing Service had some delicate political problems on its hands as it brought previously unregulated grazing under control. Not surprisingly, the ranchers who had grazed the public range for free strongly resisted the imposition of even the low fees. Many were pioneers who were largely responsible for the area's settlement and development. A policy that was not equitable to them in the circumstances would have very little chance of being implemented. The policy of low fees and commensurable base property was reasonably fair to the original permittees but ultimately produced a set of inefficient regulations; a classical efficiency—equity tradeoff.

This set of issues is still very much alive. Under the spur of recent legislation the government has been riding hard to charge livestock grazers the "fair market" value for forage. "Fair market" value is usually defined to mean what the forage would be worth if it were allocated in private and competitive markets. The rationale for this policy usually advanced is that the public owners of the range resources should receive its fair value so as to avoid subsidizing specific user groups, who have been subsidized for a long time anyway. In other words, equity requires that tenant users pay full value. Much of the debate has centered on what is "fair market" value and whether or not it costs the rancher more to run stock on the public range than on comparable private ranges from which monthly rentals are available that might be used as the indicator of fair value. (See Godfrey's paper in this volume for further discussion.) Part of this controversy turns on whether or not the permit value itself should be included as a cost of public grazing. The government has always insisted that the permit is a privilege and not a right and therefore has no legitimate value. As if a government edict or even a legislative statute could repeal the inexorable workings of the market. Permit values were generated by government policies that priced the grazing below its value and gave the ranchers at least some security of future use, both of which are necessary conditions for the permits taking on a value.

What are the efficiency implications of charging "fair market" fees in the name of equity to public
landowners. The grazing fee, like any price, has distinct efficiency as well as equity implications. These are too often neglected in range policy discussions, partially because scientists and especially economists have not analyzed sufficiently the efficiency consequences of setting the fee at different levels.

It is my sense that the eligibility requirements for holding permits misallocate grazing services more than the level of the fee charged. Let me try to demonstrate why this is so. Suppose the fee were set below the value of forage in livestock grazing. If transfers of permits were unrestricted, permits would take on a value that would represent the capitalized differential between the annual competitive value of the forage and the annual grazing fee. So long as the differential existed, the permits would have a market value and would be bought by the most efficient users. Thus the level of the fee would be innocuous in its allocative impacts. If the fee were raised to the competitive value of the forage, however, the permit value would go to zero and the fee would become binding in its allocative effects. Only the most efficient users could afford to pay the fee and would thus obtain the permit. Thus, one way of ascertaining whether or not fees are approaching competitive levels is to observe how much interest there is in acquiring permits. Another is the degree to which ranchers opt for nonuse of the preference which they do hold. If the grazing preference is unused over several grazing seasons the suspicion must be raised that the fee exceeds the net value of the forage to the grazer.

Given the eligibility requirements that at least partially ration the permits to qualified ranchers, the level of the fee simply determines the annual "economic rent" (revenue minus variable costs) captured by the eligible permittees who hold the permits and at the same time contributes to determining the value of the permit itself (Roberts, 1963). This, of course, is the equity issue and it arises because fees have historically been "low" as argued above. Even with the costs of maintaining the eligibility requirements, such as commensurability and land ownership, differentials between the fee and forage value have been large enough to support substantial permit values in most areas. If the government raises the fee, the permit value falls below what it otherwise would be and the rancher suffers a wealth loss. If he actually purchased the permit at a higher price with debt the wealth loss may also create a cash flow problem for him. If he has always held the permit or inherited it, the wealth loss may not cause so much stress, but is a real loss nevertheless. In terms of what is fair, does it make
sense to raise fees to shift more of the economic rent to the public owners, and thus impose wealth losses on ranchers, many of whom have incomes below the national average?

Given that the eligibility requirements cause inefficient allocation of grazing preferences, and fee levels at fair market values seem to be inequitable to ranchers what should be done? My proposal (Gardner, 1963a) nearly twenty years ago seems just as applicable today as it did then. In brief, the proposal called for the creation of perpetual permits for a given quantity of grazing to be determined by the Bureau, relying on the best scientific evidence available on range condition and competing multiple use demands. These permits would be issued to ranchers who presently hold permits in exchange for those now in use. These permittees would be completely free to retain or to dispose of the new permits to whomever they wished, for whatever price could be negotiated.

Prudent management may require changing the quantity of forage allocated to grazing from time to time. If additional AUM's become available because of permittee investment or management, the permittee would be allowed to harvest them at the set fee. If new allotments were created on land previously ungrazed the new permits could be sold at auction. If grazing needed to be permanently reduced, the government could simply buy up the permits in the market. This policy may seem inequitable on its face. After all, why should the government buy back permits it had freely given away? Because this is one way of avoiding the imposition of wealth losses on the 80-85 percent of permit holders who have purchased permits from other ranchers. It was the government policy of underpricing grazing along with re-issuing permits to buyers of permitted cattle and dependent base property that gave rise to permits taking on capital value.

The equity problem relating to the level of the fee could be quite easily solved. If the fee were set at the value of the grazing, the permits would have no value and a market for them could not function. If set at a "low" level the new perpetual permits would have a higher value than the old ones given the reduced uncertainty of the new permit system. It follows that at some fee level the new permits would be worth, on the average, exactly what the old ones are now. To avoid windfall gains or losses to current permit holders, the government should try to ascertain what this fee level would be and charge it. Thereafter, the fee should be fixed in real terms to move with some "reasonable" price index so as to avoid future wealth gains and losses to ranchers and the public land owners.
Baden (1980) has presented a slightly different approach:

There is, however, an alternative that captures the benefits of private ownership, generates revenue for the public treasury and does not violate standards of equity. . . . First, separate the grazing from the other values such as mineral and wildlife. Second, calculate the discounted present value of the permit. One would calculate the present value of the income stream to the federal treasury that would be produced by the permit. Data for this computation are either currently available or can be established by a simple decision involving the determination of future fees. Third, allow present permittees to purchase property rights in the grazing resource at the above figure. If the present permittees do not want to exercise their option, then these rights can be put up for auction.

Both Gardner and Baden proposals approach the efficiency problem by creating markets for permits where they can move to the most efficient grazers without restriction. They approach the equity problem somewhat differently. Baden's system is equitable since ranchers pay the present value of future fees in order to purchase the grazing rights and thus are no worse off. The government does not lose by selling the permits to grazers at the discounted estimated future fees that would have been collected. Gardner's system is equitable in charging fees that would leave ranchers just as well off as they are now. Which of the two, or some modification of each, is superior needs to be searchingly analyzed. Baden's proposal involves private ownership of grazing rights; Gardner's only a free market in government owned grazing preferences.

Other grazing regulations that promote equity at the same time probably reduce efficiency. Regulation 4110.4-2 indicates that where a decrease in public land acreage available for livestock grazing necessitates reductions or cancellations in grazing preferences, that the cancellations will be equitably apportioned by the authorized officer. It is not exactly clear what "equitably apportioned" means. The reduction would be efficient if the officer could cancel out the preferences of the highest cost grazers.

Regulation 4110.5 indicates what applicants will be eligible for any additional forage that might become available. Among the factors to be considered are: a) Historical use of the public land, b) Proper range
management and use of water for livestock, and c) general needs of the applicants' livestock operations. Items b) and c) may be related to efficiency as well as to equity, but they are by no means equivalent to it.

Regulation 4120.6-1 states: "The authorized officer may require a permittee or lessee to install, maintain, and/or modify range improvements on the public lands." Given all the problems with security of tenure, the history of grazing reductions, and rising grazing fees, this seems an astounding requirement and must seem onerous to stockmen if taken literally on its face. I have been told by officials in the Bureau, however, that the regulation is applied only when a majority of ranchers wish to proceed with a range improvement project benefitting all, but there are one or more holdouts who wish to be "free riders." This means they could profit from the investment of others without paying their fair share. Thus, they are required to participate. Interpreted in this way I have no objection to the regulation since the requirement conduces to efficiency as well as equity.

Equity is also an issue relative to multiple use. Some users of forage such as livestock grazers pay fees, and as indicated above there is now considerable pressure to raise them to "fair market" value. Other indirect forage users such as hunters and fishermen pay a license fee, although the amount paid is hardly a reflection of the average value of the service provided by the federal land and/or water resources and besides does not accrue to the federal government. Other users such as watershed beneficiaries and many types of recreationists and environmentalists pay nothing at all. Often representatives of these groups are the most vociferous advocates that livestock grazers ought to pay fees that represent the full fair market value.

This is not an easy issue to resolve. It may be quite infeasible to price some uses of the public lands. Prime examples are the so-called "public" commodities or services (Samuelson, 1954) those that are nonrival in consumption and where access to users is difficult or impossible to control. Public land used for open space and for its aesthetic quality (Gardner, 1977) is a good example. Open space exists for all to enjoy and consumption is nonrival so long as congestion does not occur. If unrestricted transportation roads pass through open space, access is uncontrolled and use charges are probably infeasible because it would be difficult and costly to collect them. To be perfectly clear, this discussion is not an argument for pricing commodities that qualify as public goods. It is simply a statement of fact that equity problems will always exist when some users are required
to pay for benefits received from using the public lands and others are not.

My sense is that both efficiency and equity goals would be well-served, however, if competitive pricing were utilized to the full extent that it can be; i.e., for all nonpublic goods. Equity would be well-served if consumers of public goods could be taxed to the point that tax revenues would at least cover the cost of supplying the public good. Of course, this assumes that consumers can be identified and costs can be determined, neither of which is easy or costless. Unfortunately, no taxation scheme is completely neutral in its impacts on economic efficiency and thus a more equitable policy might well be one that is less than perfectly efficient. Such is the nature of many efficiency-equity tradeoffs.

**Range Improvements**

The efficiency-equity dilemma is also well illustrated in the matter of investment in range improvements on the public lands. Many studies over the last three decades have shown that it is economically feasible to invest in range improvements, particularly on private lands (Nielsen, 1981; Gardner, 1962b). Reported rates of return in these studies have been extremely variable and I have shown (Gardner, 1963b) that most of the variability of studies completed before 1963 is attributable to the methods used to calculate profitability rather than to differences in the basic data showing costs and returns. Dr. Workman's paper following this one will focus on some of these issues relating to economic feasibility and ranking alternative projects.

In range improvement, economic efficiency is enhanced if two conditions are met: (1) if the resources utilized in the improvement practice have net economic yields higher than those in their best alternative use, and (2) in terms of project scale and durability, if scarce resources are utilized in the improvement project until the marginal value of increasing scale or durability is just equal to the marginal value of the resources in their best alternative. If yields are higher in range improvement than in alternative uses then "under-investment" in range improvements is indicated. This is precisely what most of the studies on private lands tend to show. But there the situation is relatively uncomplicated. Property rights are fairly secure, and if the investment produces more forage the rancher can raise the stocking rate and utilize any grazing system he wishes to take the forage.
The situation is vastly more complex on the public lands. The question of economic feasibility is much more complicated where multiple use is mandated and multiple products must be evaluated. When the amount and/or the composition of vegetation is changed many of the multiple uses are affected, some positively and some probably negatively. These must somehow be evaluated in aggregate if economic feasibility is to be determined. At first blush it would appear that economists in the Bureau have the perspective and information to make the most adequate studies. As Workman points out, however, the problem is that there are strong incentives in the bureaucracy to justify all projects by whatever means necessary so that investment funds can be acquired. Sometimes this is hard to do when increases in forage are allocated to uses other than livestock grazing, especially to those uses that are difficult to quantify in monetary terms.

Cost-sharing between the agency and the rancher will seldom generate the most efficient quantity of investment funds, especially under present regulations. The rancher perceives several problems. Suppose the improvement practice does generate increases in forage. What guarantee does he have that he will be allowed to graze it, given the heavy pressures from the multiple users who are also demanding more? It is possible, of course, that his investment might forestall future grazing reduction? How can he be sure when the multiple use decisions are entirely in the hands of agency managers and there are no legally binding guarantees? For many years the agencies have been reluctant to allow private investment on the public lands, supposedly because it would give the investors greater leverage in forage allocation decisions and reduce the manager's authority to make needed reductions in stocking rates or changes in season of use.

Grazing regulations of the Bureau appear to encourage the permittees to make investments: #4120.6-3 states that any permittee may apply for a range improvement permit to install, use, maintain, and/or modify range improvements that are needed to achieve management objectives and that the permittee shall provide full funding. The regulation adds that the permittee shall have title to removable improvements authorized under the range improvement permit.

The question at issue is whether or not these regulations provide sufficient incentives for "efficient" private investment as defined above. There are reasons stated in the regulations themselves that cast some doubt. Grazing regulation #4120.6-2 specifies that "Any permittee or lessee may enter into
a cooperative agreement with the BLM for the installation, use, maintenance, and/or modification of range improvements needed to achieve management objectives within his designated allotment." So far so good! Regulation 4120.6-2 also states that the United States will have title to range improvements produced by a cooperative agreement between the permittee and the U.S. government, and that acquisition of a range improvement permit or participating in a cooperative agreement does not convey to the permittee right, title, or interest in any lands or resources held by the United States. Regulation 4120.6-6 goes on to indicate that "range improvements shall not be removed from the public lands without authorization." It must be quite obvious that lack of a clear title to range improvements and required authorization for removal must impair incentives for improvement investment. Besides, most improvements (fences, water developments, vegetation conversion) are simply not removable.

More importantly perhaps, what happens if the permitted AUM's are reduced or the permit cancelled? If the permit is cancelled, the regulations say that the permittees shall receive fair market value for their interest in the permanent range improvements. This clause provides some security but outright cancellation seldom occurs. The more typical case is a reduction in the AUM's allowed. In this case, the regulations make no provision whatever for any compensation for investment lost in range improvements. Given the long history of grazing reductions, the pressures from other multiple users for increased use, and the reluctance of agency officials to encourage private improvements, the climate for private investment on public ranges is not favorable.

Perhaps private investment is not needed if public funds can produce the efficient quantity of range improvements. FLPMA stipulates that one-half of all grazing fees collected by the government shall be used for range improvements. These are called "range betterment" funds and half of them go to the district or region where they were generated via fees, and the other half may be used anywhere on the public lands for range rehabilitation at the discretion of the Secretary of Interior.

Two points deserve attention. If it is in fact true that rates of return to range improvement are higher than comparable rates earned by the resources in their best alternative uses, then this formula allocation would automatically provide investment funds and would be economically efficient. This assumes that the funds were not dollar-for-dollar offset by reduced appropriations for range improvement. I would doubt that the probability is high that such a perfect match
has occurred; thus, formula allocation may have increased the flow of funds for range improvement. Still, investment by formula is always dangerous on efficiency grounds since funds are directed to given purposes and even certain geographical locations regardless of relative economic yields. The Bureau evidently does not have the flexibility to rank all range improvement projects by net economic yield and then allocate these funds on a project-by-project basis, by descending yields, until the funds are exhausted. This procedure would almost surely produce more efficient investments than any allocation formula. The reason that formula allocation was initiated is probably found in equity considerations. If there are benefits to be captured by range improvement and grazing fees are the sources of the funds, then why not give the benefits to those who paid the fees? Good equity reasoning! The fit is not perfect, the improvements are not made on the exact ranches in proportion to fees paid, but half the funds do filter down to the state and the district of their generation. This rule may make it more palatable politically to raise fees to fair market value as required in recent legislation and as strongly advocated byOMB since the ranchers appear to be getting some of them back in the form of range improvement benefits.

In sum, once again efficiency of resource allocation is probably sacrificed on the altar of equity.

Economic Analysis in the Bureau of Land Management

I do not consider myself sufficiently informed about the Bureau's needs for social and economic analysis relative to its capabilities for meeting these needs to give more than a cursory and probably naive discussion of this topic. Other scholars following me in this workshop will probe more deeply, I trust, and Workshop 6 will be devoted largely to the legal, political, and social setting within which the Bureau operates its programs. Still, the above notwithstanding, a few comments will be given to complete the discussion of the role of economic analysis in the Bureau.

Benefit-cost (B-C) analysis formally has been performed in the BLM since 1976 in an effort to improve the productivity of rangeland investments. Two very recent documents, dated March 3 and March 11, 1981 explain clearly the goals to be pursued and the procedures to be used in economic and social analysis. The documents are Instruction Memorandum 81-296 and Instruction Memorandum 81-315, and I regard them as
clear and forceful statements. For the most part the economic analysis advocated is sound. They deserve careful attention and study, and ultimate implementation should improve analysis in the Bureau by an order of magnitude.

Apparently they are to be regarded for the moment as tentative and experimental. To quote from the Director's letter attached to 81-296, "This policy is issued as interim guidance. It is to be applied and used by all field offices. We will request a report by about January 15, 1982, from each office on ways this policy can be improved so that we can prepare a final policy by March 1, 1982." In the spirit of trying to be helpful, I will raise a few questions on procedures that seem to me to be flawed, while leaving unsupported a much larger set of issues with which I am in agreement.

B-C analysis will be performed on improvements required to implement new Allotment Management Plans (AMP's). The following instructions are given:

No single criterion can serve as a indicator of the efficient use of Federal investment funds and as a measure of sustained yield and multiple use criteria in the Federal Land Policy and Management Act of 1976. To capture the essence of national policy guidance, we have aggregated national concerns into two categories; economic efficiency and environmental quality . . . The B/C ratio will be used as an initial screen to determine economic feasibility. Allotments will then be ranked on the basis of a modified B/C ratio. The environmental quality criterion will be used to rank the allotments in terms of their current ecological productivity and stability, employing the acreage in the allotment that is in poor ecological condition as the measure of quality.

It is later indicated in the memorandum that poor ecological condition is a description of the successional state of the allotment in relation to climax range condition.

The decision process calls for a B-C screen; i.e., if the allotment investment plan does not produce a B/C ratio of unity or better, "adjustments in design, scope, or nature of proposed investments can be made in an attempt to improve the B/C ratio, consistent with management objectives." (BLM 81-296). Then all allotments will be ranked by B/C ratios. Even if an allotment investment program has a B/C ratio less than unity, . . . B-C analyses may be waived in a situation
where an improvement is needed to prevent severe loss to public or private resource values."

Allotments are also ranked by the environmental quality criterion; i.e., acres in poor ecological condition. Then the average of the rankings of the B/C ratio and the ecological condition determines priority of investment.

Several aspects of this procedure might be questioned. In principle, I am quite prepared to grant that ecological condition is a legitimate criterion for investment considering the mandates of recent legislation. The problem is how to consider it without opening the floodgates to admit any project that the range manager or any private user may feel strongly about for a number of possible reasons and thus eliminate the efficacy of any objective standard. There are opportunities aplenty in the procedures for doing just this. The B-C analysis can be waived altogether if the ecological condition is deemed poor enough. And, to rank allotments on the ecological condition criterion by the acreage in poor condition would seem to favor the large allotments, all other things equal, and I can see no logical justification for this. In short, there are too many qualifications to the rigorous application of a B-C test or screen. No wonder OMB often appears to lack confidence in the procedures of BLM as an effective test of economic or financial feasibility.

I cannot offer a perfect alternative given the mandates of the legislation. But I believe that formal incorporation of ecological benefits and costs in the B-C framework and then use of the ratio as a definitive screen would be preferable on economic efficiency grounds to the Bureau's outlined procedures.

Another problem is the use of the allotment as the analytical and accounting unit for B-C calculations. Admittedly, the AMP is the core of the Bureau's range improvement program and management plan. But I fail to see why this requires that range improvement feasibility be reckoned on an allotment-by-allotment basis. The physical boundaries of range improvement projects would seldom if ever coincide with allotment boundaries if they are most efficiently designed. After all, the allotment is simply a convenient range unit for management and administrative purposes. Why not do the benefit-cost accounting on a project-by-project basis? The myriad of factors affecting range productivity on an entire allotment would then not confound and obscure the benefits and costs of a single investment project plan. The important analytical consideration is to include the entire benefits and costs of a project, public and
private, wherever and to whomever they occur. Allotment accounting does not appear to accomplish this need.

I have one additional problem with the recommended procedure. Memorandum 81-296 discusses the criterion of National Economic Efficiency and states:

The B/C ratio will be used as an initial screen, to determine economic feasibility. Allotments will then be ranked on the basis of total benefits/Federal costs. The effect of subtracting private cost (including contributions) from the denominator will be to increase the value of the B/C ratio and improve the position of that allotment in the ranking. This approach will provide an incentive for user contributions and increase the effectiveness of Federal rangeland improvement expenditures.

Yes, this procedure will improve B/C ratios and will give priority to investments that maximize the returns per dollar of Federal expenditures. That goal may be of some interest to OMB. But as a criterion to indicate national economic efficiency, i.e., to maximize the benefits per dollar of scarce resources used, public and private, it is obviously badly flawed. And why should subtracting private cost provide incentives for private participation? Private participation will be influenced by the benefits received by the contributor per dollar of his contribution, not the benefits per dollar of federal contribution. In sum, for purposes of indicating efficient resource use implied by the national economic efficiency criterion, benefits should be shown in relation to all investment costs, public and private. BLM already argues that all benefits should be counted, not just those captured by the federal treasury. To be consistent all costs must be counted as well.

This brings me to my final point. It must be obvious that the demands on the Bureau's economists and sociologists are enormous. At the Washington level there are tremendous needs to satisfy the efficiency and equity implications of BLM policy in land-use planning, forage allocation, administering the permit system, setting grazing fees, estimating market and nonmarket values for outputs and inputs, developing guidelines for range improvement appraisal, and a host of other related issues. At the state and district level are the onerous requirements of the mandated EIS's, and the AMP's. I have not even mentioned mitigation studies, the subject of Professor Martin's paper.
Only administrators in the Bureau can know in any definitive way whether the capability in the Bureau matches what I consider to be a staggering load. The issues are as complex as those faced by economists and social scientists in any public agency, or anywhere else for that matter, and their resolution will require competence and training of the highest order.

As I understand the numbers, there are five economists and two sociologists working at the Washington level in the Bureau, but nonexclusively on range problems. Many are also working on minerals, energy, and forestry as well. At the state level, approximately twenty economists and twelve sociologists are working in the Bureau, and most of them do not have Ph.D. degrees. At the district level, there are approximately the same number as at the state level with about the same level of training. Since there are ten state offices and fifty-six district offices, the Bureau does not have all the districts covered with economists and social scientists, and the state people must be spread awfully thin.

My perception is that most of the effort of economists and sociologists in the BLM consists of busy work associated with mandated EIS's, ex post facto justification of range improvement projects and acquiring heaps of information in attempts to get the public involved in the decision process. Left undone is the really solid economic and social analysis of the bureau's policies in terms of their impact on the community. For the economists, this would include efficiency and equity studies and for the sociologists, social impact analysis.

This cavalier look at the agency and its problems, and the growing importance and controversy of economic and social issues, prompt me to wonder if there should not be some transfer of man-years from the technical, range management side to the economic-social side. In addition, it is quite obvious to me that the Bureau's difficult and complex economic and social problems require and deserve the best trained professionals available.

Recommendations

The Bureau should give serious consideration to the following recommendations which are derived from the above discussion.

1) Multiple use management must be buttressed by solid empirical analyses that attempt to evaluate the multiple products taken from the public lands and estimate their costs. This should put the land
allocation and forage allocation decisions in a more systematic, quantitative, and objective framework.

2) More resources should be devoted to economic and social analysis at all levels, even if it means transferring some from traditional range managements uses. I emphasize the importance of analysis as contrasted with much of the descriptive work now being done.

3) Since they are inefficient in allocating grazing, eligibility requirements for holding preferences such as prior-use, commensurability, and ownership of land and water, should be eliminated unless it can be conclusively shown that such action would have a disrupting, chaotic effect on the industry and the local economy. This would free the permits from any appurtenant land, water, or livestock and allow unrestricted transfer at whatever negotiated prices the market would dictate.

4) To the extent practicable, all direct users of the public lands should participate in paying fees that would defray at least administrative and management costs.

5) If grazing preferences are reduced on a fairly permanent basis, permittees should be compensated proportionately for their interest in permanent range improvements just as they are for cancellation of privileges.

6) Create incentives for private investment in range improvement by devising an evaluation system for changes in grazing capacity that will be credible to ranchers. Included must be a guarantee that ranchers can take the AUM's of increased grazing capacity.

7) B-C ratios for evaluating range improvements should be calculated on the basis of all investment costs and benefits, private and government.

8) B-C analysis should be done on a project basis rather than on an allotment basis.

9) Environmental concerns should be incorporated into B-C analysis directly rather than used as a separate ranking device for project selections.

Bibliography


