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House Rules: Environmental Ethics for a Sustainable World

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Executive Summary

This inquiry into ethics, economics and ecology is proposed to provide environmental professionals with a comprehensive view of the value of sustainable water use projects. Ethics is the systematic examination of our rights, our responsibilities and the consequences of our conduct to determine the best course of action. Economics examines the nature of commercial transactions in human society, while ecology studies the complex physical relationships between living and non-living systems. Though related in theory, these disciplines often appear opposed to one another as the focus of ethics contrasts with the "value-free" science of economics, and the relevance of economic theories that promote environmental destruction is challenged by diminishing resources and declining quality of life. Over the past several decades, however, the three fields have begun to influence each other in ways that are especially important to water managers.

The title of this study is derived from the Greek word oikos (house) which is the root of both economics ("household laws") and ecology ("household science"). When ethical judgments develop out of an awareness of the fundamental interrelatedness of the biosphere, the result is environmental ethics, whose principles include biotic integrity, intergenerational equity and the precautionary principle. When we allow environmental ethics to constrain our use of resources, economics evolves into ecological economics, which is based on a more accurate understanding of society's dependence on the natural world. Together, environmental ethics and ecological economics give water professionals a context in which to assess the value of their projects. By communicating their benefits to the public.

Introduction: A Seat at the Table

Rachel Carson

In 1962, American biologist Rachel Carson published a warning about the effect of chemical pesticides on the environment. Even as industry spokesmen rushed to repudiate her allegations, legislators introduced dozens of new laws regulating pesticides. Some date the origin of the modern environmental movement from the release of Silent Spring and the furor it caused. In the years since Carson sounded her silent alarm, more evidence has emerged showing how natural systems have been degraded due to the use of technology by a burgeoning human population. As environmental scientists and engineers, there is much we can do to reduce society's impact on the environment by designing ways to use resources more efficiently. In the area of landscape irrigation, for example, recent innovations include moisture sensors to control sprinklers, subsurface evaporative irrigation systems and the use of recycled water to make the most of limited water supplies.

We will need these inventions and more by mid-century when experts predict our global population will reach 10 billion people. However, many water professionals find it difficult to obtain support for water conservation, water recycling and other efforts that benefit the environment. On the one hand they are discouraged by public resistance to innovations that require even slight changes in behavior; on the other hand they are hindered by economic models that ignore the benefits their projects provide and by politicians who are so focused on the next election they are unwilling to make long-term investments. They may not seek a national platform, but they want at least a seat at the table where their projects are discussed and a chance to make a case for sustainable water use.

The following discussion is intended to help water resource managers recognize the ethical value of their projects as a basis for communicating their benefits to decision-makers and the general public. Part 1 offers a description of the fundamental principles of ethics, economics and ecology, while Part 2 examines how ethics and economics have been transformed by ecological concepts into environmental ethics and ecological economics. Far from static, these fields continue to evolve in response to new knowledge about the global environment. Part 3 provides some examples of how ecological economics and environmental ethics together support sustainable water policies use.

Part 1. House Rules: Ethics, Economics and Ecology

Today we think of ethics and economics as two distinct fields. But when the steam engines of the industrial revolution first howled into life in 18th century Europe, ethics and economics were both elements of moral philosophy, a subject that also included natural theology and jurisprudence. In fact, the founder of modern economics, Adam Smith, was a professor of Moral Philosophy at the University of Glasgow when he published his Theory of Moral Sentiments nearly twenty years before the book for which he is best remembered today. Since that time ethics and economics have developed along different paths, but they remain linked by their common concern with the nature of value in society. Meanwhile, ecology has challenged both ethical and economic theories with information about the interconnectedness of the physical, biological and social worlds.

Ethics: An Honest Game

The word ethics is derived from the Greek ethos meaning “custom” or “habit.” In his Nicomachean Ethics, Aristotle (384-322 bce) considered how people ought to conduct themselves in order to achieve happiness, which is the goal of both the wise individual and the state. Along with virtues such as courage, temperance and liberality he examined legal principles like justice and equity. For Aristotle ethical conduct is correct only if it leads to a greater good, making both means and ends the subject of ethical judgment. He also held that matters of public policy often involve ethical questions, since humans are by nature political (Ethics 1094b).

Aristotle

When we describe an action as “ethical” we usually mean that it conforms to some standard of conduct, so that the same action might be considered “ethical” or “unethical” depending on whose standards are used. But just because people have different standards does not mean ethics is arbitrary or irrational. The two essential questions addressed by ethical philosophy are “What is the right thing to do?” and “What do we mean by right?” The first question comprises the field of normative ethics, while meta-ethics considers how one should go about justifying moral arguments. Ethical philosophers

distinguish several different principles that can be used to support ethical decisions, including moral obligation, respect for rights and utilitarianism (Botzler 1998).


Immanuel Kant

The theory of moral obligation holds that certain ethical principles are so fundamental that all moral individuals must uphold them, without regard to consequences. This theory was most fully expounded by Immanuel Kant (1724-1804) who defined a categorical imperative as a principle "which can at the same time make itself a universal law." A prime example of such a principle was Kant's maxim that each rational being "must treat itself and all others never merely as means, but in every case at the same time as ends in themselves." Ethical systems based on moral obligations are also referred to as deonotological (from the Greek deion, "that which is binding"). In recent times, John Rawls (1921-2002) took an approach similar to Kant except that he focused on the rights that resulted in moral obligations. From that perspective, he formulated a principle of justice that states, "Each person has an equal right to a fully adequate scheme of equal basic liberties which is compatible with a similar scheme of liberties for all." (Rawls 1971)

By contrast, from a utilitarian standpoint an act is ethical only depending on whether its result is considered good or bad. In a nod to the ancient school of Epicureanism, British philosopher Jeremy Bentham (1748-1832) equated "the good" with that which produces pleasure or reduces pain (Bentham 1907) and concluded that ethical conduct is that which produces "the greatest good for the greatest number." Bentham's protégé John Stuart Mill (1806-1873) expanded this theory by acknowledging the existence of "higher" pleasures like intellectual enjoyment or the satisfaction that comes from social reciprocity. While often cited as a kind of "common sense" ethic, this position was directly opposed by Rawls who countered it by claiming that "Each person possess an inviolability founded on justice that even the welfare of society as a whole cannot override."

Religion is another source of ethics, although religious principles are thought to be divinely inspired rather than philosophically derived. Religious codes tend to be deontological rather than utilitarian, taking the form of categorical obligations ("Thou shalt not kill") or a duty to respect rights ("Do not do to another that which is hateful to yourself"). Occasionally, they provide utilitarian reasons for observance ("Judge not lest ye be judged") although the goal is more theological than practical. Like secular ethicists, those who follow religious laws must also interpret them to apply them to their lives. Perhaps for this reason, Judaism, Christianity and Islam each adopted Aristotelian logic during the early part of the last millennium as a way to extend the relevance of their beliefs to the concerns of contemporary (i.e. medieval) society (Strauss 1995).

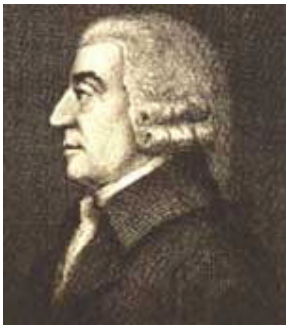
While the importance of ethics as the foundation of democracy is widely recognized,[1] over time awareness of its political significance has declined to the point that today ethics is often thought of as a personal matter, or as a standard of publicly acceptable behavior akin to politeness. This view overlooks the serious purpose of ethics, which is nothing less than the achievement of individual wellbeing and social welfare, to which end it engages in the systematic evaluation of our goals, our rights and our responsibilities to others. And whether our ethics are utilitarian or deontological, secular or religious, ethics requires us to examine the circumstances of our lives and our communities, as well as our values and

[1] See for example the US Declaration of Independence: *"We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights…"*

our actions. As Tom Regan (1998) wrote describing the "ideal" moral judgment: "Moral questions arise in the real world, and a knowledge of the real-world setting in which they arise is essential if we are seriously to seek rational answers to them."

Economics: Winners and Losers

The term economics is formed from two Greek words—oikos (house) and nomos (law)—and its early subject matter was, indeed, the art of managing the household, "for no man can live well or indeed live at all, unless he be provided with necessaries." (Politics 1254a) It is of particular interest to the present inquiry that even the ancients were aware of an economic practice that was concerned not with household benefits but only with the art of getting wealth, and whose unworthy goal they described as "unlimited acquisition."


Adam Smith

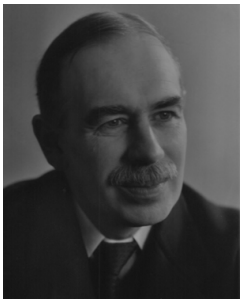
Modern economics is said to have originated with the publication of Adam Smith's 1776 treatise, An Inquiry into the Nature and Causes of the Wealth of Nations. Smith wrote his book to liberate society from meddling mercantilists whose regulations he feared would smother British commerce (Canterbery 1987). He explained how a free market steers business owners and laborers, each acting out of self-interest, to manufacture goods that provide the greatest national revenue without requiring the intervention of a king or trade associations. In the same way he showed how the sum of all individual transactions in the market results in the maximum welfare for society, as though each buyer and seller were "led by an invisible hand to promote an end which was no part of his intention." (Smith 1776)

By equating the supply of goods in the marketplace with the welfare of society Smith adopted utilitarian values ("the greatest good for the greatest number"); his system has also been described as atomistic because people behave as solitary economic individuals, unmindful of the welfare of others, while "no single, individual part of the market mechanism—worker or capitalist—is large enough to resist the pressures of competition." This view of society paralleled the physics of Isaac Newton (1642-1727), and invited the same kind of abstract mathematical analysis. Together these two features, utilitarian values and mathematical abstraction, came to characterize modern economic theory.

For nearly a century, economics was consumed with the search for a general theory of equilibrium to describe how wages, prices, rent and interest all balance in the marketplace. Generations of economists refined Smith's concepts, culminating with the work of Alfred Marshall (1842-1924) who explained how an equilibrium price is fixed by the forces of supply and demand at precisely the point of marginal utility, ensuring optimum efficiency and full employment (Canterbery 2001). But as economic models became more precise, they also became more unreal. Some dissenters (notably Marx and Veblen) accurately observed disturbing market trends towards overproduction, monopoly and unemployment, but these criticisms were largely ignored until 1929, after which interest in them increased.

Whatever else might be said of the merits of classical economics, it must be admitted that its practitioners not only failed to predict the Great Depression they were helpless to aid in its recovery. One explanation for this has been described as the fallacy of misplaced concreteness" in which artifacts of theory are mistaken for matters of fact (Daly 1994). In this case the critical error occurred when economists confused ideal market behavior—where voluntary exchanges between individuals with equal access to information results in optimally efficient distribution of goods and services—with the real market, crowded with speculators, monopolists and others who profit at the expense of the public. Based on this

critical misunderstanding, they concluded (wrongly) that to put people back to work they had only to leave the markets alone. "The standard models that economists had used for generations argued either that markets worked perfectly—some even denied the existence of genuine unemployment—or that the only reason that unemployment existed was that wages were too high, suggesting the obvious remedy: lower wages." (Stiglitz 2002)


John Keynes

But this economic theory collapsed with the economy when the policies recommended by classical economists only wound the spiral of the Depression tighter, choking off production and eliminating trade. It wasn't until President Roosevelt took the advice of another Cambridge economist, John Maynard Keynes (1883-1946), and government intervened in the market that economic conditions improved. Keynes opened a new chapter in economics with his General Theory of Employment, Interest and Money which described how government could shore up the economy during downturns by borrowing money to create jobs. As he explained it, since wage earners are consumers by another name, the borrowed money would continue to circulate until the impact of the "multiplier effect" was sufficient to stimulate private investment (Canterbery 1997). Keynes' student John Kenneth Galbraith (1908-) added to the General Theory with his own "theory of advanced development" that described the symbiotic relationship between government and industry, whereby industry passes increased wages to the consumer in the form of higher prices and "corporate growth…becomes inseparable from the goal of national economic growth." (Canterbery 2001). Galbraith, Heilbroner and others comprised the American institutionalist school of economics, which emphasized the importance of customs, laws, regulations and other "institutional factors" in influencing market behavior.

Another example of misplaced concreteness is found in the Theory of Rents proposed by Smith's disciple, David Ricardo (1772-1823). Ricardo valued land according to the rent it produced, which he equated with the smaller amount of labor required to grow crops on good land compared to less productive parcels. By basing the value of land on the difference in wages paid to farm workers, Ricardo's theory minimized the importance of landowners as a class and contributed to the rise of industrial capitalism (Daly 1994). This notion of land contrasts sharply with farmer and writer Wendell Berry's characterization of topsoil as "ceaselessly transforming death into life, ceaselessly supplying food and water to all that lives in it and from it." It is from the farmer's perspective, not the economist's, that Berry (1987) concludes: "Our life and livelihood are the gift of the topsoil and of our willingness and ability to care for it, to grow good wheat, to make good bread; they do not derive from stockpiles of raw materials or accumulations of purchasing power."

All economists have not ignored these problems. Certainly Keynes grasped their reality when he proposed government controls that contradicted the prevailing theory of his day. More recently Joseph Stiglitz (2002) received the 2001 Nobel Prize in economics for his work in asymmetries of information that showed "whenever information is imperfect and markets incomplete, which is to say always… the invisible hand works most imperfectly." In the main, however, economists seem committed to continuing the quest that began when economics left moral philosophy to become a scientific discipline: first to describe, then to predict and finally to enforce the validity of a market that does not exist outside their own theory. As a result, economics has attained "a degree of unreality that can be matched only by medieval scholasticism." (Heilbroner and Milberg 1995) Moreover, by hitching this imaginary system to a utilitarian definition of social welfare that equates goods in the market with "good for society," economists have cultivated a kind of sophisticated fatalism that portrays negative social and environmental consequences as inevitable

results of the marketplace, rather than as the product of their own erroneous policies. The result, according to Canerbery (2001) has been the growth of a "casino economy" in which "the central function of households and businesses [is] speculation" as opposed to the production of real goods and services. It remains to be seen whether we will be able to modify these policies to conform with ecological reality, or if an environmental collapse on a par with the Great Depression will be needed to reform our economic models.

Ecology: Table Stakes

Ernst Haeckel

The term ecology was coined in 1866 by German scientist Ernst Haeckel (1834-1919) who fashioned it from the Greek word for household and the suffix logos meaning "word" or "study." Haeckel proposed to study "the economy of nature" i.e. each animal in relation to its inorganic and organic environment, so as to better understand "all those complex interrelations referred to by Darwin as the conditions of the struggle for its existence." (Costanza et al. 1997a) For a while ecology was somewhat narrowly focused on studies of animal populations (e.g. predator-prey equations) but by the middle of the twentieth century it emerged as a discipline in its own right that studied the structure and function of ecosystems, including systems analysis enhanced by computer models of "macroscopic" energy flows and resource projections. (Odum 1971)

Ecology might have followed the abstract path of economics into the trap of misplaced concreteness, but in the aftermath of Silent Spring people began to demand solutions or at least strategies to clean up polluted air and water, stop urban sprawl and preserve what was left of open spaces and endangered species. Ecologists responded by measuring trends globally, which resulted in a 1972 report to the Club of Rome (The Limits to Growth) that predicted shortages of oil and other resources unless population growth slowed or consumption decreased (Meadows 1972). In 1975, British scientist James Lovelock (1995) theorized that the earth itself could be understood as a single self-regulating organism and he found some evidence to support this view in the co-evolution of earth's atmosphere with the plants and animals that inhabit the planet.

Atmospheric science figured in two other discoveries that cast doubt on the earth's ability to absorb the waste products of human activity. First was the tendency of carbon dioxide to trap infrared radiation, causing an increase in global temperatures (the "greenhouse effect"). Second was the reaction between chlorofluorocarbons and ozone in the upper atmosphere. Since ozone functions as a filter for ultraviolet light, the resultant increase in radiation is potentially hazardous to human health. Though still controversial, these discoveries served to alert scientists and the public that certain unanticipated consequences of human activity were global in scope and not readily reversed.

Lovelock's "Gaia Hypothesis" (which he later upgraded to "theory") not only personified public concerns about a deteriorating environment, it also gave scientific plausibility to the idea of biospherical egalitarianism, the ethical notion that people must limit their impact on the environment out of respect for the right of all living things (and ecosystems) to survive. This perspective expanded into a full-blown critique of economic, political and social norms, which was subsequently systematized by Norwegian philosopher Arne Naess who dubbed it deep ecology (Merchant 1992). Its tenets included rejecting the artificial distinction between individual and environment, opposing pollution, and supporting democracy, diversity and decentralization (Naess 1990).

It may seem odd that a branch of evolutionary biology should itself evolve into a school of social criticism that today includes such variations as spiritual ecology, ecopsychology and ecofeminism. But ecology's focus on the interconnectedness of all things earned it the nickname "the subversive science" because its findings, perspectives and principles so often "are used to challenge political, economic, and ethical perspectives in contemporary society." (Botzler1998) From that standpoint it seems only natural that ecology should give rise to an ethic based on holistic values, and that such an ethic would eventually conflict with an economic theory based on individual consumption.

Part 2. House Limits: Environmental Ethics, Ecological Economics

During the last half of the twentieth century, both ethics and economics were challenged to address the problems associated with environmental degradation. Issues ranging from deforestation and crashing fish catches to global warming and ozone depletion demanded a response, and academics and professionals joined activists and politicians in search of solutions. Ecology presents a paradigm for understanding the world based on the unity and interdependence of nature and human society. The fusion of ecological thinking with ethics and economics encouraged both those disciplines to rethink their fundamental principles in line with this new understanding.

Environmental Ethics: Down the River

The term environmental ethics means more than the application of ethical principles to environmental issues. Based on an awareness of the interdependence of life on earth, the term also implies an ethical consideration of all living beings (biospherical egalitarianism), respecting the rights of future generations (intergenerational equity), and accepting responsibility for remote, long-term environmental impacts in a way that tests the limits of our knowledge about the consequences of our actions (the precautionary principle).


Aldo Leopold

In A Sand County Almanac, American forester Aldo Leopold (1887-1948) proposed an environmental ethic (he called it a "land ethic") in the form of a Kantian categorical imperative: A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise. Since Biblical times, people and cultures have valued the environment as an aspect of creation, even allowing certain rights to nature and animals (Rosenblum 2001). But Leopold's formula went beyond primitive laws, and he held that the duty to preserve biotic integrity was ethics in its most evolved form. In this regard he took a Darwinian view of ethics, believing its purpose to be the expansion of human awareness to ever-widening circles of community, eventually including the entire biosphere as "member[s] of a biotic team." (Leopold 1971)

An obligation to preserve biotic integrity entails a number of corollary duties. First and foremost, by acknowledging the rights of other species, biotic integrity prevents us from pursuing our own economic and political goals at the expense of the global ecosystem. This is also spelled out in the principles of deep ecology which state in part, "The well-being and flourishing of human and nonhuman Life on Earth have value in themselves…Humans have no right to reduce this richness and diversity except to satisfy vital needs." (Devall 1985) On a global scale the principle acts as a counterweight to economic pressures that convert rain forests into cattle ranches and mountains into strip mines. Closer to home, it requires familiarity with the neighborhood environment to ensure that development protects the local ecology, even at a higher cost.

Another consequence of biotic integrity is the need to narrow the gap between rich and poor countries, not out of a sense of fairness (however much justified) but to prevent the irreversible destruction of native ecosystems. To meet their financial obligations, cash-strapped countries from Brazil to Malaysia routinely deplete their mineral and biological resources, often under the direction of international agencies. At the same time, "first world" nations—one-fourth of the world's population—consume 70% of the world's energy, 75% of its metals, 85% of its wood and 60% of its food, and the gap is widening (Athanasiou 1998). The ethical necessity of relaxing pressures on the poorer nations while at the same time constraining the consumption of the richer ones is obvious, even in the face of the practical challenges presented by such an endeavor.

While most people understand biotic integrity as a utilitarian principle (e.g. it ensures the survival of our species), others interpret it deontologically, such that it extends rights to the biosphere and its nonhuman inhabitants. This controversial viewpoint is countered by fundamentalists who claim (based on Genesis 1:28) that humans have a prior right to "rule over the fish of the sea, the birds of the sky and all living things." Others contend that the very idea of granting "rights" to nature is fundamentally "unnatural" since "we would not expect any other species to prioritize the needs of others over its own." (Soper 1995) They also argue that, since animals are unable to behave ethically towards us, we have no ethical duty to treat them humanely, though we may do so out of benevolence. In response, animal rights advocates point out that we routinely grant rights to other moral patients (as distinct from moral agents) by virtue of their "inherent value" (Regan 1983). A careful reading of Leopold suggests that his sense of duty was not to any individual animal but to the biotic community collectively. As J. Baird Callicott (1998) explains, "The land ethic not only provides moral considerability for the biotic community per se, but ethical consideration of its individual members is preempted by concern for the preservation of the integrity, stability and beauty of the biotic community. The land ethic, thus, not only has a holistic aspect; it is holistic with a vengeance."

Another moral principle derived from ecology is an expanded scale of responsibility, both in space and in time. "We all live downstream" is a truism in the water industry, but it perfectly describes the expanded scope of environmental ethics. Ecology respects no national boundaries, a point proved whenever Canadian forests are wasted by acid rain from US factories and San Diego beaches are fouled by Mexican sewage. Environmental ethics therefore requires us to evaluate the remote impacts of projects whether or not such studies are legally mandated, and to mitigate those that would cause harm. Since ecosystems persist for hundreds of years, environmental ethics also extends responsibility beyond the present, to future generations. This responsibility is acknowledged in the concept of intergenerational equity, and is referenced in the familiar definition of sustainability (first proposed by the UN Commission on Sustainable Development) as "the use of resources to meet the needs of today's generation without inhibiting the ability of future generations to meet their needs." An ethic of intergenerational equity is particularly challenging because it raises the question of how much effort we should expend on behalf of our descendents. As biologist E. O. Wilson (1984) observed, "We want health, security, freedom, and pleasure for ourselves and our families. For distant generations we wish the same but not at any great personal cost." This tension was illustrated in the divergent reactions to The Limits to Growth (which called for strict conservation), when some critics complained that the report failed to account for future technological advances, while others argued that conservation would deprive future generations of a challenge that might stimulate their technical creativity. A more balanced solution proposed by Rawls involves making intergenerational decisions from behind a "veil of ignorance," as though we did not

know which generation we were born into, thus avoiding excessive savings on the one hand and unsustainable consumption, on the other (Rawls 1971).

A third ethical principle derived from the ecology is the precautionary principle that states "when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically." (Raffensperger 1999) It is distinguished from risk analysis by its bias against assuming risk, even if the probability is small and the cost is low. In a sense, the principle is captured by the question "What if we're wrong?" since it favors the alternative with the least bad consequences ifassumptions turn out to be false. With respect to global warming, it favors development of non-carbon energy sources (solar, wind power) since if climate worries are unfounded these technologies may be unnecessary, but if global warming fears are real and energy alternatives are not in place the impact could be devastating. On a local level, the precautionary principle supports programs to manage dental waste and properly dispose of fluorescent bulbs even when the receiving water's capacity to absorb mercury is not fully known.

This approach is also associated with "the soft path," because it prefers a diverse portfolio of low-impact projects with multiple benefits (including non-structural alternatives) over large, capital-intensive solutions dependent upon a single resource (the "hard path"): recycling wastewater instead of building new dams and reservoirs. Gary Wolff and Peter Gleick (2002) at the Pacific Institute have detailed a "soft" path for water use that includes extensive investment in decentralized facilities, efficient technologies, and human capital. Among "soft" techniques are conservation and reuse and providing water quality and quantity appropriate to the users' needs instead of tapping new supplies. The soft path for water also involves creating institutional policies that promote "equitable access to water, proper application and use of economics, incentives for efficient use, social objectives for water quality and delivery reliability, public participation in decision making, and more."

At bottom, an environmental ethic, expanded by the precautionary principle, acknowledges our duty to protect a global ecosystem that is by nature complex and hard to model with any precision over long periods of time. The underlying attitude is one of humility in the face of an interconnected world that is at the same time "known and unknown, visible and invisible, comprehensible and mysterious." (Berry 1987) Indeed, such an approach points to the very "ecological" nature of ethics itself, which considers events in a comprehensive manner and requires us to take responsibility for the consequences of our actions, even when they occur at second or third hand. (So, for instance, the drug dealer is held liable for overdoses, the arms dealer for terrorist deaths.)

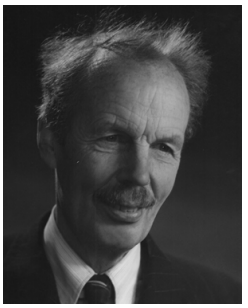
Without rejecting traditional moral obligations, environmental ethics calls attention to the needs of the community of life on earth and the rights of future generations. While there are many valid utilitarian reasons for preserving biodiversity, arguments in support of universal responsibility tend to focus on the rights of species and our duty to the biosphere as a whole. Some, like Leopold, celebrate this expanded responsibility as evidence of our maturation as a species. On the other hand, environmental ethics also adds a level of complexity to our decision making, as we must now balance ecosystem rights against individual and societal rights, including property rights, as well.

Ecological Economics: Full House

Despite their common etymologies, ecology and economics have followed such divergent paths that they are usually thought to oppose one another. As WorldWatch founder Lester Brown (2001) noted, "The gap between economists and ecologists in their perception of

the world as the new century begins could not be wider." While economists see the environment as a subset of the economy, ecologists see the economy as a subset of the environment. Where one sees growth and progress, the other sees decline and depletion. "Economists look at the unprecedented growth of the global economy and of international trade and investment and see a promising future with more of the same… [Ecologists] look ahead and see more intense heat waves, more destructive storms, melting ice caps, and a rising sea level that will shrink the land area even as population continues to grow."

But just as ecology expanded the scope of ethics, it also challenged economics to reconsider the sufficiency of a market driven by self-interest to produce social welfare. For our purposes, we should examine how spatial and temporal externalities are internalized through monetization and the use of discount rates, and explore the limits of the market to absorb externalized costs and benefits. Our treatment will be superficial (as evidenced by the lack of equations) but may suffice to show how the new field of ecological economics deals with these challenges to facilitate the implementation of sustainable water projects.


A. C. Pigou

Externalities are impacts of production and use whose value is not captured by an item's price. They are also called "spillover effects" since effects spill over onto parties who suffer or benefit but do not participate in the transaction. Economist Arthur Pigou (1877-1959) was one of the first to recognize the importance of externalities in the marketplace. Distinguishing between social and private welfare, Pigou (1932) observed that private value differs from social value when "costs are thrown upon people not directly concerned, through, say, uncompensated damage done to surrounding woods by sparks from railway engines." He noted that, "All such effects must be included…in reckoning up the social net product."

For example, when erosion from a clear-cut hillside chokes creeks with silt but the price of lumber fails to include the cost of compensating downstream fishermen, this "externalized" environmental cost is passed on to society as a whole. As a result, logging companies have no incentive to adopt less destructive practices and timber buyers have no incentive to look for substitute materials. In other words, the problem of externalities is that "a market cannot distinguish between a piece of wood harvested sustainably from a forest and one harvested from a clear-cut that has destroyed habitat and future productivity." (Hawken 1993) Unless an appropriate tax is imposed to reflect the value of these lost resources, the market "efficiently" leads buyers and sellers to annihilate the ecosystem, enriching a few but diminishing the quality of life for all.

Positive externalities are less often noted but no less important. "Natural services" provided by the environment as the underpinning of all human economic activity include maintenance of the atmosphere and climate stabilization to soil generation, drinking water and waste assimilation; their economic value has been conservatively estimated in excess of $50 trillion USD per year (Costanza 1997b) As Gretchen Daily and Katherine Ellison observe, "A woman's work is never done—nor fairly compensated—and this is nowhere truer than in the case of Mother Nature. Much of Nature's labor is of enormous and obvious value, which has failed to win respect in the marketplace until recently." (Daily and Ellison 2002) The absence of a market for these externalized services routinely results in their devaluation and ultimately their destruction, since "what is priceless is worthless."

Where laws protect private property, externalities occur in "the commons"—an area or resource owned by the public and maintained by the community. Unfortunately, individuals who follow their self-interest wind up exploiting the commons until it loses its

value: “Freedom in a commons brings ruin to all.” What is true for taking goods out of the commons is just as true when it comes to putting pollution into it: “The rational man finds that his share of the cost of the wastes he discharges into the commons is less than the cost of purifying his wastes before releasing them. Since this is true for everyone, we are locked into a system of “fouling our own nest,” so long as we behave only as independent rational free-enterprisers.” (Hardin 1968)

To correct this problem, Pigou proposed a system of “bounties and taxes” to directly influence the price of goods, thereby allowing the market to recognize the value of positive and negative externalities. Ecological economists now devote considerable effort to determining the value of environmental externalities in order to internalize them in the cost of products. The New South Wales Environmental Protection Authority maintains a database (http://www.epa.nsw.gov.au/envalue/) of such studies “to assist decision makers to incorporate environmental values into cost-benefit analyses...” Among the techniques cataloged are contingent valuation, travel cost method, preventive expenditure, dose/response approach, replacement/repair cost and hedonic pricing, to name a few.

Water projects generate both positive and negative externalities. A study by the Australian research organization CSIRO (Young 2000) identified many negative effects of the urban water system, such as disruption of storage site ecology and reduced downstream flows (water supply); reduced availability of water for agriculture (water use); reduced use of receiving water for bathing, surfing, etc. and disruption of discharge ecology (wastewater treatment). Sustainable water projects have positive externalities to the extent that they avoid these negatives, as when implementation of a water reuse project eliminates withdrawals from a local river, preserving the downstream ecosystem. As discussed in Part 3, failure to account for positive externalities has been noted as a factor inhibiting the development of water reuse projects (Sheikh 1998), while including their value can make an environmentally beneficial project cost effective (Rosenblum 2004).

The impact on future generations is another type of externality which has proved even harder to capture in the marketplace. Not only is it difficult to estimate, but its economic importance is minimized by net present value calculations that rate its future worth against the lost opportunity of investing equivalent funds at interest. When environmental projects take decades to complete (e.g. wetland restoration), traditional discounting has the effect of discouraging their construction altogether. Thus at an annual interest rate of 10% a 25-year $100 million marsh restoration project would have to generate benefits of over $1 billion to merit construction. Economists have devised a variety of techniques to compensate for this devaluation, including a sliding scale that goes to zero for periods beyond 300 years (Bazelon and Smetters 2001) and the use of negative discount rates to signal a community’s commitment to invest in the future prosperity of its children (Hammer 2002). The problem is complicated, though, because lowering the discount rate to reflect a higher long-term value may have the countervailing effect of encouraging investment in infrastructure projects that deplete resources (Swanson 1995). So researchers continue their search for an optimum discount rate that encourages savings and protects resources, furthering the work of pioneers like Ramsey and Hotelling despite Ramsey’s own view that discounting is “ethically indefensible.” (Endress and Roumasset 2005)

As much as any environmental issue, intergenerational equity challenges our underlying assumptions about the market’s ability to produce social welfare without the aid of externally imposed regulations. To some extent the problem results from the impossibility of knowing the future worth of natural resources to a society that might be quite different than our own. As Daly and Cobb (1994) observe, “Discounted present value…does not reflect the welfare of future people themselves, or even our estimate of their welfare.

Rather it reflects how much we care about future people compared with ourselves." But on a deeper level, it might be that the difficulty we have calculating the future value of intact ecosystems is the same one we face accounting for their worth in our own time. If so, our efforts to educate the market through the use of Pigouvian taxes and modified discount rates may only mask a deeper incongruity between the market and the environment. This is, in fact, the stance adopted by ecological economists who argue that our dependence on nature cannot be adequately expressed in a cost-benefit analysis, and that a market designed to promote individual satisfaction cannot be sufficiently "well-educated" to prevent the exploitation and destruction of irreplaceable ecosystems.

Two related examples illustrate the fundamental incompatibility between market-based economics and sustainable development. First, the market leads to species extinction when conventional economic valuation confuses physically limited resources with their value in money, which can increase infinitely through compound interest. So for instance when the increase of certain slow-growing resources (e.g. hardwood trees) falls below the prevailing interest rate, the logic of the market urges the owner to harvest them and invest the proceeds. Raising the price of hardwood through taxes might depress demand but it will only increase the seller's motivation to "unload" his resource so he can invest in more profitable goods or save his money at interest. "It is difficult to see how Pigouvian taxes could correct this anomaly since it arises not from market imperfections, but from the proper functioning of markets within the logic of present-value maximization." (Daly 1994) For that matter, Pigou (1932) anticipated the need for additional "authoritative control," when he noted that "It is as idle to expect a well-planned town to result from the independent activities of isolated speculators as it would be to expect a satisfactory picture to result if each separate square inch were painted by an independent artist."

A related concern is the inability of the market to recognize the ecological value of biodiversity. Economists who wrestled with this issue at a recent Cambridge conference admitted that "current evidence indicates that the financial values of genetic resources could be quite low…thus limiting the potential of a property rights system to provide substantial conservation and protection incentives." (Sedjo and Simpson 1995) While holding out hope that educated consumers might yet prefer "salamanders over cars," Roughgarden (1995) conceded that the "imperatives of moral reasoning are not the same as the costs, benefits and axioms of economics… Therefore, it is necessary to reassert the moral objective of stewardship." Taking a more radical approach, Daly and Cobb (1994) conclude, "When vital issues (e.g. the capacity of the earth to support life) have to be classed as externalities, it is time to restructure basic concepts and start with a different set of abstractions that can embrace what was previously external."

What would these restructured concepts look like? Ecological economists like Costanza (1997a) begin by observing that a system that encourages substitution of natural capital for labor is decidedly at odds with a world where 6 billion people utilize 40% of all land-based photosynthesis, and twice that number forty years hence will need virtually all of the planet's vegetative energy, leaving no room for anything but farms. Since natural capital—not labor—is now the limiting resource, they suggest replacing the "empty" world labor theory of value with a theory designed to preserve natural capital: "In this new full-world era investment must shift from human-made capital accumulation toward natural capital preservation and restoration. Also, technology should be aimed at increasing the productivity of natural capital more than human-made capital. If these two things do not happen then we will be behaving uneconomically, in the most orthodox sense of the word."

To some extent, this is only the latest round in the 19th century argument between classical and institutional economists. Those who want the market to allocate goods

based on “full-cost” pricing contend that this approach provides more personal freedom than regulation, and an “educated” market is the only path to sustainability “because no other institution in the modern world is powerful enough to foster the necessary changes.” (Hawken 1993) Institutionalists counter that even if we could resolve the immense technical difficulties, the same business interests that benefited from the exclusion of externalities would minimize their inclusion through taxes or fees today (Wolff 1997). It remains for us to consider which market methods and what types of rules can best develop sustainable water systems.

Part 3. Playing For Keeps: Towards Sustainable Water Use

What guidance do ecological economics and environmental ethics offer to the water engineer who is neither an economist nor an ethical philosopher? While their circumstances vary, utility managers all over the world face a similar challenge: to provide abundant, high-quality, low-priced water without spoiling the environment. As they struggle to meet this ambitious goal, they are frequently torn between Chambers of Commerce representing the interest of local businesses, and environmental organizations advocating the less vocal but equally pressing needs of the nonhuman and unborn.

This final section examines how techniques and principles of ecological economics and environmental ethics can be applied to facilitate the development of sustainable water use programs. In particular, it considers the implementation of water recycling projects through the use of various types of environmental valuation in support of value-focused multi-criteria participatory decision-making. In addition, some suggestions are offered concerning the need for water resource managers to communicate both their technical opinions and professional judgments to policymakers and the general public.

The Economics of Water Reuse: Everybody Antes

As noted earlier, Aristotle recognized the existence of two types of economics (Politics 1258a): one concerned with the art of managing a household and the other with “the art of acquisition which is commonly and rightly called an art of wealth-getting, and has in fact suggested the notion that riches and property have no limit.“ Daly and Cobb (1994) invoked this Aristotelian distinction to differentiate the proper practice of an economics that respects society and the environment from its acquisitive, anti-social twin. Ecological economics, they claim, can be distinguished by three characteristics: 1) a long-run rather than a short-run view; 2) consideration of costs and benefits to the whole community (i.e. no externalities); and 3) focus on concrete use value rather than abstract exchange value.

Managers responsible for providing water and wastewater services are reminded of the pitfalls of “nonecological” economics every time they try to justify sustainable projects with highly externalized “least cost” economic models. A statewide California task force of 40 public, private and non-profit representatives recently conculded, “Not accounting for non-market impacts of recycled water projects can be an impediment to analyzing the feasibility of the projects.” As a result, they recommended that a group convene to estimate non-market benefits and costs and to develop a “consistent economic feasibility analysis framework” to support the appropriate evaluation of reuse projects. They also warned against confusing economic analysis of project benefits with financial analysis of project funding (Recycled Water Task Force 2002).

Recent studies have identified three types of commonly ignored benefits from water reuse: water supply reliability, environmental enhancement and avoided costs (Sheikh 1998, Young 2000). Improvements in reliability result from abundant, locally controlled

wastewater supplies, as well as from increased availability of traditional sources. Reduced withdrawal from surface and ground water, and reduced discharge of treated effluent into receiving waters all enhance the environment. Avoided costs not captured by conventional analyses include reduced energy costs, fertilizer displaced by nutrient in the water, and deferred costs of constructing new water supply and wastewater treatment facilities. Benefits can also include better public health as a result of wastewater treatment and an improved business climate due to more secure water supplies.

A review of current economic models used to evaluate recycled water projects in the United States indicates that a growing number of managers attempt to monetize externalities, using both revealed preference and stated preference methods (Raucher and Rice 2004). Among the first type are hedonic value and travel cost, while the second type includes contingent valuation based on personal preference and "willingness to pay," such as the survey of nearly 4,000 California residents performed by the California Urban Water Agencies (CUWA) to estimate the value of water supply reliability (Barakat and Chamberlin 1994). CUWA also sponsored development of a spreadsheet model for performing economic feasibility analyses of water reuse projects (Atwater et al. 1998). The City of San Jose (California) recently compared water conservation, water recycling and other flow reduction alternatives by monetizing a range of benefits that included effluent reduction, pollutant reduction, water supply reliability, infrastructure savings, environmental enhancement (including recreation) and public education (Rosenblum 2004). This method allowed reviewers to screen projects whose benefit-to-cost ratio was greater than one and to identify "external" beneficiaries to whom costs might be assigned.

Water reuse projects face an additional hurdle when the cost of the water they produce is compared to the current price of water. In this case the problem is not that benefits are externalized; on the contrary, it is that the costs of existing supplies are not fully accounted. According to Raucher, customers do not usually pay for the cost of water as a resource since "the natural asset (i.e. raw source water) often is obtained for free." Furthermore, "most water rates are based on average costs rather than costs at the margin," so customers pay "blended" rates that average costs over the life of many projects. A recent attempt at "full cost accounting" in Canada estimated that uncounted value provided by water and wastewater services could amount to more than 50% of the current water rates (Renzetti and Kushner 2004). By comparison, the cost of recycled water purchased from a treatment facility with new infrastructure amortized entirely in the future inevitably exceeds the current cost of water—often several times over. The only remedy is for managers to reassess the value of water to the community based on future productivity or willingness to pay (Raucher 2005). This conclusion was also reached by MacDonald (2004) in a recent CSIRO report on the use of pricing mechanisms to encourage water reuse. She recommends the use of full-cost pricing and cautions that, "the externality charges need to be implemented across potable water, reuse water and sewage. Excluding any one of these from the framework will create a distortion in interconnected markets… Only by pricing to account for the full costs will investment address financial and environmental objectives."

By using the techniques of ecological economics, and by continuing to press for new and better ways to incorporate externalities and recognize resource values, managers will be able to justify environmentally sound projects like water conservation and reuse to elected officials and other decision makers. A clearer picture of use values and environmental costs is necessary to balance the allocation of water between water users and the environment as required by progressive environmental legislation like the 1997 New South Wales Water Reform Package (Anderson 2001). It is also needed to allow managers to

communicate the value of sustainable water use practices to developers and others in the private sector who must accommodate local and state regulations in their project designs. The earlier such designs are included in the projects the more likely they will accomplish environmental goals as evidenced the successful use of "Water Sensitive Urban Design" standards in many Australian cities (Coombes 2000). Finally, water professionals can gain a further advantage by taking a holistic "environmental" view of their own projects to see how their benefits might be increased, for example by reaching beyond jurisdictional boundaries to include new funding partners.

The Ethics of Water Reuse: Straight Flush

Notwithstanding the environmental benefits of "whole cost" accounting, utility managers must use contingent valuation and other stated preference methods with care—not because (as some assert) they are inaccurate, but because in certain cases they are irrelevant. Like mainstream economic theory itself, contingent valuation rests on the untested assumption that any choice can be rendered equivocal by a dollar amount which a respondent is either willing to pay (for a gain), or willing to accept (for a loss). While this is often true, there are times when a sizable minority of individuals will view the choice not as a "preference" but as an ethical matter, which no amount of money can compensate. As Sagoff (1993) explains, "Recent studies using 'contingent valuation methodology' suggest that a majority of Americans, indeed, would prefer injunctive relief against polluters to receiving cash compensation in any amount." So the US Endangered Species Act (ESA) protects endangered species "even if it is inefficient to do so." In a more extreme example, the U'wa people in Colombia threatened mass suicide rather than allow Occidental Petroleum to drill for oil on their tribal lands, i.e. the only price they were "willing to accept" was infinite (Barnum 1998).

Economist Michael Jacobs (1997) emphasized this point when he distinguished environmental externalities from other types by noting that choices about public goods are essentially ethical: "Causing negative [environmental] externalities may be represented not simply as being a matter of interest to others, but…wrong." For his part, Jacobs recommends replacing cost-benefit analysis with direct deliberation by the affected parties. Others suggest "triple bottom line" accounting, multiple criteria analysis, life cycle analysis and similar methods that allow a fuller non-monetized expression of environmental values in a participatory decision making process (Elkington 1998, Environment Australia 2003, Marks 2004, Robinson 2003, Rosenblum et al. 2001). While the term "value" in this context is used in the economic sense, the elaboration of ethical values can also help "frame" water reuse projects in a way that allows the public to identify with their objectives, e.g. environmental stewardship (Haddad 2004).

Although agencies contemplating water recycling usually understand the need to involve their communities, they do not always focus on the ethical dimensions of sustainable water use. More often their communication is limited to explaining the safety of treatment methods or the cost-effectiveness of recycled supplies (Wegner-Gwidt 1998). But as San Francisco Public Utilities Commission manager Cheryl Davis observed "While the industry still exhibits some longing for an earlier time when a methodical technical approach simplified both discussion and analysis, this narrow focus has proved untenable for the issues facing our time." (Davis 2001)

The importance of finding common ethical values was also demonstrated by a recent WateReuse Foundation study of six indirect potable reuse projects, half of which were implemented while the other half failed due to a lack of popular support (Resource Trends 2004). The purpose of the study was "to understand the key ideas of value related to the

project, how communication of the project was managed, and how key people involved in the project perceived the benefits and risks." Of the 25 best practices identified as critical to project success, the need to "communicate and collaborate about value" was cited by the study as "the master best practice [to] develop support for the project through communicating and collaborating with key audiences." Other important techniques included a clear articulation of the problem and alternative solutions and enumeration of all benefits associated with the project.

The aforementioned 2002 California Recycled Water Task Force (RWTF) reached a similar conclusion, recommending a number of actions to involve the public in order to "make project decisions that respect and incorporate the community's values and concerns (considering public health, growth, coordination with local planning, environmental justice issues, etc.)." As the task force members explained in their final report, "Determining what a community values, then making decisions based on that information is the foundation of a community value-based decision-making model. This model encourages participants to recognize that most people believe in a unified set of fundamental values, then takes them further, into the realization that these values can be the basis for consistent and improved decision making." (RWTF 2003)

A graphical representation of the priority of ethical considerations in motivating stakeholders is shown in Figure 1 (Rosenblum and Anderson 2004). The direction of influence is primarily from the top down, suggesting that if a project incorporates the ethical values of the community (and if those values are sufficiently well known), then political support will ensure the allocation of sufficient economic resources to obtain technical solutions to build the project. On the other hand, if the project is out of step with public values, it is unlikely that it will achieve political support even if it addresses an environmental need in a technically feasible and economically sound manner. Influence does occur from the "bottom up," as when a critical environmental condition (e.g. a drought) motivates policymakers to overcome economic and technical challenges to reuse water. However, upward influence is essentially a process of translation whereby the consequence of an environmental, technical or economic event is expressed in terms of public values and hence in terms of political action.

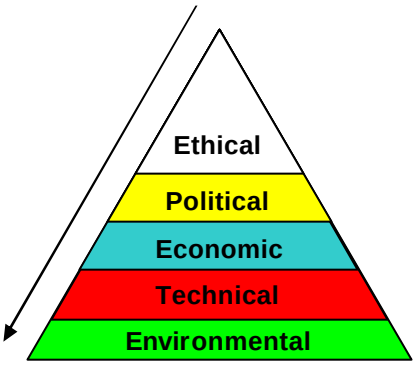


Figure 1. Decision Factors Influencing Implementation of Reuse Projects (after Kasower)

The hierarchical relationship of these factors was recently demonstrated when three northern California cities, four water retailers, five sanitary districts and a regional wholesale water supplier all collaborated to construct a 60 MLD water recycling project (Rosenblum 1999). Water reuse projects had been proposed earlier, but with an ample source of subsidized water and an unlimited discharge, neither the water nor the wastewater agency had sufficient political or economic motivation to implement them. This situation changed dramatically in 1989, however, when regulators proposed to limit wastewater treatment plant flows to protect two endangered species. Using the hierarchical model as a guide, the ethic of biotic integrity (codified in the form of the US Endangered Species Act) translated an environmental issue (degradation of the Bay ecosystem) into a political issue (the Board regulation) which in turn revalued the economics of reuse (through fines, etc.). The process was also iterative: before it would

agree to participate, a water agency that did not profit from the project had to be reminded of the benefit it received due to its political obligation to provide water for the community,

Sometimes water reclamation raises competing ethical issues, as when local agencies squared off recently over concerns about the potential of recycled water to degrade ground water supplies. While recycled water producers pointed out that water reuse protects upstream ecosystems, potable water agencies invoked the precautionary principle over concern for emerging contaminants (e.g. NDMA) whose effect on human health at even low concentrations is not fully known. For several years these agencies have debated how best to protect both the environment through reuse while minimizing if not eliminating the risk from pollutants of unknown toxicity (Saunders 2001). Eventually they turned to the California State Water Resources Control Board for standards and requirements that could facilitate reuse without jeopardizing the quality of ground water supplies (Larson 2005). The matter has yet to be resolved.

A more comprehensive picture of the relationship between these factors is provided by Norgaard (Figure 2), showing how natural and social systems influence each other. "Deliberate innovations, chance discoveries, and random changes occur in each subsystem which affect through natural selection the distribution and qualities of components in each of the other subsystems… With each subsystem putting selective pressure on each of the others, they co-evolve in a manner whereby each reflects the other." (Costanza et al. 1997a) In terms of the present inquiry, we can understand organization to include both economic and political systems, which respond to changes in environment, technology, etc. As in Figure 1, ethical judgments (represented here by the term values) play a pivotal role in the process, presenting the water resource professional with a unique opportunity to identify the benefits of sustainable water projects in terms of both environmental ethics and ecological economics.

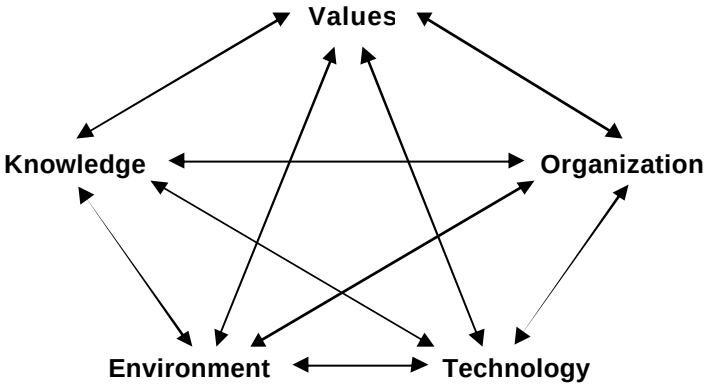


Figure 2. The Co-Evoloutionary Development Process (after Norgaard in Costanza et al. 1997a)

The primacy of ethical considerations described in the diagrams above is not in the least refuted by the importance commonly assigned to economic feasibility tests in deciding which projects to adopt. On the contrary, it only shows how difficult it is to acknowledge values and to take responsibility for decisions without referring to some external system. The explanation that some environmentally beneficial project is "not economically feasible" merely masks but does not excuse the fact that the decision maker, for whatever reason, does not value the environment as highly as some other opportunity available at the same cost. Here again we see the appropriateness of the original status of ethics and economics as branches of moral philosophy, for no matter how elegantly we analyze them, economic choices are like all other choices in that through them we reveal our values and our ideals about our rights and our responsibility to others.

There are many reasons, both individual and cultural, why managers might choose to pretend that their ethical choices are only the "value-free" results of economic computations. Some might wish to hide behind the illusion of objectivity to escape the

blame for decisions they know to be morally wrong. More commonly, managers trained in the language of business use it to sound professional, justifying decisions on net benefit that might be better described in terms of intergenerational equity or other non-economic factors. The roots of this preference for mathematical explanation may go even deeper—back to Descartes' coordinate geometry and Bacon's scientific method that promised to make all things knowable. In that case, it is time for economics "to regard itself as a discipline much more closely allied with the imprecise knowledge of political, psychological, and anthropological insights than with the precise scientific knowledge of the physical sciences" so that it may once again "play a useful role as explicator of the human prospect." (Heilbroner and Milberg 1995)

This is not to say that cost-benefit analyses and similar tools are not useful, only that they should augment and not replace group decisions based on shared values. To that end, a number of guidelines have been proposed to help stakeholder groups recognize the value of sustainability. Daly and Cobb (1994) offered three principles for resource use: 1) the rate of harvest should not exceed the rate of regeneration (sustainable yield); 2) the rate of waste generation should not exceed the environment's assimilative capacity; and 3) the depletion of non-renewable resources (where permitted) should correspond to equivalent development of renewable resources. The Natural Step (Hawken 1995) has four tests:

Does the project decrease dependence on non-renewable metals, fuels or minerals?

Does it avoid the production of new and persistent substances?

Does it increase biodiversity?

Does it use relatively fewer natural resources to create human value?

A "no" suggests that environmental costs will be passed on to future generations. Like the Ten Commandments, the Eightfold Path and other ethical templates these guidelines are not intended to automate our decisions, only to focus our attention on our essential duties.

Conclusion: Cards on the Table

When Rachel Carson spread the word about pesticides on behalf of future generations, she woke the world's conscience and gave birth to a movement. As water professionals, the resources we manage are no less critical to the future of the global community and we are therefore no less obliged to contribute our ethics as well as our expertise to the decision process. Nor is this obligation to speak up for sustainability fulfilled just because a suitable project fails our economic tests; as we have seen, the problem may be inherent in our tests, not our projects. As Carson herself noted, we are living in an era "in which the right to make a dollar at whatever cost is seldom challenged."

It has been said that our generation is the first to know the extent of our environmental problems, and the last to be able to do anything about them. In that case, we may well have entered what will become known as "the ethical century," not because we are more moral than our forebears, but because to a greater degree we will now be held accountable, both to our descendents and to the other members of our "biotic team." If, as Hawken claims, only the market is powerful enough to protect the environment, we may find that only the force of ethical argument is powerful enough to turn the market in the direction of sustainability.

In one striking passage in Wealth of Nations, Adam Smith warned against allowing the business community too much influence over public policy. He explained that those who live by profit (whom he called dealers) "have generally an interest to deceive and even to oppress the public" and he cautioned that "any new law or regulation of commerce which comes from this order…ought never to be adopted till after having been long and carefully examined…with the most suspicious attention." Two hundred years later, we find economics sitting squarely in the dealer's lap where along with labor and capital the invisible hand holds a damaged planet with shrinking glaciers, spreading deserts and a hole in the ozone the size of North America. The stakes are high: we are gambling with the rent. We have the technical skills to live in equilibrium with our environment, but do we have the ethical courage to overcome the fiscal and political obstacles? It is late in the game, but if we play by House Rules—ecological as well as economic—we can still beat the odds and create a sustainable society for ourselves and future generations

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