THE NEW RESOURCE ECONOMICS: OLD IDEAS AND NEW APPLICATIONS

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The role of any science is to systematically reduce indeterminancy, and it is on this basis that scientific paradigms are judged. As Kuhn notes, "paradigms gain their status because they are more successful than their competitors in solving a few problems that the group of practitioners have come to recognize as acute" (p. 23). In the economics profession the neoclassical model based on marginal analysis has gained this status because of its success in reducing indeterminancy.

Due to this success, economists interested in natural resources and environmental problems have adopted the neoclassical approach. By no means, however, has the adoption of the neoclassical paradigm eliminated methodological debate or led to conclusions accepted by all members of the profession. As Randall suggests

> The mainstream economists fall into several loose groupings. The middle ground is occupied by those who find the mainstream economic methodology useful and even quite powerful, but who recognize that it has some perplexing limitations, especially when applied to policy analysis.... To one side of the middle, there is a group of free-market zealots, who see the economic system in very simple terms, and who cannot understand why others fail to see what, to them, is obvious. They divide their time between proselytizing for free-market solutions among non-economists and

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attempting to keep the other group of mainstream economists on the straight-and-narrow. To the other side of the middle, there is an ill-defined group of those who are quite uneasy about the limitations of mainstream economics and policy analysis and suspicious that the zealots confuse methodology and ideology, but are unable to develop a coherent alternative to the mainstream methodology (p. 37).

The fact is that a growing number of economists are beginning to question the middle ground.

The purpose of this paper is to lay out the basic elements of the emerging new resource economics (NRE) paradigm. Let me begin by saying that some will find little new in the paradigm. The scholars involved in the development of this new approach have simply applied the foundational contributions of Alchian, Buchanan, Demsetz, Hayek, Mises, Olsen, Tullock, and others to a particular subset of economic problems. On the other hand, the integration of these ideas and their application to resource and environmental problems is quite new. In this paper I will first argue why the existing way of thinking would benefit from reform. Following this I will integrate property rights, public choice, and Austrian economics with the standard neoclassical paradigm thereby identifying the salient components of NRE. Finally, evidence will be presented to support why NRE is gaining support.

I. Old Resource Economics (ORE)

Until recently the vast majority of the writing in natural resource

economics has been confined to the neoclassical paradigm. The central elements of this paradigm are (1) marginal analysis, (2) information and uncertainty, (3) interest theory.

The marginal revolution in the late 1800s formed the watershed between classical and neoclassical economics. From Jevons to Samuelson, we have learned that economic decisions involve a comparison of marginal benefits with marginal costs. Until sufficient action has been taken to equate the two, optimization cannot be attained. Once this principle is mastered, it becomes clear that many incremental adjustments are possible and that neither demand nor supply are perfectly inelastic. Barnett and Morse drove this point home by demonstrating that substitution holds the key to mitigating the impacts of resource scarcity.

In recognizing that these incremental adjustments take place in a world with uncertainty and imperfect information, neoclassical economists have extended the model to incorporate these problems. The extension has basically taken two courses. First, following marginal analysis, the economics of information suggests that there is an optimal amount of search put into collecting information. In this sense, information is produced like any other input. Since any given decision-maker will not have an infinite amount of free information available, actual equilibrium results will differ from those derived from textbook models. The second course has been to consider how expectations are formed and how risk preferences affect decisions. Again, the emphasis has been on marginal analysis with equilibrium depending on the formation of rational expectation.

Since most decisions involve some degree of allocation over time, the time preference of individuals and the time productivity of resources are crucial for determining intertemporal allocation. The work in the 1930s by Irving Fisher and Harold Hotelling led economists to be skeptical of notions such as maximum sustained yield and to realize that natural resources, like other assets, will have prices related to the discount rate. The specific application of intertemporal choice to natural resources has dramatically changed how economists look at exhaustible and renewable resources.

The tools of ORE are those of scientific resource managers who hold that the marginal concepts provide an ideal way for formulating the multiple use problem. In this formulation, the optimal production mix in a management plan is the one where the values of various uses are equated at the margin. Since the manager using the concepts are <u>not</u> motivated by profit or by self-interest, it is hoped that they will apply economic theory and quantitative method in impartial and efficient ways to accomplish the goals of their respective agencies. The scientific managers propose agendas that "insist on real decentralization and real decision-authority," "rely on administration, not legislation," and "let professionals manage" (Behan, p. 27-29). Since "politicizing land management and land managers . . . will lead to less professionalism and poor land management," scientific managers argue that they should be insulated from the political process (Box, p. 26). The scientific manager armed with the ORE paradigm is "always analytical . . . . Always, the economist's reasoning, his <u>analytical</u> framework. . . , his data, and his conclusions

are exposed forthrightly to the examination and criticism of others. In these ways, scientific objectivity is actively sought. Polemics, pamphletering and outright advocacy are left to others, or to the economist in his nonprofessional role as a citizen and a human being" (Randall, p. 36).

When managers do not act with objectivity, ORE economists have proposed perfecting bureaucracy. For example, in an invited address before this association, Robert H. Haveman argued that the "use of natural and environmental resources is dominated by market failures" (p. 868) and that policy makers have responded to these failures by adopting rule-making/enforcement policy strategies, engaging in public investment programs, and developing policies on preservation/developmental alternatives (p. 870). Since the policy makers have not always remained "scientifically objective," Haveman's reforms call for a "National Commission on User Charge and Beneficiary Cost-Sharing" (p. 875) and for an "Office of Policy Evaluation and Analysis with substantial staff capability" (p. 876).

In summary, ORE generally has taught us that market failure is pervasive in natural resource allocation and that cost/benefit analysis applied by scientific, objective managers can improve on the failures. Building on marginal analysis, the neoclassical paradigm has lent itself well to mathematical modeling and statistical estimation, and many believe that the rigorous mathematical/statistical approach to economics allows shadow prices to be derived and used in lieu of actual market processes. Furthermore, government agencies such as the Forest Service

and BLM are enamoured with building models that generate sophisticated mathematical and statistical results designed to improve resource management. The assumption is that given sufficient data and large enough computers, it is possible to produce wise (efficient?) management plans. The FORPLAN model of the Forest Service provides a state of the art example of model building. Forest economist Richard Behan concludes that this model and 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 . . . . RPA/NFMA [Resource Planning Act and National Forest Management Act] mandates with the force of law that forest plans can 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 statutes that a law-based society can muster" (p. 802).

II. Toward a New Resource Economics Paradigm

In contrast to ORE, NRE focuses attention on information and incentives which result from market and nonmarket institutions. Anthony Fisher captures the essence of NRE: "We have already abandoned the assumption of a complete set of competitive markets, leading to all the difficulties discussed earlier. But, if we now similarly abandon the notion of a perfect planner, it is not clear, in my judgment, that the government will do any better. Apart from the question of the planner's motivation to behave in the way assumed in our models, to allocate resources efficiently, there is the question of the ability to do so" (p. 54).

Because ORE pays little or no attention to institutions which structure and provide information and incentives, resource economists often seem surprised and puzzled at the fact that neoclassical policy implications are not more widely adopted in the policy arena. Such concepts are useful in the private sector because private decision makers have information in the form of market prices and incentives to act on that information. In the public sector neither of these conditions hold. The "products" which are being generated from public lands for the most part are zero priced. Given the lack of markets, the public lands manager is forced to make marginal comparisons without the benefit of information contained in prices. This lack of economic information forces the public land manager into trading off in terms of political currencies, and this currency, at best, provides distorted measures of value.

The second problem for public resource management is that the incentive structure in the public sector is quite different from that in the private sector. In the private sector individuals in the decision process are residual claimants (Alchain and Demsetz). This means that someone receives the residual which is left after all costs have been paid. The owner/residual claimant has an incentive to discover good information and use that information to improve efficiency which in turn enhances the residual claim. In the public sector, however, there is no residual claimant. The rewards for public land managers are not dependent on maximizing the net value of joint production. While there is not total agreement in the economics literature about what is maximized by

bureaucrats, it is agreed that efficiency is not the main goal of decision makers. If the public resource manager were to follow the tenets of joint production theory, it would have to be because they were honest, sincere folks interested in the public interest and not because of self-interest.

Because information and incentives have not been emphasized in the ORE, the standard neoclassical paradigm can be improved on by incorporating elements of property rights, public choice, and Austrian economics. While this NRE paradigm is by no means complete, it is being extended to bring more reality to natural resource economics. What follows is a brief synthesis of that emerging way of thinking.

The starting point for the new paradigm is the individual--especially the entrepreneur. Following marginal analysis, entrepreneurs search for situations where marginal benefits and actions exceed marginal costs. Their responsiveness to opportunities moves resources to higher valued alternatives and improved efficiency and thus moves the system closer to equilibrium. The question is whether the opportunities they discover and the actions they take will increase the size of the pie for society.

If entrepreneurs face the full opportunity costs of their actions, they will take only those actions that produce positive net benefits for themselves and for society. The entrepreneur who discovers a higher valued use for timber, for example, stands to gain. If allocation to that higher use requires the entrepreneur to bear the opportunity costs of current use, the reallocation will only take place if the net differ-

ence is positive. Responsibility for opportunity costs is the key.

The property rights structure will determine who is responsible for which opportunity costs. If these rules are to govern market allocation of natural resources, property rights must be well-defined, enforced, and transferable. When property rights are well-defined, individuals have a clear idea of what actions they can take regarding resources. This is necessary for market trades, which depend on interested parties knowing what is being traded.

Enforcement will determine how likely it is that an owner can enjoy the benefits of his ownership. Since rights cannot be perfectly enforced, ownership will always be probabilistic; but when the probability of capturing benefits from a use is low, it is less likely that the owner will devote the resource to that use. For example, if a water owner decides to leave water in the stream to improve fish habitat but is unable to exclude fishermen who do not pay from using the stream, he will have less incentive to provide water for that use. In this sense, enforcement is the ability to exclude other users. As long as exclusion is possible, resource owners can capture the benefits from the various uses of their resources.

If the owner is to be fully aware of the opportunity costs of his actions, property rights must be transferable. When the owner is not allowed to transfer his resource to another use, he will not consider the full opportunity costs of the other use. If the other use has a higher value, that value will be ignored and inefficiency will result. Various land use regulations restrict the transfer of ownership rights, and laws

forbidding the use of water in coal slurry pipeline tell the water owner that he must ignore the value of water in this use. Even if water used for a coal slurry is more valuable than for irrigation, the owner cannot capture the higher value. Again, well-defined, enforced, and transferable property rights must be included in the rules of the game if entrepreneurial efforts are to enlarge the size of the pie.

At this point, it is important to emphasize that all decisions are made under uncertainty and that mistakes will be made. When an entrepreneur moves a resource from one use to another, he does so with the expectation that the new use has a higher value. This expectation depends on the entrepreneur's subjective evaluation of the world. The basic economic problem, therefore, becomes one of utilizing "knowledge which is not given to anyone in totality" (Hayek, p. 78). As Hayek points out, the refinements in the neoclassical model have tended to divert attention from this problem and focused attention on the possibility of planning. When we realize that knowledge is dispersed and cannot be condensed into a single variable for planning purposes and that entrepreneurs are making decisions based on their "best guess" about the future, we must recognize that decisions may not be efficient ex post.

The second thing to remember about uncertainty is that there is an optimal amount of search. To the extent that entrepreneurs can gather information to reduce uncertainty, they will do so to the point where the expected additional benefits from the search activity are equal to the expected additional costs. Of course, given varying preferences, what may be the optimal amount of search for one entrepreneur may be different

for another, so it will be easy for outsiders to argue that better decisions could result if more information were collected. But optimal search tells us that perfect information is not the norm to which we should compare the real world.

In this context, it is useful to consider market systems as information systems. By consistently seeking out the margins within which they can improve their welfare, purposive actors search for substitutes for scarce resources and attempt to move resources to more highly valued uses. In this context the ultimate resource becomes the creative potential of self-interested individuals. When increased relative scarcity is translated into increased potential profits, the creative energies of entrepreneurs are unleashed.

With well-defined, enforced, and transferable property rights, the entrepreneur is part of a pie-enlarging process; but what if private property rights do not exist and there is a gap between authority and responsibility? To answer this question, remember that the entrepreneur is continually searching for unforeseen opportunities that will generate rents for himself. An efficient property rights system insures that the entrepreneurial process will create rents, thus producing the only free lunch available to society. But the entrepreneur is not concerned with whether he is creating a free lunch or dining at someone else's expense. Imagine that the entrepreneur faces two opportunities for success: one in which rents can be created only through improved allocation of privately owned resources and one in which rents are derived from exploiting a common pool resource or from transfers available from government.

First, consider the economics of a common pool resource. Traditional natural resource literature has made us keenly aware of the inefficiency associated with the "tragedy of the commons." Steven Cheung (1970) elaborates on how entrepreneurs would dissipate rents associated with private resource ownership, showing how each private decision maker could perceive an individual return above opportunity costs while the final solution would have marginal benefits less than marginal costs. Exploiting the common pool resource will benefit the individual, but it will be a negative-sum game for society.

The second opportunity for entrepreneurs to participate in a negative-sum game is for them to engage in rent seeking. Simply put, rent seeking includes efforts to use the coercive power of the government to increase personal wealth for some at the expense of others. For example, when a group of producers succeeds in getting the state to license all producers and, thereby, restricts entry, monopoly rents will be earned. Since these rents come at the expense of the consumer, they represent a redistribution of wealth. Hence, both producers and consumers will invest entreprenuerial talents and other resources in efforts to prevent or obtain the transfer. The "taking issue" in land use planning is an excellent example of this process. Zoning restrictions in many cases represent a redistribution of rights. Similarly, when the Department of Interior decides whether public lands will be used for timber, grazing, recreation, or wildlife, they are affecting the distribution of benefits to consumers. It is not surprising that interest groups employ valuable resources trying to influence these decisions. When the entrepreneur

discovers unforeseen opportunities to use government to increase his wealth, rent-creation--a positive-sum game--is replaced with rent seeking--a negative-sum game.

While such entrepreneurial efforts explain the demand for rent seeking, the activities of politicians and bureaucrats explain the supply. Just as entrepreneurs in the marketplace recognize and fill demands for goods and services, politicians and bureaucrats discover previously unforeseen opportunities to meet the demands of various constituencies. In both cases, niches are being filled, but the constraints on each are very different. For the succcessful entrepreneur in the marketplace, new goods and services can only be provided if the benefits from those goods and services exceed the opportunity costs of the resources used in production. Private property rights provide a reality check on the entrepreneur.

In the political system, however, the politician or bureaucrat who provides goods and services to interest groups does not have to pay the opportunity cost of expended resources. Property rights to resources that are "owned" by the government are only informally defined and can be disputed at every legislative session. For example, the Forest Service "owns" vast amounts of timberland, and rights to use these lands are informally held by the groups who derive benefits from them. Since these rights are informal, if timber interests, for example, want an increase in the allowable cut, they can attempt to convince bureaucrats to take rights away from recreation and environmental groups. If the bureaucrat does so, he might be concerned with alienating the losing groups, but he

does not have to face the full opportunity costs.

Each bureaucrat, in seeking to maximize budgetary discretion, realizes that he has access to the common pool treasury of the government (see Baden and Fort). He asks the question, "What is the gain to my organization (and, hence, to me) of capturing more from the treasury?" The bureaucrat, the agency, and the constituency enjoy the benefits of an increased budget, while the costs are spread among all other bureaucracies in terms of lost opportunities. In order to increase his agency's capture, each bureaucrat must find ways to increase the magnitude and scope of agency activity. As a result, they pursue programs that concentrate benefits while dispersing costs, thereby building up a constituency for increased agency activities.

Since opportunity costs are not internalized in the political allocation process, there is no direct reality check on whether a given situation can be improved on. Therefore, it is possible for enterprising politicians and bureaucrats to pursue inefficient policies, witness the water project pork barrel. The economics of public choice has taught us to view public sector activities as we might any others. Politicians and bureaucrats have objectives that they are trying to maximize, such as votes, budgets, power, prestige, and discretion. While it is not clear which goal may be dominant, it is clear that public servants generally are not trying to maximize efficiency. As they pursue these goals through collective action, the cost functions they face differ from those where voluntary consent is required. Collective action essentially allows those who bear the costs to be separated from those who receive

the benefits.

Building on the premise that actors in the political system are as likely as those in the private sector to be motivated by self-interest, the public choice paradigm has taught us to think in terms of rational voter ignorance, special interest effects, and shortsightedness effects from politicians. Hence, the information and incentive structures are as likely to generate governmental failure as they are to generate market failure. Not only does inefficiency result, but entrepreneurial talents are expended by interest groups trying to influence political decisions and by politicians and bureaucrats trying to supply political benefits. Without the reality check inherent in the private property system, the potential for negative-sum games is real.

III. The Value of NRE

Applications of the NRE paradigm are only beginning to emerge, but those applications raise two important questions. First, how pervasive is market failure in the natural resource area? Second, has collective action actually improved on market allocation, however imperfect market processes may be? A few brief examples of answers to these questions are all that space permits.

ORE has focused on market failure due to open access, public goods, and externalities; NRE, on the other hand, has recognized the potential for private contracting to correct market failure. The property rights literature has improved our understanding of the evolution of property rights and contracts (see Anderson and Hill and Umbeck). By considering the wide range of contract options available in the market, we have been

forced to reexamine bees pollinating apple blossoms as an example of an externality (Cheung, 1973) and lighthouses as an example of a public good (Coase). Furthermore, it has been shown that well established private rights to Great Lakes timber resulted in efficient markets rather than the "rape and run" tactics alleged by conservationists (Johnson and Libecap).

NRE is also focusing on market responses to environmental quality. Baden and Stroup brought to our attention the Audubon Society's Rainy Wildlife Sanctuary where natural gas has been extracted since the 1960s with no significant dimunition of environmental quality. As a residual claimant, the National Audubon Society has an incentive to cooperate with oil companies and vice versa. In that particular case coordination and cooperation have been substituted for the challenge and conflict inherent in the public planning process. As the value of wildlife has risen along with other amenities, private efforts to improve management have been undertaken. Groups such as the Nature Conservancy and Trout Unlimited have increased their efforts to improve wildlife habitat. The International Paper Company recognizes that proper management of game can increase the income potential of timber lands. With land holdings of seven million acres, it is not surprising that IP is investing in this possibility. It should be noted that all of these examples commonly fall under the ORE category of market failure.

NRE is also documenting the existence of government failure. A book entitled Bureaucracy vs. Environment (Baden and Stroup, editors, 1981) documents energy policies that promote such programs as synfuels produc-

tion, legislation that promotes over grazing of BLM land, timber production that has negative value, and rest-rotation grazing and chaining practices that destroy the environment on federal grazing land. Higgs has shown how fishery managment has led to technical regress and salmon harvests that have negative net social value.

IV. The Future of NRE

In this paper I have attempted to draw together the essential ingredients of neoclassical, property rights, public choice, and Austrian economics to construct a new, systematic approach to natural resource economics. When old paradigms no longer adequately explain the world, it is necessary to seek alternatives. The marginal conditions derived from complex ORE models have little value for policy decisions because they have implicitly assumed that knowledge is given and that it will be used by dispassionate, highly organized, professional technicians who care primarily about efficiency. While such models may explain what an efficient world <u>should</u> look like, they tell us very little about why we have failed to attain the "bliss point." While NRE may be nothing more than new applications of old ideas, it does offer an alternative view of the world. It sets a new agenda for research from which testable hypothesis must be generated and evidence to test the hypothesis must be mustered.

It should be emphasized that NRE, like ORE, recognizes the possibility of market failure. The existance of market failure, however, does not necessarily call for a non-market alternative. As Castle (1965, p. 542) has pointed out, the relevant comparison is between imperfect market

solutions and imperfect bureaucratic solutions. Good NRE gives the kind of rigorous theoretical and emperical attention to government failure that ORE has given to market failure; this compares real-world alternatives rather than unattainable ideals.

In terms of Randall's groupings quoted at the beginning of this paper, NRE lies on the free-market side of the middle, but the new resource economists are not necessarily zealots. Perhaps the users of NRE present the paradigm with ardour and enthusiasm partially based on faith in inductive and deductive reasoning. This faith, however, is derived from what is seen as a preponderance of evidence supporting the efficiency of the market processes. If the NRE is to flourish, it must be subjected to systematic testing.

Footnotes

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