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A Reappraisal of Public Land Management

by

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COPERNICUS AND THE FORT COLLINS COMPUTER

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Introduction

The title of this paper may be somewhat misleading. The name Copernicus implies scientific models of the order of the universe while the Fort Collins computer implies heavy duty number crunching. Let me puncture the hopes and diffuse the concerns of various members of the audience. Despite the title of this paper, I solemnly swear that I will not take a derivative, perform a least squares regression, border a Hessian or invert a Jacobean. I will not, in brief, f(x) you.

I am, of course, aware of the theoretical underpinnings of a market process that generates Pareto optimal outcomes. These are, with a conceptual density, perhaps unrivaled in economics specified as follows:

> According to neoclassical theory, the individual consumer maximizes a single valued, convex, twice-differentiable utility function subject to a budget constraint. The budget constraint is determined by the prices of the rights to the use of the (homogeneous) commodities in the individual's choice set and by income. Income, in turn, is determined by the quantity and by the (derived) prices of the rights to the use of the (homogeneous) resources which the individual owns, including the fractional ownership of business firms. The individual is typically a price taker both as a buyer of commodities and as a seller of resources. The state of nature constrains the stock of resources, whose initial distribution is given, and the state of the arts constrains how business firms may convert resources into commodities. Production functions are convex, twice-differentiable, and eventually exhibit decreasing returns to scale. Each business firm maximizes profits subject to its demand and cost conditions. To derive and test implications of this theory, therefore, it is both necessary and sufficient to identify the variables which enter utility and profit functions, and to indicate how changes in constraints affect the appropriate opportunity sets. (De Alessi 1983)

Only one person in many thousands is likely to appreciate the theoretical sophistication of the above. Unfortunately, of those who do, only remnant minority are likely to understand its implication for social

organization- In other words, very few individuals understand formal systems of economics and few of those who understand the" formal systems appreciate the implications for public policy and general well-being. Fortunately, however, not only is it not necessary to understand the formal systems, such an understanding may pose a serious liability when trying to understand how the world actually works. There is, I'm suggesting, a culturally induced miopia associated with mathematical sophistication in economics. Such training then is neither a necessary nor a sufficient condition for economic understanding. Thus, individuals with Ph.D.s in economics may publish articles in Econometric, R.E. Stat and The Bell Journal while being baffled as to why stores give green stamps, why voters are rationally ignorant, why special interests dominate policy, or why public bureaucracies are primarily run for the benefit of the bureaucrats in them. For such individuals, the failure of the world to conform to De Alessi's description of the competitive market is often taken as a criticism of the output of actual markets. (Thus, the experimental work of Vernon Smith and Charlie Plott which progressively relaxes the assumptions of the "ideal market" and finds that it still produces outcomes consistent with the ideal model does, in fact, have relevance for the real world.) Market failure, the alleged failure to meet Pareto criteria is used to justify the replacement of markets with governmental officials. Among economists, the results apparently are predictable only to those with training in public choice and political economy.

Recognizing that we do not live in the zipless world of Ronald Coase, where transaction costs are zero and where externalities are internalized, and being quite familiar with the various causes of market failure, I assert with confidence that while market failure does exist, it may not be

overstated even by market critics, the relevant comparison is net between imperfect markets and perfect governments but rather between imperfect institutions of both forms.

As we approach the Bicentennial of the U.S. Constitution, it is important to recall that the authors of that document explicitly considered laws and public policies to be experiments. For nearly a hundred years, we have experimented with increasing governmental ownership, allocation, and management of the nation's resources. The data are coming in and the evidence is compelling: governmental failure is both more pervasive and more serious than market failure. Further, the failure of government to manage efficiently, equitably, and with environmental sensitivity are predictable consequences inherent to management by public officials.

At this point I would like to emphatically state my view that these problems are not the result of bad people but rather of inappropriate institutions that systematically and predictably generate bad information and perverse incentives. Again, the problems of governmental management are not the result of evil or incompetent people and they will not be solved by replacing existing personnel with better ones. Obviously, given bright, well-intended, nonself-interested vestal virgins of the public interest armed with the best scientific information and the resources to utilise that information, nearly any problem can, at least in principle, be solved. Such a conjunction of attributes, however, constitutes a null set. The scientific management approach is perhaps of philosophical or theoretical interest, but it is largely irrelevant to the problems at hand.

In terms of its utility for policy analysis, the scientific management (better people model) is even less relevant, by several orders of magnitude, than the idealized market presented above. The market model

generates testable implications applicable to the real world. Given that deviations from the market model are often rather, minor, it has robust explanatory powers. In marked contrast, the council of perfection inherent to the scientific management euphorism for bureaucratic pathology is, to the best of my knowledge, perfect irrelevant to all but historians and to politicians seeking to augment their power.

The New Resource Economics

Much of the analysis being conducted in natural resource economics and policy is statistical, technical, and formal. Shadow prices for non-marketed resources, linear programming models of optimal timber harvest scheduling, and the application of optimal control theory to groundwater management all provide examples of the ingenious application of these techniques. The level of sophistication in this research is impressive, but the implications are often enigmatic and sometimes irrelevant.

The new resource economics (also referred to as the new institutional economics), with its focus on institutions and their effects on individual decision makers, is a more encouraging and quite possibly a more relevant approach to natural resource policy. This new economics takes decision makers as the relevant units of analysis and then focuses on the information and incentives provided by the institutions within which they operate. The propositions underlying this approach are, first, that individuals act on information and incentives and, second, that institutions generate information and structure incentives. By focusing on the institutional structuring of information and incentives, it is possible to explain important aspects of pollution, the rapid depletion of resources, the extinction of animal and plant species, and inefficient resource use.

Most researchers concerned with natural resource management recognize that government is necessary to defend and protect property rights if resources are to be efficiently used. This applies whether we are concerned with environmental amenities that are directly appreciated or with resources that are converted into marketed products. The new resource economics goes beyond this realization to help predict the sources of resource management problems, identify the causes of those problems, and suggest a range of solutions. It can also guide policy makers toward the realization of a more productive, positive-sum management of increasingly scarce natural resources.

Only by moving to higher levels of efficiency will there be the potential for all parties to gain. Many economists and policy makers, for example, agree that institutions for forest management promote policies that are inefficient, unproductive, and often environmentally unsound. As the effects of agency programs (e.g., deficit timber sales, chaining, rest-rotation grazing, and water and grazing subsidies) become known, many of these same analysts are beginning to understand how institutions established under the premises of the new resource economics would encourage more timber production at lower costs, better wildlife habitat, more backcountry recreation, and less subsidies--and they would do so at substantially lower costs than we now face. Should such reforms be adopted and efficiency enhanced, all parties could be better off. Under these new institutional arrangements, citizens whose taxes subsidize current mismanagement, backpackers and wildlife enthusiasts, and consumers could have their welfare improved.

Alternatively, when efficiency is reduced, one party's gain leads to another party's loss. The confrontational tenor of many conflicts over natural resource management arises precisely because as efficiency is reduced participants are faced with the necessity of splitting a smaller pie. Anyone seeking more for himself threatens others with the prospect of having less. Institutions influence both the size of the pie and its distribution, and enormous amounts of political and economic pressure are brought to bear on promoting or dismantling inefficient programs. Such actions result in a negative-sum game. The application of the principles of the new resource economics can free the system of much of this conflict.

The new resource economics differs considerably from the more traditional theories of scientific management and pluralism. The theory of scientific management is predicated on the assumption that public spirited, well-intended managers armed with the scientific method will not be motivated by profit or self-interest but will seek the public interest as they direct the use or nonuse of natural resources. It follows, then, that these managers should be insulated from the political process and left free to exercise their vision of the good society. Scientific management assumes that natural resource problems have a single, best solution. The emphasis on scientific method, technical competence, and a well-intended efficient bureaucracy leads many land managers to focus on the physical resource rather than on how people interact with that resource. This perspective relies on a successful search for the benevolent despot.

The proponents of pluralism differ from scientific managers in their recognition that the public lands should be managed with a recognition of multiple and competing sources of power. In their view, politics are in-

herent in the administration of public resources. Because individuals have competing goals within society, the political arena is the proper place in which to deal with conflicts, and the political process will tend to be an efficient, effective, and equitable way to arrive at the right decisions.

While the proponents of scientific management search for the elusive benevolent despot, the pluralists search for managers who can locate a Rousseauian general will that develops from the political process. For the pluralist, the public interest is a necessary byproduct of competition among private interests and the American system of public resource management is one in which politicians provide the guidelines by which scientific managers operate. The pluralists currently dominate the governmental management of natural resources.

How does the new resource management differ from these perspectives, and how can its implementation lead to a more efficient, economic, and ecologically sound management of our natural resources? The new resource economics begins with a different perspective, emphasizing a more pragmatic, applied approach to the problems and focusing on important questions that revolve around how institutions affect information and incentives. There is no need to search for a few good men to impose the principles of scientific management. There is also no need to politicize the management process. There is, instead, the institutionalization of proper incentives and appropriate flows of information, so actors are given reason to respond in an efficient and productive manner.

The Neglected Model of Resource Management

The fundamental assumption of the new resource economics is that individuals, not societies or groups, are the basic decision makers. Individuals are assumed to be goal-oriented and self-interested; most simply, they attempt to achieve or acquire the things they value. This does not

mean that all people are selfish; new resource economists simply contend that it is poor policy to rely on good will or appeals to the public interest. Instead, the model focuses on the institutions that structure incentives and provide information to the predominantly self-interested individuals who make decisions.

Although traditional economic analysts focus on private choices in the market, new resource economists extend their analyses to public or collective choices. Consumers attempt to maximize their utility when making private choices in the market and retain that self-interest when they vote. Producers tend to maximize profits in the private arena and attempt to maximize market advantage and subsidies in the public sector. We cannot, then, assume that government is an arbiter of value conflicts but is, rather, comprised of self-interested voters aggregated into special interest groups, politicians, and bureaucrats. Politicians tend to maximize political income rather than net social welfare. Public bureaucrats attempt to maximize budgets, security, and perquisites of office and income. Thus, incentives created by alternative institutional arrangements matter a great deal.

A keystone of the new resource economics is the presumption that when people make decisions they evaluate the expected costs and benefits of alternatives and select the option that will maximize their satisfactions. The predictive prowess of the model is based on the most constant and pervasive component of human action: individuals attempt to increase their relative welfare positions.

While solidly tied to neoclassical economics, the new resource economics draws from related perspectives. Austrian economics contributes a

heavy emphasis on markets as systems within which information is processed, the importance of entrepreneurship in responses to changing relative scarcities and opportunities, and the subjectivity of values. Property rights economics, a conjunction of law and economics, lends its view that property rights are critically important because of their effect on incentives and the generation of information. When property rights are unclear, unspecified, or unenforced, the environment will be used inefficiently and individuals will be able to impose costs on others. From this perspective, pollution, erosion, and the threatened extinction of common property resources, such as whales, are expected outcomes. Essentially, property rights tie authority to responsibility and thus generate favorable social outcomes.

Public choice theory contributes the most to the new resource economics by extending neoclassical economics into the public arena. A consistent finding in public choice research is that the political compromise esteemed by pluralists is not required when each colluding interest group gets what it wants at the expense of the general taxpayer. Public choice analysis also explains why voters find it rational to be ignorant of most policy issues, since their vote is almost never decisive, and why bureaucrats, politicians, and their clientele groups have a great deal of knowledge about their specific interests and find it convenient to distort and suppress information. When authority and responsibility are separated, well-positioned special interests can use the coercive mechanism of government to obtain goods and services paid for by others. Thus, "wants" are inflated into "needs," and coalitions develop to provide these "needs" at public expense, For example, low priced water is "needed" in Arizona and is paid for by taxing individuals and corporations from New York and Texas.

The most basic conclusion emerging from public choice theory is that when goods and services are provided through the political process, little heed will be given to the dictum that costs and benefits should be equated at the margin; that is, one should stop buying more of an item when the marginal costs and benefits are equal. The important consideration, however, is the distribution of those costs and benefits. It has been standard practice in natural resource management for political operators and astute bureaucratic entrepreneurs to concentrate benefits to special interests and disguise the costs to the general taxpayer.

New resource economists conclude that the existing system responds to the values of those who are well-organized and have the capacity to control agendas at the expense of those who are not organized. Relatively small groups of resource users, environmentalists, and commodity producers along with sympathetic politicians and bureaucrats exploit the political as well as the resource potential of the public lands for private benefit, often at the expense of the general citizen. As a result, American citizens are subsidizing the destruction of environmental quality, enriching special interests, and decreasing the quotient of freedom remaining in America. General efficiency has no constituency in the political process, and any system that fails to recognize that decision makers respond on the basis of information and incentives that affect self-interest encourages perverse outcomes. Environmental quality suffers, efficiency is lost, and freedom is constrained.

At root, it seems that many resource economists fail to differentiate engineering from economics. They have fundamentally misperceived the role of economics and may benefit from exposure to Buchanan's (1979) What Should Economists Do? If economics is a science, how might it be more profitably directed? May the resources invested in this area of economics yield higher returns than they presently do? Science systematically, reduces indeterminacy. This terse definition may provide a beginning for evaluating the subdiscipline of resource economics and for suggesting changes in the resource economics paradigm.

There are two kinds of science: empirical and nonempirical. The nonempirical sciences include mathematics and symbolic logic, internally consistent systems with no necessary reference to the furniture of the world. Through rules of correspondence, they provide essential tools for analyzing empirical phenomenon but they have no empirical content. Empirical science includes meteorology, geology, physics, and the social sciences, some of which succeed in reducing indeterminacy in their prescribed areas. Those whose experimental potential is high have advantages over such sciences as geology, meteorology, and evolutionary biology. Basically, however, empirical science may be divided into the social sciences whose subjects are purposeful actors—that is, humans—and those whose subjects are nonhuman.

Three social sciences are noted for their success in systematically reducing indeterminacy: structural linguistics, mathematical demography, and microeconomics, including macroeconomics based on micro foundations. Only these are noted for doing "good science"; that is, they are successful in systematically reducing indeterminacy. Of these, both formal linguistics and mathematical demography exist primarily as arcane intellectual

curiosities whose importance to philosophers and historians of science is probably greater than their importance to the human enterprise. This does not in any way demean their scientific status but, rather, responds to their perceived relevance. The concern in this paper is with the subset of microeconomics that deals with natural resource issues. It is in this area that a paradigm change may be needed.

Microeconomics has achieved the status of what Kuhn (1962, p. 23) has labeled "normal science": "Normal science, the activity in which most scientists inevitably spend almost all of their time, is predicated on the assumption that the scientific community knows what the world is like." Occasionally, some series of findings or events challenge the foundations of a normal science and alternative and competing paradigms emerge.

Kuhn (1952, p. 23) notes that "paradigms gain their status because they are more successful than their competitors in solving a few problems that the group of practitioners has come to recognize as acute." Perhaps the most well-known case of" paradigm change involved the emergence of Copernican astronomy. When its geocentric predecessor was developed in the two centuries bracketing the birth of Christ, it had performed well in predicting changing positions of the heavenly bodies. Even though Ptolemaic astronomy is still used to provide engineering approximations for locating the planets, predictions made with Ptolemy's system always varied from the most accurate observations. When faced with a discrepancy, astronomers could eliminate it by tinkering with their system of compounded circles. But one correction would yield errors in other parts of the system, leading to an increase in the complexity of the science of astronomy—a complexity that was growing faster than its accuracy could accommodate. This condition led to the Copernican revolutions

> In the sixteenth century, Copernicus' co-worker, Domenico da Novara, held that no system so cumbersome and inaccurate as the Ptolemaic had become could possibly be true of nature. And Copernicus himself wrote in the Preface to the De Revolutionibus that the astronomical tradition he had inherited had finally created only a monster. By the early sixteenth century an increasing number of Europe's best astronomers were recognizing that the astronomical paradigm was failing in application to its own traditional problems. That recognition was prerequisite to Copernicus' rejection of the Ptolemaic paradigm and his search for a new one (Kuhn, 1962, p. 69).

Some historians of science claim that if the Greeks had been less constrained by dogma, heliocentric astronomy might have developed in the third century B.C (Koestler, 1959} p. 50). This may be analogous to the situation confronted by resource economists self-constrained by the research biases of federal agencies, the limits inherent in linear programming models, the failure to differentiate economics from engineerings and the incentives fostered by congressional legislation. The biases of resource economists were enshrined in federal law when Congress enacted the Resources Planning Act and the National Forest Management Act, the planning mandate for the National Forest System. The presumption was that rational public planning of the national forests is both desirable and possible. The alternative paradigm provided by the new resource economics, however, suggests not only that these assumptions are invalid, but challenges the rationale for holding timber lands in the governmental sector.

The expenses, the lost opportunities, and the political conflict flowing from FORPLAN, the linear programming model used by the Forest

Service in its efforts to plan and manage the national forests, may provide an analog to the problems that precipitated the Copernican revolution. The FORPLAN model was adopted in 1979 and is the preliminary planning tool used on all national forests,

FORPLAN requires that the land be stratified into from 1,000 to 3,000 unique analysis areas for the typical national forests. Before FORPLAN, the same forest required perhaps a dozen analysis areas. On each area, a minimum of two prescriptions state what kind of activities may take place. Hundreds of yield tables for forage and other outputs and cost and value tables must be constructed and keyed to the matrix of each analysis. The resultant linear programming model contains more than 3,000 rows and 10,000 columns.

Because FORPLAN requires data that aren't available, analyses are based largely on guesstimates made by bureaucratic experts. By aggregating these data for more than 120 national forests, in principle the Forest Service is able to engage in "national forest planning." Since most of the products from the national forests are not marketed, subjectivity acquired shadow prices dominate the model, Given the sensitivity of the model and the slipperiness of shadow prices, it is likely that the Forest Service is engaged in a very expensive though largely useless electronic ritual.

But many resource economists and scholars responded to the innovation with hopeful praise. As Davis (1980, p. 10) has noted, "Using such a planning technology is truly a quantum leap and applies a major cultural as well as technical change by the agency." Richard Behan (1981, p. 802), dean of the College of Natural Resources at Northern Arizona University, has written that the current planning process is

as close to the classic rational and comprehensive model, and as close to perfection, as human imagination can design and implement. The legislation is long and detailed; the regulations added much specificity; the adopted procedures and FORPLAN, the analytical model that the agency insisted upon, are rational and comprehensive and at least theoretically rigorous and invincible; and the training manual for planning teams highlights and prescribes the very latest in mathematical, conceptual, and analytical elegance.

RPA/NFMA mandates with the force of law that forest plans be rational, comprehensive, and essentially perfect. We have adopted an idealized planning process and blessed it with all the force and power and rigor of statute that a law-based society can muster.

Economists familiar with public choice, property rights, or the Austrian paradigm could probably predict the results of this perfection. The Forest Service, with a monopoly on the data and resultant analyses, behaved as Niskanen predicted a decade ago and, thus, received higher appropriations from Congress. They can now tell Congress what benefits are foregone if their budget is not approved (Giltmer, 1981, p. 806). Such planning is extremely expensive, often costing more than the resource is worth. Further, no unit is planned only once, and any significant issues are likely to be challenged in court. In defense, agency bureaucrats will invest more resources in "better" planning, with little if any sensitivity to the marginality principle.

In discussing the Forest Service planning process, Behan (1981, p. 806) expressed concern over such a "perfect" system: "Idealized, perfect planning that is mandated in law, and constrainted only by an agency's

budget, will exhaust that budget. . . . There will come a time when the Forest Service can do nothing but plan, and all its management, production, and protection activities will cease." The Forest Service planning process has been selected for examination not because it is the worst example, but because it is the best. Being a state of the art process, it generates state of the art problems.

The computer used to run FORPLAN is located in Fort Collins, Colorado. It can digest a 3,000 x 10,000 matrix, but not in a 16-hour period. I have been told by practitioners that in certain cases no matter how FORPLAN is run, it must spill over into prime time. As the planning process "improves" and as potential variation is incorporated in the model, the Fort Collins computer may ultimately choke. Bureaucratic creativity would overcome that relatively simple problem, and Fort Collins would soon be blessed with an even larger computer. Alternatively, the problem of centralized planning could be recognized as insoluble and alternative institutions could be developed. There is a lesson to be learned from comparing the increasing complexity required to reconcile empirical observations with Ptolemaic astronomy and the increasing complexity the Fort Collins computer will soon have to face. Perhaps a revolution similar to that inspired by Copernicus will result from the problems confronted in this area of applied economics.

Conclusion

Given well-intended, competent bureaucrats armed with perfect information, one can, in principle, solve any problem of resource management. The new resource economics, however, presents an alternative view of both the possibility and the desirability of attempting to plan natural resources in

the public sector. Price theory is applied to the public sector to find out what happens when public servants are self-interested. The conditions for rent dissipation are specified. It is recognized that institutions structure both information and incentives and that entrepreneurs identify opportunities in the physical and institutional environment. These considerations have been absent from the engineering that passes for resource economics, and the cost is becoming obvious.

The Political Economy Research Center makes modest claims for its contribution to the new paradigm in resource economics. This group and the dozens of scholars who have worked with us have applied the foundational contributions of Alchian, Buchanan, Demsetz, Hayek, Mises, Olson, Ostrom, Tullock, and others to a particular subset of economic problems. When confronting the technical complexity and high emotional content of natural resource issues, one may be tempted to retreat into ever more technical quantification. It is our hope that the failures inherent to public sector planning will become increasingly visible and that the planning paradigm will be challenged both analytically and in the policy arena.

Every public policy may be thought of as an experiment. The land management agencies represent American experiments with collective ownership and the problems of public planning. The engineering economists that dominate the profession will sequentially confront the problems inherent in their paradigm. Should it become obvious that resources under public management are liabilities rather than assets, alternative paradigms will be sought, The new resource economics provides a possible foundation for replacing the current edifice.

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The Political Economy Research Center is an unusual organization. Our research orientation and level of commitment provide PERC associates with an important opportunity to analyze and make recommendations on economic and natural resource issues in both the governmental and private sectors. Approximately 50 percent of our efforts have been devoted to natural resource economics and policy, while the balance of our work deals with taxation, regulation, entrepreneurship, economic history, and a sprinkling of other topics. To the best of our knowledge, we are the only research organization with this orientation.

Since its founding in 1980, the Center has maintained a principled commitment to the development of a society of free and responsible individuals in their relations with one another and their environment. On the basis of considerable study and research, we expect these values to be fostered by social and political organizations relying on private property rights, the rule of willing consent, and the market process. Although we are sensitive to the problems of market failure, we recognize that there is an analogous set of problems with governmental management.

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