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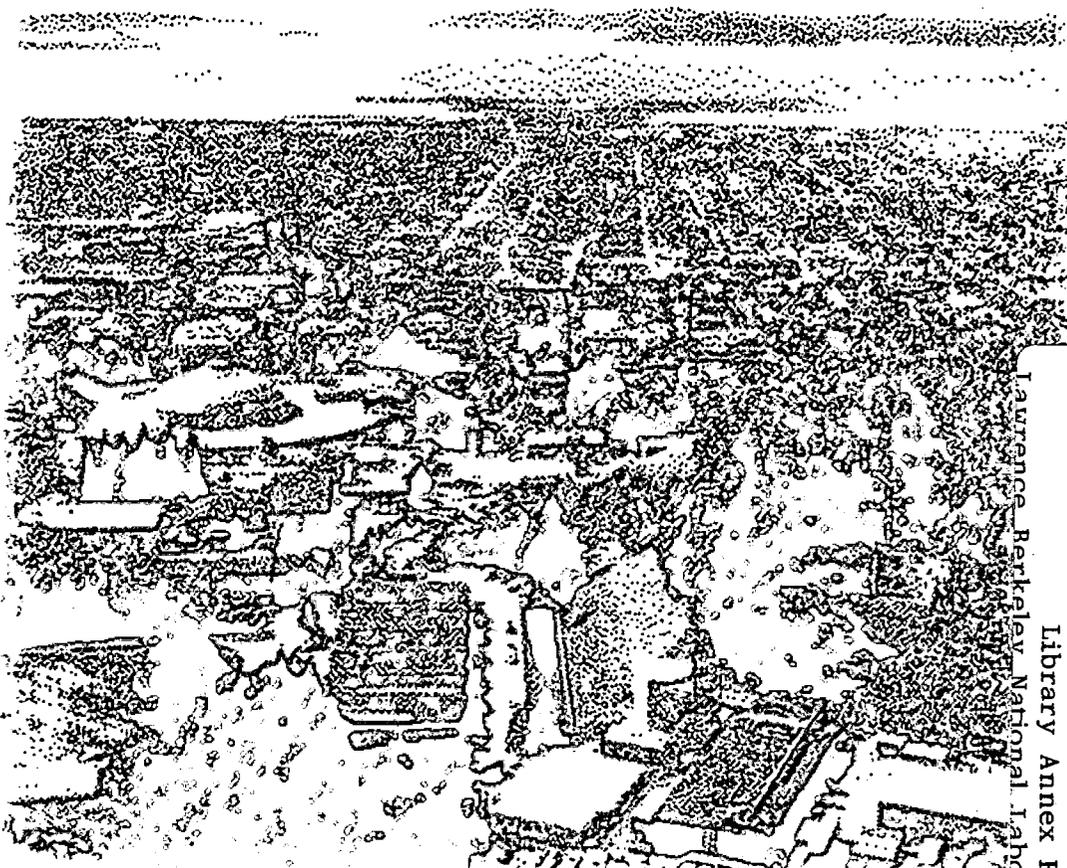
A Finite World, Earth Sciences, and Public Trust

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A Finite World, Earth Sciences, and Public Trust

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A FINITE WORLD, EARTH SCIENCES, AND PUBLIC TRUST

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Abstract

The beginning of the twenty-first century has coincided with our recognition that life-sustaining Earth cycles are remarkably fine-tuned, and that humans have developed technological abilities to perturb these cycles. Also, inspired by the gifts of freedom and democracy, humans have given themselves laws to exploit nature for profit. The upshot is that nature's balance, governed by immutable physical laws, is being confronted by social laws driven by human aspirations. This conflict, and its implications to the human relevance of the Earth sciences are explored in the context of an extraordinary tradition of European culture known as public trust.

Introduction

Most earth scientists agree that the Earth is a bounded natural system. Although this finiteness of the Earth was recognized by nineteenth century naturalists, its potential implications to human society went largely unexamined. Aggressive economic development of natural resources went on at a feverish pace. Essentially, the Earth was taken to be an unbounded system.

In parallel, society was moving away from powerful monarchical governance towards democratization of freedom, education and wealth. In this atmosphere, social policies actively encouraged large scale exploitation of nature for human benefit and for profit. Many believe that democracy assures them the right to unrestrained manipulation of nature. Many individuals, particularly those deeply committed to individual freedom, believe that technology will continue to overcome the constraints of a finite Earth system. Many naturalists, however, believe that limitless resources development is unrealistic and that a change in mind-set is needed that is compatible with a judicious reliance on a finite Earth system.

It is becoming apparent that achieving civilized human sustenance in a finite world transcends the scope of science. In a finite world subject to mass and energy conservation, optimizing benefits for one region entails depriving benefits for another. Although technologically

feasible, some solutions may be unacceptable on broader social grounds. Important decisions on resource development can no longer be made in isolation by a team of technical experts. They will have to be made through a process of informed public participation. Sciences and the humanities must therefore come together for wise judgements on natural resources utilization..

This coming together of sciences and the humanities was espoused passionately by Wilson (1998). Wilson's perspective is that human knowledge is a seamless continuum from the sciences to the humanities. He argues that science will continue to enhance our understanding of the material world. But, problems related to civilized living in a finite world can be solved only by combining the sciences (physical, biological, geological, behavioral) with humanities (philosophy, history, moral reasoning, comparative religion, and interpretation of the arts). He admonishes natural scientists to appreciate their role within the broader continuum of human knowledge.

Given that we need a broader knowledge-base to guide us in civilized living, this essay explores the link between earth sciences and one aspect of modern environmental law known as public trust. The motivation is that it may stimulate earth scientists to pause and explore the human relevance of their own work.

Law of Nature and Law of Humans

During the sixth century A. D., the Byzantine Emperor Justinian I commissioned a group of legal scholars to examine all known writings of authoritative jurists and codify Roman law. The result known as the Justinian Code contains legal tenets relevant to society and natural resources.

At its foundation, the Justinian Code distinguished between "law of nature" and laws enacted by humans. The concept of law of nature, based on reason and morality, was borrowed from Greek philosophy. Law of nature, observed alike by all nations, was deemed fixed and immutable. In contrast, the laws of humans, which were enacted by states were susceptible to frequent change by consent of the people or by the passage of new law. The spirit of the law of nature was articulated thus, (Althaus, 1978),

"By the law of nature these things are common to mankind — the air, running water, the sea, and consequently the shore of the sea. No one, therefore is forbidden to approach the seashore, provided that he respects habitations, monuments, and buildings, which are not, like the sea subject only to the law of nations."

Regardless of the technological advancements of the past 1,500 years, the distinction between the law of nature and the law of humans is as valid now in a shrinking planet as it was in the sixth century when the Romans sought to protect vital natural resources from the control of powerful monarchs. In 1225 A. D., King John, defeated by English barons, signed the Magna Carta. This document guaranteed the personal liberties of the people of England, including access to vital natural resources. The spirit inherent in the law of nature, asserting free access of vital natural resources to all humans, is commonly referred to as the doctrine of public trust.

Soon after America's independence, the doctrine of public trust was incorporated into the Northwest Ordinance of 1787, specifically to free ensure access of navigable waters of the Mississippi and St. Lawrence Rivers. Inspired by this Ordinance, public trust became part of the constitutions of the many states that subsequently joined the Union.

Legal Standing

Sax (1970) elegantly summarized the essential features of public trust within the American legal system. Although public trust is actively debated among legal scholars, one perception that has much support is that certain interests (e.g. water, navigability, fishing) are so vital to every citizen that it is necessary for society to be especially vigilant so that no particular individual or group acquire power to control them. A consequence of public trust as manifest in water law is that one does not own a property right in water the same way one owns a right in other material things. Rather, one's right is usufructuary, meaning that it is a right to benefit from a resource, implicitly recognizing the needs of others. While deriving benefit, the source of the benefit itself is not to be altered or damaged. Thus, for example, governments have the responsibility to regulate water uses for common benefit, recognizing the physical interdependency implicit in the resource. Remarkably, public trust has three attributes that make it amenable to use as a tool to approach management of natural resources. These are: (1) it asserts a legal right in the general public without owning specific property rights, (2) it enables action that is enforceable against government, and (3) it enables interpretation consistent with evolving concerns about the human environment.

Sax (1980) elaborated on the practical implications of the public trust doctrine. First, governments hold natural resources in trust for the public. Thus, governments have a fiduciary

responsibility for actively protecting such resources. Second, governmental responsibility is not simply one of preventing private ownership from gaining control of the resources. Nor is it one of banning the use of the resource so as to protect it. Rather, governmental responsibility is one of assuring stability in the sustained use of natural resources by citizens. Implicit here is a recognition that natural systems do change, both because change is intrinsic to the Earth and because human sustenance will cause some change in the natural system. The essence of governmental responsibility is therefore one of offering protection against unacceptable, destabilizing change. For example, although the slow disappearance of species because of evolutionary changes is inevitable, the sudden disappearance of species because of human action is not.

In the free American society that has evolved in a climate of subduing the Earth for acquiring wealth, private rights to property is an important theme of human law. Intrinsic to legal rights of private property is the association of reasonable expectation and title to property. Contrary to this association, public trust asserts expectation without formal title. This diffuse notion of expectation without explicit title to property has, in the past, inhibited some courts from ruling in favor of public trust claims. Other courts, however, have held that legislatures have a responsibility to enact laws for public purpose and that public trust is part of that responsibility.

Precedents

Although public trust is inherent in the foundations of federal and state law, economic growth after the industrial revolution contributed to the erosion of its legal stature during the nineteenth and early twentieth centuries. The situation began to change with the onset of the environmental movement in the United States during the 1960s. One component of this movement that actively drew upon the spirit of public trust involved many legal battles waged by citizens groups in the state of New York to preserve the aesthetic beauty and the biological diversity of the Hudson River (Cronin and Kennedy, 1997).

In 1963, Con Ed, an electric power company, applied for a permit to construct a pumped storage reservoir on top of Storm King Mountain in the Hudson Highlands. Initial protests to this proposal by citizens groups were based on aesthetics and spiritual values. Later, these were joined by concerns about damage to spawning grounds of bass. The environmentalists succeeded after

nearly two decades of litigation. The Storm King reservoir never materialized. Drawing inspiration from this, other citizens groups successfully sued many industrial establishments on the Hudson River that were discharging toxic contaminants into the river. These court cases succeeded in establishing new legal precedents such as the right to sue based on aesthetic and environmental grounds rather than economic grounds, or the right of a private citizen to sue violators of public rights in federal courts.

A celebrated case involving public trust concerned Mono Lake in California. During the 1940s, the City of Los Angeles, which had acquired riparian rights to water in four of the five streams that flowed into Mono Lake, began diverting water from the streams to an aqueduct that provided domestic water supply to citizens of Los Angeles. By the mid 1970s, Mono Lake water levels fell dangerously low. The rare and fragile ecosystem of the saline, inland lake was seriously imperiled. In 1983, the Supreme Court of California upheld the primacy of public trust in ruling against the City (*National Audubon Society v. Superior Court*, 1983). The Court determined that Mono Lake was a navigable water body and thus fell within the scope of public trust. Based on public trust, the Court held that maintaining the integrity of the ecosystem was indeed an important public benefit and that the municipal benefit of the citizens of Los Angeles cannot occur at the cost of the Mono Lake ecosystem. This decision forced the City of Los Angeles to work with local communities to develop a plan which will enable it to have access to Mono Basin water after the needs of the lake's ecosystem are satisfied.

Hawaii is an island state with limited freshwater supplies and historic water use traditions of native people prior to the arrival of American immigrants. The Supreme Court of Hawaii recently took an even stronger position in favor of public trust than California. In the matter of water use permit applications for the Waihole Ditch (*Supreme Court of Hawaii*, 2000), the Hawaiian court held that restriction of public trust to navigable and tidal waters (as was done in the Mono Lake decision) offers only a partial picture of the water resources trust of Hawaii. Under the Hawaiian Constitution, the state has both the authority and duty to preserve the rights of present and future generations in the waters of the state. The Court recognized that the state must strike a balance between private and public use in deciding reasonable and beneficial water use. But it asserted that such a balancing of public and private purposes begins with the presumption in favor of public use, access, and enjoyment.

Not all states subscribe to public trust with the same breadth as California and Hawaii. Many in the American legal community that favor private enterprise would strongly argue against interpreting public trust too broadly. Nevertheless, it is reasonable to expect an enhanced role for public trust in the United States as the impacts of natural resources development become increasingly manifest on the environment. It is likely that public trust will also come into greater focus internationally as citizens groups plead their cases across national borders.

Implications to Earth Sciences

Land, soil, and water together constitute the natural infrastructure on which all life on Earth depends. Sustenance of natural resources for the benefit of all requires maintaining the physical and chemical integrity of the natural infrastructure. Without human intervention, the natural infrastructure of a region represents a long-term balance among geological, hydrological, geochemical, nutritional and biological cycles. These remarkably fine-tuned phenomena have evolved over geological time. Biological systems are vulnerable to even small alterations of these delicate cycles. Human intervention through massive inputs of energy and alteration of the landscape result in a disequilibrium among the cycles. In response, nature responds by establishing a new balance. The interactions among the various Earth cycles occur simultaneously on many spatial and temporal scales. Adding to the complexity, the forcing function (climate) is difficult (or even impossible) to predict over long periods of time.

Society is gradually moving away from a mode of discovering new sources of energy, water and nutrients to a mode of sustenance within a finite system through recycling and reuse. This sustenance entails providing short-term nourishment for the present generation and preserving the natural infrastructure in the long-term for future generations. Given the complexity of the natural system in space and time, sustenance in this sense requires a change in the manner we draw upon earth sciences for common benefit. In particular, a change is necessary from a mental mode of discovering new resources and continued manipulation of nature to one of vigilant monitoring of the response of the system to resource use and modifying the patterns of use should unacceptable impacts be detected. Here, monitoring is used in a broad sense of an integrated observation of hydrological, geological, geochemical and biological factors. Monitoring in this sense poses new

challenges to earth scientists. Systematic monitoring of natural resource systems is not quite a part of our contemporary mind-set. Monitoring may even be discouraged lest it should reveal undesirable impacts that may impede exploitation.

Drawing attention to the intimate and largely unexplored linkages that exist among environmental policy, social science, biology and ethics, Wilson (1998) states, "The ease with which the educated public, not just the intellectuals and political leaders, can think about these and similar circuits, starting at any point and moving in any direction, will determine how wisely public policy is chosen". Democracy implies a society of citizens rather than serfs. In such a society citizens participate in and guide decision making. The implication to earth sciences is that new and emerging knowledge about the functioning of earth systems as a whole must be made available to the concerned citizen in a credible manner. The inevitable fragmentation of knowledge associated with specialization must be compensated by a deliberate effort towards understanding the larger whole.

There also are institutional implications. We now live in an intensely commercial atmosphere. Every public institution is expected to be "accountable" for the funds invested in it. Here, accountability is taken to imply direct service to the public. Such services are even expected to generate significant revenues to sustain the institutions. Benefits such as long-term accumulation of knowledge (e.g. monitoring, basic understanding of earth systems) usually are not addressed as part of accountability. To enable wise decisions on sustainable use of natural resources, existing or institutions must be vested with the responsibility of systematic monitoring, interpretation of data, and dissemination of information.

In regard to monitoring and institutions, public trust has an important role to play. Governments have a responsibility to protect natural resources from unacceptable, destabilizing changes as they are put to beneficial use. Timely recognition of unacceptable change requires a knowledge of the present state of the system and a knowledge of the direction and rate at which it is changing. This requirement can only be met through resource inventory, followed by continuous and systematic monitoring. Governments have a public trust responsibility to maintain resource inventory and monitored information on changes in the attributes of resource systems. It is likely that public trust in the future will help define new roles for national institutions such as the U. S. Geological Survey, U. S. Fish and Wildlife Service and the Forest Service.

In an influential essay, Hardin (1968) spoke of the tragedy of the commons arising from

overpopulation in a finite world. He defined tragedy as the "...solemnity of the remorseless working of things". Hardin saw a basic incompatibility between unlimited individual freedom to optimize one's benefit in a finite world and the destruction of the commons. He did not foresee a rational way of preserving the commons without surrendering some of the liberties taken for granted in a democratic society. Over the three decades since Hardin's paper, there has been much progress in the environmental movements of the United States. The successes in New York (Hudson River) and California (Mono Lake) suggest that the doctrine of public trust can potentially contribute to lessen the damage to the commons. Public trust vests in society the responsibility of moderating certain perceived individual liberties when they are in conflict with the well-being of the commons.

For the earth scientist concerned about judicious utilization of natural resources, public trust is more than a philosophical curiosity. The doctrine has come of age. It has a substantial body of case law and precedent to render it to be a valuable tool for natural resources management. Used thoughtfully, the tool can go a long way towards careful management of natural resources. Such a thoughtful use will entail combining good scientific knowledge, an awareness of the ethical foundations of law, and an acumen to reach out to the court system when such a step constitutes the most prudent course of action..

Concluding Remarks

Society is continuously evolving. Contemporary environmental problems are merely manifestations of the continuing adjustment of human societies to their changing surroundings. Although on-going conflicts and confrontations may superficially suggest lack of progress, ideas, perceptions and values do inevitably change in the long-term. One example is worth citing.

The U. S. Bureau of Reclamation was born in 1902 when the nation had a vision of progress through social engineering. For nearly nine decades, the Bureau functioned as a powerful, well-funded organization. It helped reclaim millions of acres of wetlands, constructed spectacular multi-purpose irrigation projects, and took pride in making deserts bloom in the American West. But, following the failure of the Grand Teton dam in southeastern Idaho during the 1970s and the problem of selenium poisoning in the San Joaquin Valley of California during the early 1980s, the Bureau's mission changed dramatically. A philosophy of helping agriculture through large hydraulic

structures gave way to one of resource management, conservation, and protection. The Bureau had learned much about the long-term consequences of confronting nature's forces.

In some respects public trust is almost a self-evident notion, such as that of being a good citizen. In an ideal democratic society, public trust need never be formally invoked because it will be implicit in all laws and policies. In reality, however, this ideal will be approached only through a citizenry that is broadly educated and comprehends the difference between law of nature and law of humans.

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