A Rhetorical Critique of 'Nonmarket' Economic Valuations for Natural Resources

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ABSTRACT: Various 'nonmarket' economic valuation methods have been used to compute 'total' value of nonmarketed natural resources and related recreation. We first outline the history of these valuation techniques and use the Exxon Valdez disaster response and the valuation of whooping cranes, an endangered species, as examples of how these tools can constrain policy. We then explain how, by excluding non-economic social spheres, economic valuation techniques produce a terministic screen that deforms policy makers' vision of the ecological problems faced by society. Using Luhmann's functionalist social theory, we demonstrate that when natural resource managers privilege economic motives, they trivialize other social functions such as education, politics, religion and law. This process presents a significant ethical dilemma for democracies by first naturalizing, then ethicizing, existing pattersns of domination.

KEYWORDS: Environmental ethics, functionalism, natural resources, nonmarket economic valuation, rhetorical criticism, wildlife

The Exxon Valdez ran aground on Alaska's Bligh Reef shortly before midnight on 24 March 1989, spilling approximately 10 million gallons of crude oil into the heretofore pristine waters of Prince William Sound (U.S. General Accounting Office, 1989). The spill confirmed the fears of area citizens, who had joined environmentalists' campaigns during the 1970s attempting to prevent transporting oil through the sound. Their allegations of the ecological dangers posed by pipeline and tanker transport had delayed pipeline construction for several years. However, industry claims that the expense of an alternative route (building the pipeline overland through Canada into the Midwestern U.S.A.) would price Alaskan oil out of market range ultimately ruled. At the time of the spill, one fourth of U.S. domestic oil production moved through Prince William Sound

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(Came, Quinn, & Lowther, 1989; Laycock, Dold, Soucie, Luoma, Gilliland, & Dawson, 1989).

In keeping with the 'environmental' agenda espoused by U.S. President Bush, Exxon was ordered to shoulder the responsibility for environmental degradation and clean up the oil. In March 1990, following a year of studies attempting to quantify the damage in economic terms, the U.S. Department of Justice and the State of Alaska announced lawsuits seeking millions of dollars in compensation (Dayton, 1990). Exxon's chairman, Lawrence Rawl, responded angrily to these suits, justifying corporate handling of the spill by claiming that, "we took responsibility, we spent over $2 billion, and we gave Alaska fishermen $200 million on no more than their showing us a fishing license and last year's tax return" (Behar, 1990, p. 62). Yet, based on its assessment of Exxon's cleanup, the Alaska Oil Spill Commission (appointed by Alaska's Governor Cowper) recommended that "Never again, should the spiller be in charge of [cleaning up] a major oil spill". Their study found that "privatization and self-regulation" contributed to both the spill and questionable cleanup techniques (Laycock, 1990, p. 110). The report suggested that neither the oil industry, nor other private corporations were appropriate guardians for publicly owned natural resources. Rather, this was a responsibility of state and federal governments, as they represented their citizens. This view had previously been expressed by the U.S. General Accounting Office's (1989) Report to Congressional Requesters regarding the Exxon Valdez spill. After stating that the preparation for, and response to, the Exxon Valdez oil spill was "clearly inadequate" and that a major "reason for this state of national unpreparedness is that there is no single designated leader or authority to ensure that preparations are adequate", they proposed that "the federal government should perform this leadership role" (p. 12).

The response to Exxon's oil spill in Prince William Sound represents an important trend in natural resource management policy. Because Exxon had damaged resources not belonging to the corporation, it was required to pay the owners (the public) for those resources. Damage assessments were determined by valuation methods based on capitalistic economic dogma that has become central in U.S. natural resource policy decisions. But visual images of oil-soaked birds, blackened beaches, and dead sea otters stimulated visceral responses from the public, and these responses combined with identification of the Alaska spill as the nation's worst environmental disaster, fuelled public demands for more than short-term economic restitution (Came, et al., 1989; Hackett, Hager, Drew, and Wright, 1989). Even though public outcry promoted awareness of short-term economic restitution's inadequacy as an appropriate response to this disaster, the term 'disaster' was required to justify the additional obligation. Because the emotional response to the oil spill does not question the primacy of economic valuation in more 'normal' (non-disastrous) circumstances, decisions regarding ecological threats remain dependent on economic valuation methods.

Only by critiquing the valuation method itself, can its primacy be shaken.

In this essay we present a brief history of economic valuation as it has been applied to natural resources and related recreation. We first describe models intended to quantify the 'value' of wildlife, because they illustrate models designed to assign monetary value to natural resources with little direct market value. We then use the Valdez disaster response and valuation of whooping cranes (*Grus americana),* an endangered species, as examples of how these tools can constrain policy. We explain how, by excluding other social spheres, economic valuation techniques produce a terministic screen that deforms policy makers' vision of the ecological problems faced by society. Finally, we argue that privileging private economic motives over others presents significant ethical dilemmas for democracies. Luhmann's theory of modern function systems provides a conceptual pattern for exploring these dilemmas within the context of contemporary U.S. culture.

ECONOMIC VALUATION OF U.S. NATURAL RESOURCES

The U.S. Public Trust Doctrine assigns ownership of the natural resources found on vast tracts of public land to U.S. citizens. In contrast to most European countries, this doctrine also assigns ownership of wildlife, whether on public or private land, to the citizenry. State and Federal government agencies have been given the responsibility for managing these resources as trustees for the benefit of the public, expressing a recognition that natural resources have 'value' to the populace. Wild animals, however, need habitats in which to live. Humans increasingly compete with wildlife for space by turning prairies and wetlands into cropland, forests into urban sprawl, canyons into reservoirs, and deserts into golf courses. Activities such as oil exploration/extraction and mining have caused additional change. Such landscape alteration has led to the extinction of some animal species and the expansion of other wildlife populations, which society may perceive as either beneficial or detrimental. For example, human activity led to the near extinction of bison *(Bison bison)* in North America – which many consider a tragedy, yet human induced environmental change also led to greatly increased numbers of white-tailed deer (*Odocoileus virginianus)* – which many consider beneficial.

A corollary to the Public Trust Doctrine is that, because wildlife has 'value', this value must be weighed against that of other natural resources such as minerals, timber, water, and space. Natural resource dependent industries such as mining, farming, hydrologic exploitation, or urban development remain fundamental to the U.S. economy. Thus, when industry wants to explore for oil in critical wildlife habitat, government wildlife management agencies are pressed to justify, in terms of benefit to the public (measured in dollars), why the exploration should not be allowed. Simply put, they must explain why wildlife

is worth more money than oil. If exploration and subsequent oil extraction take place, agencies are asked to calculate, in terms of dollars, a mitigation value for wildlife loss. Although most people agree that wildlife has value, quantifying it in dollars, and achieving numbers comparable to the billions a new oil field on the North Slope of Alaska is worth, is difficult at best.

Such quantification (called 'value' throughout this section) was initially based on valuation methods used for marketed natural resources (commodities). To determine the value of a stand of timber, for example, one can ascertain what price the logs would fetch at a sawmill, add to this the economic benefits the logging and milling operations contribute to the community, and subtract the cost of building roads into the area, felling and bucking the trees, and hauling them to the mill. What is left is the value, or 'net economic surplus'. The same general process is used for valuating mineral, grazing, and wildlife resources. One could argue, for example, that creeled trout, processed venison, or harvested huckleberries are worth some number of dollars per pound as replacements for purchased fish, beef, or blueberries, respectively.

However, it was clear to economists that the *recreational* value of consumptive public use of natural resources was far greater than the value of related commodities taken from the area. Most sport hunters and fishers spent far more on their avocations than they gained in the form of meat. Thus, because the experience had no net economic surplus, or value, there was no apparent incentive for people to hunt, fish, harvest mushrooms, or pick wild fruit. Additionally, economists reasoned that relatively nonconsumptive uses of wildlands, such as bird watching, mountaineering, backpacking, photography, and sight seeing also must have some value, or people would not spend money (and time) performing these activities. Economists now consider recreation to be a 'nonmarket' commodity because, since it is not traded in the market, its value cannot be derived from the competitive market structure. In an attempt to resolve the paradox embodied in a 'nonmarket' commodity, an evolutionary series of models designed to place dollar values on recreation have been proposed and tested. Recreational value models based upon this research were then adapted to place price tags on wildlife.

Current models trace back to 1947, when the Prewitt Commission was attempting to determine the economic value of a recreational site (Stoll, 1983, 1986). Because recreationists must to travel from where they live to the recreation site, Hotelling proposed that incurred travel costs could be used to impute a value to recreation at a given location (travel cost method, or TCM). This model enjoyed only brief popularity until economists rediscovered it in the early 1960s. Since then the TCM has been modified to incorporate site quality, availability of substitute recreation sites, the cost of both travel and on-site time, and cost to nonparticipants.

Problems with the TCM recognized by economists include difficulty in separately valuating specific recreational components at a site, incorporating

substitute recreational experiences for unique sites (e.g., the Grand Canyon, U.S.A.), calculating the value for recreational experiences where travel is unnecessary (such as urban forests), calculating travel cost when the recreationist visits more than one site on a single trip, and determining the proper allocation of costs when one takes a multipurpose trip (combined business and recreational trips). Several modifications of the TCM are used to address these shortcomings, yet all are based on observing, then drawing inferences from, recreationist behaviour. Many economists find this a major drawback because there must be some form of related market behaviour from which inferences can be drawn. Despite its problems, variations of the TCM are still used to valuate wildlife and wildlife based recreation (Lyon & Keith, 1984; Miller & Hay, 1984; Hvenegaard, Butler, & Krystofiak, 1989).

The contingent valuation method (CVM) is widely used as an alternative technique which economists maintain addresses many of the TCM's shortcomings. A CVM is defined as "any approach to valuation that relies upon individual responses to contingent circumstances posited in an artificially structured market" (Stoll, 1983, p. 120). There are many variations to this approach, but most rely on either iterative or noniterative bidding, with the latter being further subdivided into open-ended and closed-ended questioning techniques.

Briefly, in the iterative bidding approach, respondents are asked if they would continue a given recreational experience if the cost were increased to some higher value (Stoll, 1983, 1986). If the respondent says "yes," the value is then iteratively raised until the respondent says "no". The highest "yes" amount is then the value of the recreational experience. To be administered effectively, this method requires a personal interview. Noniterative bidding circumvents this necessity. The open-ended question format is as follows: "I would not continue fishing (or some other activity) if the license (or some other factor) cost — annually". The respondent is instructed to write in the highest applicable value. In the closed-ended format, the dollar value is specified. Questionnaires with varying dollar amounts can be sent, and the results analysed statistically, to estimate demand curves.

However, the amount of money one is willing to spend on a recreational experience involving wildlife may not represent the 'total' value of a wildlife related experience. For example, people have expressed willingness to pay for wildlife oriented experiences that transcend individual spaces and times (non-use value), such as having: (1) the *option* of using the resource later (an 'insurance premium'), (2) the knowledge that the resource *exists* somewhere, and (3) the ability to *bequeath* wildlife, or other natural resources, to future generations (Brookshire, Eubanks, & Randall, 1983; Loomis, Peterson, & Sorg, 1984; Walsh, Loomis, & Gillman, 1984). People thus proclaim their willingness to financially support conservation of resources they may never directly experience.

Admitting motives that transcend space and time into the recreational value

equation led to Randall and Stoll's (1983) *Total Value Paradigm*. This combines 'all' on- and off-site use and non-use values for a given location, and has been used to the satisfaction of several economists and managers for valuating wildlife and other natural resources (Loomis, et al., 1984; Bowker & Stoll, 1988; Bergstrom, Stoll, Titre, & Wright, 1990). The artificially structured market of the CVM is used to sum the dollar values of non-use items, and in combination with the value of recreation (use), calculate the 'total' value of the resource.

One of the earliest attempts at placing a monetary value on a population of wildlife having no consumptive value involved whooping cranes. The only wild, self-perpetuating flock (less than 100 individuals) winters in and around the Aransas National Wildlife Refuge on the Texas (U.S.A.) gulf coast and breeds and rears its young in Wood Buffalo National Park, which straddles the Alberta-Northwest Territories border in Canada (U.S. Fish and Wildlife Service, 1986). Because of the whooper's grand size and appearance, haunting call, long migration route, and rarity, this species has come to symbolize the U.S. endangered species program (Binkley & Miller, 1980; U.S. Fish and Wildlife Service, 1986). Human activity at Aransas, such as oyster dredging and construction of the Gulf Intracoastal Waterway through the refuge, with its associated traffic and dredging, has adversely affected the whoopers in their wintering grounds (U.S. Fish and Wildlife Service, 1986). Environmental pollution, including agricultural chemicals and oil spills from barges passing through the refuge, poses both direct and indirect hazards to whooping cranes through possible oil fouling and elimination or contamination of forage. Although human activity at Wood Buffalo National Park has been less intrusive, timber harvest along park borders (as well as within the park), proposed 'ecotourism' development, and the existing W.A C. Bennet Dam and proposed hydrologic projects are likely to adversely impact the park (Environmental Assessment Panel, 1990). It was the government subsidized (until 1989) cattle grazing near park boundaries that has focused attention on the area, however. Because many of the park's bison have bovine brucellosis and tuberculosis (diseases that can be transmitted to cattle, thus reducing industry profits), the Northern Diseased Bison Environmental Assessment Panel recommended that all bison in and around the park be killed and eventually replaced with disease-free, genetically 'pure' wood bison (*B. b. athabascae*) (Environmental Assessment Panel, 1990). Killing such a large number of bison, and propagating thousands of replacement animals, also could adversely affect the Wood Buffalo National Park ecosystem.

Stoll and Johnson (1984) used the valuation of the whooping crane resource as an example of how one can assign a monetary value (price) to a 'priceless' resource. They used a closed-ended, noniterative bidding form of contingent valuation (dichotomous choice) to determine the value of the whooping crane resource based on current use (refuge entry fee), anticipated future use (option), and non-use (existence). They made no attempt to quantify what people would be willing to pay for related travel expenses, so the authors would not consider

this valuation 'total'. Their questionnaire was given to Aransas National Wildlife Refuge visitors and mailed to a cross-section of Texas residents and persons living in three large out-of-state U.S. cities. They estimated the total combined option and existence value of the whooping crane resource in the U.S. to be $1.58 billion, if the bids represented individuals, or $573 million if they represented households. Not surprisingly, Bowker and Stoll's (1988) evaluation of these data determined that whooping crane value was greater for those respondents having higher incomes and/or memberships in wildlife-oriented organizations.

Even though the value of the whooping crane resource may be between $573 million and $1.58 billion, this is a paltry sum compared to the value of the U.S. and Canadian petrochemical industries. If economic measures are assumed to provide 'total' gauges of wildlife's value to society, then wildlife will be found insignificant, and human alteration of habitat essential to wildlife will continue unabated. Additionally, it appears that, rather than using nonmarket methods to determine dollar value, these models simply used hypothetical market values. Surely many people value wildlife either more than they can afford to pay, or in ways that money does not address. We argue that 'total' valuation of wildlife and other publicly owned natural resources must include factors that do not lend themselves to measurement on a scale of dollars. Hence 'willingness to pay' is at least inadequate, and perhaps inappropriate, for measuring the 'total' value with which people regard publicly owned natural resources.

FUNDAMENTAL ASSUMPTIONS OF ECONOMIC VALUATION MODELS

The decision to base natural resource policy on results of cost-benefit analyses is rhetorical in its selectivity. Despite economists' claims that they are simply creating tools to measure existing reality, the tools warrant the construction of one reality rather than another. As within any reality, privileged experience becomes information, whereas the reality of dispreferred experience is denied. For example, because bison in Wood Buffalo National Park that carry brucellosis and tuberculosis could potentially transmit the diseases to cattle, the ranching industry and Agriculture Canada support the Environmental Assessment Panel's recommendation to kill all bison in the park as a means of protecting livestock industry profits (Agriculture Canada, 1989; Bulmer, 1990; Gracey, 1990). Some wildlife biologists support the recommendation because it promises to free the area of 'hybrid' bison and/or stop potential spread of the diseases to other bison herds (Ankney, 1990; Environmental Assessment Panel, 1990). Other biologists join environmental advocacy groups in opposing the Panel's recommendation. They prefer to manage Wood Buffalo National Park for the benefit of park bison, rather than cattle or other bison populations, and either question, or do not care, whether wood bison are significantly different genotypically from plains bison

(*B. b. bison*) (Aniskowicz, 1990a,b; Nudds & Thomas, 1990). Finally, aboriginal peoples who rely on bison for their livelihood, argue that the bisons' continued presence is more important than their genetic composition or whether they carry diseases that might be transmitted to cattle or other bison herds (Community and Technical Hearings, 1990; Chiefs of Treaty 8, 1990; Fuller, 1991). Peterson (1991) maintains that, while each of these perspectives are valid for their supporters, each also privileges certain aspects of the controversy over others – demonstrating how perspective (with or without science) drives wildlife disease policy formation.

Within the economic valuation paradigm, experience becomes preferred or dispreferred by satisfying or failing to satisfy two basic presumptions, both of which derive from utilitarianism. First, the basic justification for cost-benefit analysis is the assumption that actions should be undertaken only to maximize benefits. Kelman (1990) claims that for many public decisions, the question of whether benefits outweigh costs is insufficient at best, and inappropriate at worst. He argues that "in areas of environmental … regulation there may be many instances where a certain decision might be right even though its benefits do not outweigh its costs" (p. 132). Perhaps this is why, in the midst of global privatization, so many countries have made environmental protection the business of governmental action rather than private initiative.

The second presumption develops out of the first. In order to determine when an act's benefits outweigh its costs, all factors must be expressed in a common denomination so they can be compared against others. For economic valuation in the U.S. that measure is dollars, and the possibility that some things cannot be expressed accurately in dollar terms does not exist. There is some difficulty, however, in determining the dollar value (using either market or 'nonmarket' methods) of such 'products' as life, peace and quiet, or fresh air. Economists have responded to the challenge of imputing dollar value to nonmarketed goods by determining their value as it relates to marketed goods, thus creating an economically based 'nonmarket' value. For example, while peace and quiet is not marketed, houses are sold in both noisy and quiet locations. Therefore, the value of peace and quiet is the difference between the purchase price of two homes (otherwise alike, and in the same real estate market) with varying levels of noise. Although this example drastically oversimplifies the technical aspects of cost-benefit analysis, it does not oversimplify the fundamental assumptions upon which it rests.

MODERNITY AND SOCIAL FRAGMENTATION

Luhmann's (1989) functionalist social theory both clarifies the extent to which the fundamental assumptions underlying economic valuation models provide a narrowly deterministic basis for public policy decisions and provides a frame-

work within which we can critique potential repercussions of basing publicly owned natural resource management decisions on this perspective alone. Luhmann proposes a radicalized functionalism as a theoretical perspective toward society and its environment. Rather than viewing functional relations as causal, he characterizes 'cause' as a special, and singularly opaque, case of function. Functional relations exist between a problem and a *range* of possible responses, and problems that do not acquiesce to such a range are not social problems.

Luhmann uses the concept of autopoiesis to model society as a simultaneously closed (organizationally) and open (structurally) "all encompassing social system of mutually referring communications … [that] originates through communicative acts alone and differentiates itself from an environment of other kinds of systems through the continual reproduction of communication by communication" (1989, p. 7). The theory of autopoiesis relies on the powerful notion that all systems examine themselves and regulate their own functioning through a process analogous to cognition. The most basic cognitive operation is that of making distinctions (Ulrich & Probst, 1984). Any unity, including human society, can be differentiated into its constituent parts by drawing further distinctions. Alternately, one can distinguish between an individual system and its environment, emphasizing the difference between the system and its environment. The whole process of differentiating entities from their background is based upon this simple cognitive process, which specifies the organization of a system. While this interpretation recognizes that society has an environment, it insists that social relations with the environment are internally driven *responses to,* rather than *interactions with* the environment. Instead of asserting that the system adapts to its environment, or that the environment selects the system that survives, autopoiesis emphasizes the way the total system of interaction shapes its own future.

The organizational closure assumed by autopoiesis means that society can react to its environment only according to its own mode of operation. Society is seen as an autonomous, closed system because it strives to maintain an identity by subordinating all changes to the maintenance of its own organization as a given set of relations. It does so by engaging in circular patterns of interaction whereby change in one element of the system is coupled with changes elsewhere, setting up continuous patterns of interaction that are always self-referential. They are self-referential because no system can interact in ways that are not specified in the pattern of relations that define its organization. Thus, society's supposed interaction with its environment is really a reflection and part of its internal organization. It responds to the environment in a way that facilitates its own self-production.

In describing society as closed and autonomous, Luhmann is not characterizing it as completely isolated. The closure and autonomy to which he refers is merely organizational. Society closes in on itself to maintain stable patterns of relations, and this process ultimately distinguishes society as a system. There is

no beginning and no end to the system because it is a closed loop of interaction. In other words, society is seen as a system that possesses a logic of its own, rather than as a network of separate parts. Luhmann's rejection of the input-output model differentiates his approach to social theory from that used by most sociologists. Because a system cannot escape the closed loop, it makes no sense to say that society interacts with its external environment. Apparent transactions between society and its environment are really social transactions that have been prompted by resonance between society's sub-systems.

Although society is organizationally closed, it remains structurally open. Systems maintain stability by sustaining processes of negative feedback that allow them to detect and correct deviations from operating norms, and can evolve by developing capacities for modifying these norms to take account of new circumstances. The source of change then, is located in random variations occurring within the system. Chaos theory, which began developing in the 1960's, suggests that random changes in a system can lead to new patterns of order and stability (Crutchfield, Farmer, Packard, & Shaw, 1986). Random variation within society, then, generates possibilities for emergence and evolution of new system identities. Erratic changes can trigger interactions that reverberate through the system, the final consequences being determined by whether the current identity of the system dampens the effects of the disturbance through compensatory changes elsewhere, or whether it allows a new configuration of relations to emerge. The theory of autopoiesis thus encourages us to understand any transformation of society as the result of internally generated change.

The elements of social systems whereby these transactions occur are interpreted as communicative interactions rather than as individual parts. Society thus is structured by self-referential operations (communication) that are produced within the system. Luhmann characterizes these operations as communicative acts, which are the sole means for differentiating society from its environment (p. 7). Communication, which refers to "the common actualization of meaning," rather than to information transfer, provides society's *mode of operation*, and the *environment* includes everything that does not operate communicatively (p. x).

Luhmann describes the society wherein these communicative transactions take place as a centreless set of 'function systems', and insists that both what can be communicated and how it is communicated are constrained by these subsystems. He argues that because each sub-system fulfils only one primary function (hence, the name 'function system'), it cannot substitute for another, as was the case within traditional societies that were differentiated through stratification. These systems (the most important are economy, law, science, politics, religion, and education) sort all experience that is allowed to become information according to a binary code, wherein negation secures system closure by assuring that every value refers exclusively to its counter-value.

Binary codes reproduce system closure by resolving tautologies and paradoxes, and by limiting further possibilities. For example, within the function system of science, a claim that is not true is false, and a claim that is not false is true. Members of society are spared both the tautology that "truth is truth", and the paradox that "one cannot truthfully maintain that one is truthful". The principle of negation imputes binary codes with universal validity because something that is not identified by one term, must be identified by the other. Thus, the binary code of truth/falsity precludes the consideration of alternative criteria when evaluating a scientific event. Binary codes operate similarly in each function system. While the principle of negation (as materialized in the binary code) ensures organizational closure, it also ensures structural openness by inducing society to examine the possibility of that which does not exist.

Each system's programs, which *refer to* its binary code, yet are not terms of the code, further retain the system's openness. At the same time they operationalize the system's binary code, they must remain variable, because determining the relative suitability of one or the other binary value when appraising an experience requires information from outside the system. Programs, then, refer to the conditions necessary to determine the selection of one binary term over the other. For example, decisions regarding whether to perform experiments designed to determine the truth/falsity of scientific claims often rely on the binary codes of the legal system (legal/illegal) and the economic system (ability/inability to pay). Structural openness then, allows social systems to utilize terms from within other function systems, without losing their previously determined identities.

Luhmann argues that functional differentiation limits society's potential responses to environmental disturbances, for responses can be formulated only in terms of function systems. Whenever society is unable to ignore environmental disturbances, the resulting 'resonance' between society and its environment is channelled into a function system and treated in accordance with that system's binary code. Experience that cannot be translated into the binary code of a function system never becomes information. However, even though function systems screen society from its environment by sharply reducing what counts as information, they make up for this by producing resonance at the internal boundaries of society – where communication across function systems *defines* society. Additionally, function systems form each others' environments, for the world is not constituted so that events fit neatly within the framework of one function alone. For example, "*scientific* research has made the construction of nuclear plants *economically* possible through a *political* decision about *legal* liability limitations" (Luhmann, 1989, p. 49). In the case of the Valdez oil spill, an environmental disaster resulted when a *political* decision provided Exxon with *legal* justification for an *economic* decision to postpone technical changes suggested by *science* (equip oil tankers with double-hulls). Despite overlap between function systems, the systems lack integration to the degree that a positive valuation in one system does not automatically entail a positive

valuation in the other systems. For example, though Exxon's $2 billion clean-up operation in Prince William Sound may have entailed a positive *economic* valuation of the spill and resulting clean-up because it infused the local economy with financial capital, or increased the local ability to make payments, the Alaska Oil Spill Commission determined that "never again should the spiller be in charge of [cleaning up] a major oil spill" (Laycock 1990, p. 110). In this case, *both the binary code for the legal and economic* function system dictated that Exxon should pay for, and manage, the oil spill clean-up. However, structural openness produced resonance between several function systems, which enabled the investigating commission to base its recommendation on conditions relating more closely to the function systems of science and education. The commission's recommendation reflected the belief that basing all decisions regarding environmental values on the economic function system was inappropriate. Even in cases such as the Valdez oil spill, wherein function systems do not produce coordinated responses, their communicative interdependency ensures that operations can switch quickly from the code of one function system (the economic system) to the code of another (the education system).

Luhmann cautions against defining other function systems solely in terms of their relationship with the economic sphere. Although he admits that "among society's many function systems the economy deserves first consideration", he claims that the attempt to derive the near-totality of other sociological phenomenon from any one sphere is hopelessly reductionistic (p. 51). This is the problem with using cost-benefit analyses to determine 'total' worth of publicly owned natural resources. Contrary to some economists' claims, utilitarian considerations do not provide a 'total' picture of any social dilemma, and to assert that they do is to deny the information value we gain from other function systems. When the criteria and programming of one system are privileged over all others, the number and variety of experiences that count as information in a society are sharply reduced. Because society's ability to find resonance with its environment is almost completely dependent on the secondary resonance that develops between its function systems, this boundary activity is essential to the perception of environmental disturbances. Society can, however, compensate for its limited ability to recognize environmental disturbances. Through recognizing the limitations of any function system, society can benefit from the internal complexity of an integrated system (for example, although one cannot, theoretically, purchase indigenous wildlife in the U.S. *economic* system, one can manage it through the *political* system, and safeguard it through the *legal* system).

Each function system's binary code provides specific constraints. Because the economy refers to all operations transacted through the payment of money, and only to such operations, economic valuation models must determine 'total value' in terms of money. Luhmann argues that economic programs provide the means for cycling the capacity and incapacity to make payments from one segment of society to another (1989, pp. 51-62). The economy's binary code of

payment/nonpayment limits economic valuation models to conceiving of value in terms of how much money people have spent, or report willingness (and/or ability) to spend, on the resource in question. Therefore social resonance with wildlife, for example, is possible only when experience with wildlife is reinterpreted according to its placement in the cycle of the capacity and incapacity for making payments. According to Kelman (1990), assuming that values expressed in market transactions should drive public policy "denudes politics of any independent role in society, reducing it to a mechanistic, mimicking recalculation" (p. 134). As Luhmann points out, each function system experiences the environment through its own programs and codes. Terministic screens that privilege economic modes of experiencing over all others threaten to distort the social experience. When observation of environmental issues is interpreted in light of the ability to pay, the economic system can only observe social experiences with wildlife after arbitrarily decontextualizing the wildlife being studied from their non-economic milieu. Additionally, it can communicate about the relationship of society to the species in question only through economic theories already in existence, thereby choosing which experience will become information without external means of rationalizing the selection.

DANGERS OF RELYING ON ECONOMIC VALUATION MODELS

In addition to providing an arbitrarily deterministic model of social interaction with the environment, valuation models based on economics pose ethical difficulties. Kelman (1990) suggests that "there are good reasons to oppose efforts to put dollar values on nonmarketed benefits and costs" (p. 129). The validity of such models depends on several assumptions. First, one must assume that economists can control for all dimensions of quality other than the presence or absence of the nonmarketed entity. Second, one must assume that the nonmarket entity affects all people equally, and that all people have the same constraints. For example, when assessing the value of 'peace and quiet' by comparing the selling price of equivalent homes near an airport and in a more distant neighbourhood, the monetary value imputed to 'peace and quiet' will be inappropriately low if some people have different perceptions or needs than others. Those who hear less noise, or who cannot drive, will take the house by the airport at less of a discount than the 'average' person. Third, we must assume that there is no difference between the price a person is willing to pay to get something and the price s/he is willing to pay to avoid giving up something.

Fourth, and of fundamental significance, basing the value of publicly owned resources, such as wildlife, on capitalistic axioms requires the assumption that citizens do not differentiate between values expressed in private transactions and those expressed in public policy decisions. If this assumption is correct, people who drive their cars to work would oppose public transit, and those who play golf

on courses made affordable by taxpayer subsidized irrigation intended for food production would oppose water law reform. Empirical support for these assumptions is lacking.

Most importantly, Kelman points out that "the very statement that something is not for sale affirms, enhances, and protects a thing's value in a number of ways" (1990, p. 134). Pricelessness says that the thing is valued for its own sake, whereas something on the market (whether hypothetical or real) is valued instrumentally – as a means for achieving a more important end. Being not for sale does more than reflect the quantity of its valuation. Rather, it signals a thing's distinctive quality and "expresses our resolution to safeguard that distinctive value" (p. 135). Contrastingly, the very act of pricing a nonmarket entity may reduce its perceived value. The contemporary Western aversion towards buying and selling humans (including babies for adoption by presumably loving parents) is based on the judgment that this act diminishes human worth. For many people, part of wildlife's value comes from its position as a repository of qualitative values found only in non-economic sectors. If wildlife is a resource held in public trust by the government, private economic motives provide not only inadequate, but politically inappropriate, means for determining policy. Mill's familiar declaration that "the State, while it respects the liberty of each [person] in what specially regards himself, is bound to maintain a vigilant control over his exercise of any power which it allows him to possess over others", reminds us that public policy should be tied to the needs of the least powerful (1947/1859, p. 106). However, economic valuation models for wildlife postulate the value of a public resource as defined by those who exert the greatest control over the cycle of payment/non-payment capacity.

The potential danger of exclusively relying on economic valuation models for establishing wildlife conservation policy parallels problems experienced by agricultural conservationists. Peterson (1986) has suggested that the impact of U.S. farm conservation rhetoric has been constrained by philosophical determinism. Because conservation's position within American agriculture's hierarchy of values depends on its connection with short term profits, its application has been erratic at best, for farmers can reject conservation practices without rejecting the ecological principles upon which they are based. Because agricultural conservationists have relied on an economic connection between 'conservation' and 'agriculture', as soon as non-conservational production appears to be more efficient or immediately profitable, farmers replace conservation with less responsible farming practices – until another environmental crisis emerges.

Worster (1979) argues that the primacy of an economic motive explains the failure of ecologists to instil conserving principles in the U.S. public. He claims that ecological values summarized in the following premises diminish the significance of conservation in the U.S.: "Nature must be seen as capital … [People have] a right, even an obligation, to use this capital or constant self-advancement … The social order should permit and encourage this continual

increase of personal wealth" (p. 6). In an environmental ethic that features capitalistic economic principles, conservation is abandoned when the association between conservation and immediate economic gain dissolves. Wildlife managers may actually reinforce the primal importance of short-term capital gain by marketing wildlife conservation and preservation on the basis of economic valuation. By depending so completely on association with economic motives, conservationists limit the possibilities of their rhetoric to a utilitarian perspective. When wildlife conservation and preservation are reduced to only an instrument for achieving an economic goal, policies that endanger fragile or rare habitats should not be attributed to rejection of the principles upon which conservation is based, but rather to limitation of wildlife's (or other natural resource's) relative significance in an economically determined hierarchy of values. Thus, reliance on total valuation models for justifying natural resource conservation and preservation may ultimately do more harm than good.

HOW ECONOMIC VALUATION DISTORTS ANALYSIS OF ECOLOGICAL PROBLEMS

Economically determined valuation models distort analysis of ecological problems by trivializing other social functions such as education, politics, or law. For example, despite the relative accuracy of various economic valuation models in estimating the money lost by the Alaskan fishing industry due to the Exxon Valdez spill, the cultural damage to area residents cannot be appropriately measured in dollars. Whatever amount of money Exxon spends reimbursing those whose livelihoods were threatened by the spill, it will not repair damage dealt to the local culture (Scott, 1991). Descriptions of the slump Alaska experienced in the tourist industry provide only peripheral characterizations of the aesthetic impact of the spill. Although both the lay public and experts seem to agree that, in this case, economic restitution will not constitute full restitution, no alternative model is suggested.

If economic reasoning alone does not provide an adequate means for explaining and directing responses to the Valdez spill, perhaps it also is inappropriate as a means for determining management policy for other publicly owned natural resources. For example, traffic on the Gulf Intercoastal Waterway, which provides a relatively inexpensive shipping route for petrochemicals and other toxic materials, continues at high levels despite potentially adverse affects on the endangered whooping crane population. Based on Stoll and Johnson's (1984) CVM model, the value of the cranes ranges anywhere from $573 million to $1.58 billion. The ability to transport toxic materials through the refuge is worth considerably more than $1.58 billion to those industries who directly or indirectly utilize the waterway. Further, to the extent that they control the means for cycling the ability or inability to make payments, industry

representatives also control the economic function system. If policy decisions regarding Aransas National Wildlife Refuge rely on results obtained through 'total' valuation models, the refuge will be managed to facilitate industrial transportation rather than as whooping crane habitat.

Advocates of cost-benefit analysis argue that all human decisions are implicitly based on utilitarianism, and that economic valuation models simply ensure rational conclusions by making this process explicit. *Even if* economists are correct in assuming that utilitarianism is implicated in *all* decisions, market values are not necessarily given causal roles. At the most, they may reflect, rather than precipitate, final decisions. However, in the models described in this essay, market equivalences are established *in advance*, and provide the raw materials for calculating a natural resource's value.

Additionally, there is some question as to whether utilitarian calculations control decision making. Luhmann (1989) argues that social decisions are deliberately opaque, for in order to create the illusion of a natural response, all decision structures conceal their own contingencies. Any instrument (including both the TCM and CVM) for acquiring or organizing knowledge is merely a form of simplifying the observation of self observations. Further, its institutionalization releases it from the restraints imposed by unfettered critique. As Mill argues, doctrines that "make the deepest impression upon the mind may remain in it as dead beliefs, without being ever realized in the imagination, the feelings, or understanding" (1947/1859, p. 40). By privileging the economic function system, and valuation models driven by it, current methodologies naturalize the notion that those who are at an economic advantage not only do, but *should*, control decisions regarding natural resources.

In suggesting that economic models provide an inappropriate basis for determining publicly owned natural resource management policy, we are not advocating that analysis of ecological problems should begin from other causes within society, then proceed to assign blame for damages. Luhmann (1989) argues that rather than assigning moral responsibility, such analyses only provide exculpation by determining innocence. He claims that they create a "rhetoric of anxiety", which can always be used for moral justification, but simply achieves more anxiety. The aftermath of the Exxon Valdez illustrates such anxiety. Rather, we are suggesting that attempts to respond to ecological problems must recognize multiple causality in environmental conflict, and that this understanding can be incorporated only when decision rules explicitly integrate values instantiated in the programs of all function systems.

The terms used to define or evaluate anything create knowledge about, and guide appropriate responses to, that thing. For example, if wildlife is defined primarily in economic terms, it becomes an economic resource. As an economic resource, its value is determined completely by its influence on the cycle of capacity and incapacity to make payments. Thus, its concrete naming has determined its abstract nature, while insidiously naturalizing existing patterns of

domination as they relate to resources that belong to the public. As Bowker and Stoll (1988) discovered, wealthier respondents 'value' the endangered whooping crane more than do those with lower incomes. Such findings lead to the conclusion that those with lower incomes care less about wildlife conservation, and may, therefore, be safely ignored when management policy is debated. However, the significance of Bowker and Stoll's claim is somewhat diminished when one realizes that respondents' valuations of whooping cranes were determined by the number of dollars they were willing to pay to ensure that bird's continued existence. If management policy for publicly owned natural resources is to reflect more than the relative abilities of various segments of society to control economic cycles, programs from function systems in addition to the economy must be called upon to guide management decisions. Valuation of wildlife and other publicly owned natural resources must be based on analysis of their relationships to law, science, politics, religion, and education, as well as to the economy. Cultural motifs discovered in the relationships between these systems could induce the formulation of value terms that are more consonant with the concept of public trust, and less likely to legitimize the patterns of inequity that characterize both local and global relations between human societies and their environments.

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