The challenge of environmental justice

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Questions regarding the relationship between ecology and environmental justice (EJ) with respect to environmental issues have arisen amid discussions of the larger roles of ecology and ecologists in society. Both of us are engaged in research and teaching in urban communities – one at a predominantly minority university, and the other near one of the more severely environmentally impacted minority communities in the US. For us, the relationships between ecology, environmental issues, and EJ have very real applications. Our perception is that this is not the case for most ecologists. In fact, the paucity of ecologists involved in EJ contrasts greatly with the prominent roles they have played in other environmental areas.

In this introduction, we will briefly outline the historical disconnect between ecology and environmental justice as a manifestation of the larger disconnect between the majority culture of resource owner–consumers and minority groups who have been excluded from the decision-making processes affecting their environment. We then discuss what ecologists can and should do to remedy the situation.

The environmental movement first emerged in the late 19th century, as a result of debates over the best use of federal lands in the American West, and focused on the often conflicting goals of preservation and conservation. Wilderness protection is frequently viewed as biocentric and elitist, while conservation is seen as natural resource management for anthropocentric, commercial, and utilitarian purposes. Elements of both approaches dominate both ecological literature and training, and have influenced the development of professional ecological organizations and the careers of many prominent ecologists.

During the same period, another environmental approach emerged, which emphasized the mitigation of toxicological health burdens in the largely urban workplace (Hamilton 1924). In the 1980s, this approach was transformed by civil rights advocates to focus on the disproportionate levels of environmental exposures being suffered by people of color and of low socioeconomic class (United Church of Christ 1987). From these efforts the environmental justice movement was born, and defined itself as seeking "the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (Bullard 1990). Despite the lack of success in mobilizing support from the predominately white, mainstream protection- and conservation-oriented environmental groups (Gottlieb 1993), EJ efforts resulted in the People of Color Summit in 1992, the establishment of the EPA's Office of Environmental Equity (now Environmental Justice) that same year, and Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations", issued by President Clinton in 1994.

In general, ecologists have not been a part of the EJ movement (see Foreman 1998). Throughout most of the 20th century, few ecologists and mainstream environmentalists have been involved in researching and addressing ecological and environmental impacts on humans in urban areas. This contrasts strongly with their successful involvement in both preservation and conservation. Many of the approaches used in areas such as conservation management, restoration ecology, and environmental remediation are directly attributable to fundamental ecological research. Every mainstream environmental organization of which we are aware has a staff of trained ecologists. Indeed, one of the most successful environmental organizations, The Nature Conservancy, traces its origins directly to the Ecological Society of America's establishment of the Committee on the Preservation of Natural Conditions for Ecological Study in 1917 (McIntosh 1985).

Defining and resolving disproportionate impacts has largely fallen on sociological and legal examinations of human communities adjacent to hazardous waste landfills, on the medical assessment of toxic burdens, and on engineering for remediation. Basic ecological research has been underutilized in setting these issues into a larger environmental context. And, with few noticeable exceptions (see for example Southwick 1996), ecologists, by not incorporating either humans or EJ, have not worked towards the development of strategies to educate "astute decision-makers, inquisitive students, and concerned citizens" (a key priority in the National Science Foundation's 2002 draft, *A 10-year Agenda for Environmental Research and Education at NSF)*.

The concept of human impact on ecosystems is now well recognized (Rees 1995) and, in recent years, ecologists have acknowledged (even if only implicitly) their role in providing information critical to the development, implementation, and enforcement of fair and just policies. There have been a number of recent ecological studies, for instance on urban ecosystems (Grimm *et al.* 2000) and on human effects on ecosystem management (Carpenter and Gunderson 2001), as well as the inclusion, in 1997, of two urban sites (Baltimore and

Phoenix) in the LTER program, which had previously focused solely on remote regions. Clearly, ecologists have recognized that fulfilling societal needs for ecological knowledge and understanding does not undermine public perceptions of scientific value, neutrality, or objectivity.

Ecologists can contribute to environmental justice in two ways. First, ecological research should specifically target human environmental sustainability – particularly in the design of environmentally sound urban ecosystems. Second, a society-wide increase in ecological education is desperately needed to (a) enhance the understanding of urban ecosystem structure and function, (b) foster the cognitive and critical thinking skills involved in systems thinking, particularly as applied to understanding human social ecological design and policy development, and (c) promote basic scientific literacy, especially regarding the roles of evidence, experimentation, and uncertainty in scientific conclusions. For this second goal in particular, ecologists need to be involved in the development of K–16 benchmark performance measures.

Clearly, much more remains to be done. Ecologists need to develop a more inclusive ecology, incorporating all the human dimensions needed for the implementation of management, remediation, and socio-ecological restoration programs, including the problems that result in EJ. Dealing with these issues provides an important opportunity to expand our discipline by including the diversity of human social and cultural resources needed to improve the human condition. To do any less would be to continue to isolate ourselves – not only from many of the causes of environmental problems, but also from responsibly participating in the solutions.

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Government resource agencies conduct Natural Resource Damage Assessments (NRDA) to identify and quantify losses of natural resources caused by oil spills, chemical discharges, and other anthropogenic impacts. The ultimate purpose of an NRDA is restoration of the harmed resource, with the polluter paying for both the NRDA and the restoration. Environmental justice is an important issue if the affected resources are used by the public and the impacts are disproportionately severe for certain groups of people because of their socioeconomic status or ethnicity. Ecological studies are a critical part of most NRDAs, measuring resource losses and designing restoration projects, and ecologists can contribute to environmental justice by doing sound science – science based on principles, verified facts, and valid logic.

An NRDA is generally conducted by a committee consisting of natural resource attorneys, natural resource managers, economists, ecologists, and other scientists. The committee decides what NRDA work needs to be done, what losses have occurred, and what projects will provide adequate restoration.

Problems can arise when the committee makes decisions based on opinions from people they regard as "experts" or "authorities", without requiring objective scientific evidence to back up those opinions. The resultant decisions may be flawed due to cultural biases, misconceptions, research agendas, and dogma. Although all the members of the NRDA committee share accountability for decisions, it is the ecologists' responsibility to ensure that ecological decisions are based on valid, unbiased, objective science that will not jeopardize environmental justice.

Another common flaw in the NRDA process occurs when ecological studies are performed, but the ecologists do not formulate and test hypotheses, do not use appropriate designs for sampling and experiments, and do not use valid statistics. Nothing is more basic to science than the scientific method, but many ecologists do not rigorously test their hypotheses, consider alternatives, or welcome the testing of their ideas by others. Instead, they defend favored hypotheses – the antithesis to good scientific method.

Many large NRDAs are conducted under actual or potential litigation, and a 1993 decision of the United States Supreme Court is scientifically and legally relevant for ecological investigations in NRDAs. In *Daubert v Merrell Dow Pharmaceuticals, Inc*, 509 US 579 (1993), the court held that an expert's credentials were not sufficient to validate his or her opinions, and that scientific evidence must be validated by the scientific method, ie that the science in question "can be (and has been) tested".

Another case, *United States and State of Calif v Montrose Chemical Corp, et al.*, CV 90-3122-R (CD Cal Mar 15 2001), illustrates how sound science can achieve environmental justice. It was the second largest NRDA case in US

history after the *Exxon Valdez*, and it took 10 years of intense litigation before the last of many defendants settled in October 2000. Between 1947 and 1971, the defendants discharged hundreds of tons of DDTs and PCBs into the ocean near Los Angeles. Popular subsistence and recreational fish continue to be contaminated with high levels of DDTs and the PCBs, and the state of California has had to close a fishery, impose a catch limit, and issue health advisories to avoid or limit the consumption of these fish, most of which are being caught by anglers from lower socioeconomic groups and ethnic minorities.

An example of cultural bias was seen when a fisheries manager claimed that no one ate white croaker, one of the most contaminated fish species. He based this opinion on the fact that no one he knew ate this fish. Similar arguments were made by experts working for the defendants. However, these opinions were rejected when field studies and analysis of fisheries statistics showed that shore-based anglers in the highly contaminated area depended on white croaker for much of their catch, and that it was highly valued by certain ethnic groups. The fisheries manager and experts for the defendants were white, while 85% of the anglers in the contaminated area were not.

The scientific method was also an issue in the Montrose trial. An expert hired by the defendants testified that the DDTs in question did not come from the defendants' plant; however, he mainly supported his claim with a list of his credentials, not the soundness of his science. He had not used the scientific method, had not developed alternative hypotheses or tested his assertions, and had ignored evidence that contradicted his theories. Consequently, the judge disqualified his testimony and his designation as an expert. In contrast, an expert hired by the government presented evidence that the DDTs in the contaminated fish came from deposits already traced to the defendants' plant. His evidence was based on the ecology of the fish, including diet, quantified ecological energetics, and other aspects of food-web dynamics. He tested his results in multiple ways and his testimony survived multiple challenges during depositions and the trial.

Monies from the settlements are now paying for the restoration of natural resources harmed by the DDTs and PCBs, including projects to address the problem of contaminated fish being caught by subsistence and recreational anglers. Without these funds, restoration could not take place, and environmental injustice would not be redressed. In turn, the settlements could not have been obtained without sound science to back the claim.

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The private sector and advocates for environmental issues often find themselves at odds over economic development and the protection of ecosystems. Society wants both economic growth and the jobs it creates, but also healthy ecosystems and the services they provide, so reconciling these two often conflicting aims is imperative. It will require changes in attitudes and approaches by both the private sector and the environmental interest groups, and the scientific community will need to provide data and analytical methodologies so that rational choices can be made when we are faced with development and environmental options.

Traditionally, the relationship between the private sector and advocates for the environment has been one of conflict. There are many reasons for this, from the influence of the private sector on public decision making to the tendency of some environmental groups to see the world as a "zero-sum" game, where a victory for the private sector constitutes a defeat for the environment. Whatever the root causes, the results are usually the same – distrust and the creation of a polemic, leading to lost opportunities for constructive dialogue and a decreased ability to negotiate outcomes that provide society with the economic growth and ecological services it needs.

To improve this relationship there must be changes in attitudes and a new approach to economic growth and environmental sustainability. The private sector needs to incorporate environmental concerns into business decisions and to commit to transparency; communities and representatives of civil society, such as non-governmental organizations, should also be proactively included in business decisions. Such commitments by the private sector need not only be altruistically motivated. Improved corporate reputation and avoidance of project delays, litigation, and potential environmental liabilities can all improve the long-term profitability of a company.

At the same time, groups concerned with environmental issues need to acknowledge that the private sector is, and will remain, essential for economic growth and job creation, and that trade-offs with the environment will often be part of the equation when determining development outcomes. If a trade-off is seen as too large to justify, despite the economic benefits it would bring, then environmental groups should voice their concerns. If those concerns are not adequately addressed, opposition to a proposed project is a legitimate course of action. However, opposition to industrial activities, regardless of their actual environmental impacts, may result in lost opportunities for job creation and local prosperity, particularly in areas with limited prospects for development.

Governments play a crucial role in this process at both the local and national levels, as they have final approval and regulatory oversight of private sector activities. To successfully fulfill this role, they must promote a transparent process that includes both private sector and environmental concerns, and try to arrive at consensus-based solutions.

Admittedly, reaching a consensus is often a difficult and convoluted process. Competing agendas and priorities will inevitably lead to disagreement, conflict, and perhaps a

breakdown in dialogue. Although there is no single remedy for these potential pitfalls, the scientific community, particularly ecologists, can play a crucial role by providing and interpreting data on ecological processes and the potential impacts, both positive and negative, that industrial activity can have. These data will form a more objective basis upon which to establish a dialogue, make final decisions regarding industrial activity and its impacts, and predict what the social and economic consequences may be.

Analysis of a proposed project should reveal both direct and induced ecological impacts, focusing on potential changes at both site, local, and regional levels. The wide availability of geographic information systems (GIS) allows multiple layers of ecological, as well as industrial and social data to be analyzed. By overlaying the various GIS data layers, cumulative impacts can be predicted, thereby allowing more inclusive strategies for avoidance, mitigation, restoration, and compensation to be developed. Data and analytical methods can, of course, be manipulated and interpreted subjectively by specific interest groups, so it is important that consensus should be reached on data sources and analytical methodologies prior to analysis of a proposed project's impacts.

Establishing constructive dialogue between private and environmental interests is by no means an easy task, and truly effective processes and mechanisms for consensus-based decision making are still more an aspiration than a reality. Changing this situation will require both sides to recognize that each represents socially desirable values, and to commit to a transparent and participatory dialogue to resolve differences. The scientific community, especially ecologists, can help promote this change by providing the data and analysis needed to make constructive and balanced decisions. Only then will economic growth *and* healthy ecosystems be possible.

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Middendorf and Grant have provided compelling arguments for the involvement of ecologists and ecological research in EJ issues, and for the role that ecologists can play in these issues in cities. My experience as a wildlife ecologist working primarily in inner cities suggests that ecologists should look at their involvement not just in terms of peoples' exposure to environmental risks, but from the perspective of understanding the ecology of people's day-to-day environment, namely the area within a one-mile radius of their home. In cities, this environment consists of houses, streets, parks, vacant lots, creeks, and remnant natural areas. These should not just be seen in terms of exposure to contaminants, but as places where people live, go to school, relax, and come into contact with nature and environmental amenities (Floyd and Johnson 2002; Outley and Floyd 2002). To conduct relevant research there, ecologists must develop true collaborations with low-income communities and people of color.

Some ecologists have made brief connections with these communities. JT Emlen, working for the vertebrate ecology division of the Johns Hopkins University School of Public Health during the 1940s, published papers about Norway rats in Baltimore neighborhoods (Emlen *et al.* 1949). However, there is no evidence in this paper of any interaction with the residents of the rat-infested neighborhoods.

The Baltimore and Phoenix long-term ecological research projects are exemplary models of current research on urban ecosystems. However, as with earlier work by ecologists in Baltimore, they may not be the best models for how to do research to address the needs of people in poor urban environments. One of the central questions for the Baltimore Ecosystem Study is, "How do ecological, physical, and socioeconomic factors affect ecosystem function in the metropolis?", but this is not the primary question that local residents ask about environmental conditions in their neighborhood. EJ researchers working in communities of color stress the importance of a collaborative and participatory approach, involving community members and leaders in each phase of a study, including the identification of research questions, study design, data collection and interpretation, and implementation of results (Shepard *et al.* 2002). McAvoy *et al.* (2000) recognized the importance of allowing researchers to "experience reality as residents do", and recommended that researchers should incorporate the oral tradition found in many African American communities into their work.

Some of the best examples of work linking the ecology of urban environments and EJ have been done without the involvement of ecologists. Brett Williams (2001), an anthropologist, used an oral history of an African American yacht club, and interviews with numerous local residents, in her study of EJ issues on the Anacostia River. Coburn (2002) worked with residents of the Greenpoint/Williamsburg neighborhood of Brooklyn, NY to collect fish samples, conduct angler surveys, and interpret data on exposure to environmental contaminants through subsistence fishing. Spirn's (2003) work on ecological restoration in neighborhoods in Philadelphia, PA included input from school children and senior citizens.

Marianne Burke, a forest ecologist, collaborates with a social scientist, local schools, and members of the black community in Charleston, SC in her work on the impacts of urban sprawl on forested wetlands (USDAFS SRS 2002). Another project on wetland conservation involves collaboration with a group of African American women who harvest seagrass and maintain the important cultural tradition of weaving seagrass baskets. My own research on breeding birds in open spaces has benefited from the input of residents of inner city St Louis neigh-

borhoods and from Grace Hill Settlement House, an important resource in black St Louis.

In such cases, ecologists take on a new role – as participants in a collaborative project, where a local community expects the results to solve a problem that they have identified and defined. Understanding this new role is vital for all researchers involved in environmental justice issues.

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I agree with Middendorf and Grant that the pursuit of EJ would benefit from participation by ecologists, but I believe that we can contribute more by exploring new areas of ecological research, rather than becoming increasingly engaged in education.

EJ requires that ecologists understand not just ecosystems, but social-ecological systems. Ecologists, like most people, are well aware that ecosystems have been, and continue to be, strongly influenced by human action. Our research has tended to focus on the ecological aspects of human society, such as material flows or land use, rather than the perceptions, property rights, and politics that regulate human ecological processes. While such an approach is well suited for understanding ecological dynamics, it is less helpful for understanding the dynamics of social-ecological systems. Understanding these systems and managing them in a sustainable, effective, and equitable fashion requires new forms of ecology that synthesize and extend elements of the ecological and social sciences in order to develop new theories, methodologies, and tools (Walker *et al.* 2002).

Ecologists could improve EJ by extending their research deeper into political ecology, ecological management, and ecological engineering. Political ecology is important because it focuses on understanding how inequality and difference are produced by, and drive, people's interactions with nature. Ecological management is important because improving people's situation in an ecosystem requires the effective management of our relations with that ecosystem. Finally, ecological engineering is important because people must be able to create the urban ecosystems they need, if they are to avoid the problems produced by the ecosystems they live within.

Political ecology began as a framework to help in understanding the complex interrelations between local people, larger scale political economies, and ecosystems (Blaikie and Brookfield 1987). Unlike most research on sustainable resource use, political ecology examines how inequalities in wealth and power, and differences in institutions and values, influence people's interactions with nature. Most political ecology has been conducted by social scientists and tends to focus on the structure of human systems and to downplay ecological dynamics, but some ecologists and geographers have attempted to more fully integrate the two. A deeply integrated field of political ecology would provide a framework for recognizing how people contest rights to ecological services. This is necessary because the use of various ecological services, such as climate stabilization by atmospheric CO_2, is increasingly regulated by formal institutions. Understanding the forces pushing for different types of property regimes, and who benefits and who loses out as a result of these regimes, requires an understanding of political ecology, as does the development of fair, effective, and sustainable systems of ecological governance.

Management of human use and manipulation of ecosystems depends upon the existence of a practical theory of ecological management. Ecologists have worked to develop such theories, but there is still much to be done (Gunderson and Holling 2002). Increasingly, ecological managers have realized that ecological management has to be an open and adaptive process (Röling and Wagemakers 1998), involving diverse groups of people who have interests in an ecosystem. It appears that such openness can improve management, and it is often necessary, especially in democracies, to ensure that a management process it acceptable to those whose behavior it is attempting to control. Ecological management must be adaptive, because of the changing nature of ecosystems and shifts in human usage. Attempts to develop processes such as adaptive co-management and to involve people in citizen science efforts are creating new forms of ecological management. These, in turn, are stimulating new types of social-ecological research as we attempt to learn how to

manage well in situations where ecological dynamics are uncertain and social goals are contested.

Environmental injustice also raises the question of how people can create ecosystems that provide the services they need and want. Addressing urban EJ means more than the prevention of harm – it also requires the development of functional, attractive urban ecosystems. While ecologists have traditionally focused on restoration and conservation, urban ecosystems are novel creations that require innovative ecological engineering to provide ecological services for their residents. Despite the efforts of restoration ecologists and landscape architects, our ability to create ecosystems that reliably supply desired ecosystem services is limited. Improving this ability, as well as defining its limits, is a tremendous research opportunity for applied ecology.

EJ involves much more than ecologists sharing their knowledge with non-ecologists. It requires that ecologists understand social-ecological conflicts, are able to effectively manage human dominated ecosystems, and know how to create desirable ecosystems. The opportunities for this knowledge range far beyond EJ and represent some of the most exciting research prospects for ecology.

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Middendorf and Grant's call to engage as ecologists in the EJ movement leads us to consider the perspectives of religious adherents, who have been involved in the movement since its beginning. In 1982, in an incident now acknowledged as the birth of the EJ movement (TMSL 2003), 500 people were arrested in Warren County, NC for demonstrating against a toxic waste landfill in a low-income, minority community. Among them were the Director of the United Church of Christ's Commission for Racial Justice and the co-founder of the Southern Christian Leadership Conference.

Institutional involvement in environmental concerns blossomed in the early 1990s, when 32 Nobel laureates and other eminent scientists issued an *Open Letter to the American Religious Community*, recognizing that action is taken to preserve what is considered sacred (NRPE 2003). Soon afterwards, a similar appeal was made to the international religious community by 1700 scientists through the Union of Concerned Scientists (UCS 1992).

The sacred texts of all major world religions – including Judaism and Christianity – acknowledge the earth as sacred, and 86% of Americans self-identify as Jews or Christians (USCB 2000). The scientists recognized that the moral authority and socializing force of religious organizations (55% of Americans report attending a religious service at least once a month; Inglehart and Baker 2000) were needed, together with scientific information, for effective action.

Several religious initiatives have since emerged, notably the National Religious Partnership for the Environment (NRPE), an alliance of the Coalition on the Environment and Jewish Life (COEJL), the National Council of Churches' Eco-Justice Working Group (representing most mainline protestants), the United States Conference of Catholic Bishops' Environmental Justice Program and the Evangelical Environmental Network (NRPE 2003). A commitment to social justice is a defining characteristic of NRPE and many religious environmental initiatives. For religious adherents, environmental care builds upon their track record of social engagement with those who have been disproportionately impacted, through education, policy, and healthcare. In the past decade, dozens of declarations, policy statements, letters, and resource kits have been issued at the international, national, and judicatory level (FRE 2003). Academic forums have also engaged ecology and religion (FRE 2003). Each tradition relies on its own scriptural, practical, historical, and ritual traditions to inform their still-emerging body of literature about the environment. However, certain values are common to all members of the Judeo-Christian family, including responsibility to God to care for the earth, recognition of the earth as a source of wisdom about God, equality of all humans to have access to basic resources, a faith in human ability to live within the limits of the earth, and concern for those most affected by environmental degradation.

Religious organizations have broad involvement in environmental initiatives, from land restoration and stewardship, energy conservation, and alternative energy to public policy advocacy and education. To be effective, religious organizations are increasingly relying on sound science to inform their constituents. When the Catholic Bishops issued their global climate change statement, a summary and affirmation of the Intergovernmental Panel on Climate Change report was included (USCCB 2001). However, for direct collaboration between ecologists and religious adherents, much of the historical distrust between religion and science will have to be addressed. Scientists still hear the echoes of Lynn White's (1967) thesis naming the Judeo-Christian tradition as the chief source of environmental ills in the West. However, con-

cerns common to ecology and religion, including a transnational perspective and a future-oriented vision, may help to build a bridge. Despite areas of disagreement, including the role of humans in nature and population concerns, the religious community has formed working alliances with mainstream environmental organizations (Gardner 2002). Involvement by respected individuals in both fields and ESA members who network as Christian Ecologists, may also help in the development of a working relationship between religion and ecology.

The diversification of ecologists, the growth of urban ecology, increased participation of stakeholders, and our involvement in EJ issues may be greatly enhanced by incorporating spiritual values and religious communities. In an African American community study, religious attitudes and behavior were related to levels of environmental concern (Harper 2000). The conclusion that environmental education should incorporate spiritual perspectives along with cultural heritage and ethnic values, and that religious values should be included when encouraging environmental stewardship, can apply to our work as ecologists. Implementation of the NSF report *Complex Environmental Systems*, which urges integration of the human dimension and socioeconomic models pertaining to justice concerns, may be advanced by working through the existing community found in religious organizations. Increasing diversity of perspectives, acknowledging the "holism" of the individual, and bringing together our scientific and religious ways of knowing can increase engagement and potentially create a synergy for reducing environmental injustice in our world today.

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