

## Integrating humans and nature: reconciling the boundaries of science and society

After many decades of separation, environmental and ecological sciences have formally undertaken an effort to reintegrate humans back into nature. Recent concern with the 'human dimension' represents a significant departure from historic traditions where the human–nature boundary has formed the division between natural and social sciences. Now, ecology and environmental sciences are thematically and functionally embedded in the social matrix, and the interrelationships and interdependence between humans and nature constitute the primary drivers of much ecological research. Integrating natural and human sciences derives from the recognition that many issues dominating society today (e.g. pollution, land-use practices, biodiversity, conservation and overpopulation) involve linking social and ecological approaches. This is represented by the integration of the human and natural sciences in many recent programs (e.g. Man and the Biosphere, the Sustainable Biosphere Initiative and the Intergovernmental Panel on Climate Change). Because of growing interest in integrating humans and nature, an interdisciplinary group of scholars gathered to discuss recent changes in how the human–nature boundary is perceived, and implications for ecological and environmental sciences\*.

The group reflected the complex web of the human–nature boundary, and included scholars from diverse schools of ecology, sociology, psychology, anthropology, Native American science, environmental education and philosophy. Hailing from different backgrounds, interests and agendas, surprisingly scholars converged on several common issues and goals. The diversity of topics discussed reflected the breadth and depth of issues involved in reintegrating humans and nature, rather than disciplinary differences. Topics included: how can scientists and science contribute most to helping the plight of the natural world?; what is 'natural?'; the nature of

time; the nature of scientific inquiry; the need for pluralism in science; how science implicitly embodies values and ethics; and how traditional models separating humans from nature are reflected in the fragmentation across disciplines, organizations, individuals and physical landscapes.

Discussions of the human–nature relationship, and its treatment in models and other studies, inevitably led to debates on science itself: how science defines and influences our perceptions of humans and nature. Amid differing views, one main theme emerged: if it intends to adhere to its pledge to serve humanity, the science community must change its perceptions in two essential ways. First, ecologists and social scientists alike support the urgent need to move beyond a 'proscience' versus 'anti-science' stance<sup>1</sup>. This means recognizing science as a social process, embedded within its attendant history, narrative, and political, economical, personal and cultural assumptions, much as any other worldview, but having significant analytical power and use. One of the chief barriers to integrating natural and human sciences rises from the insistence by many (usually natural scientists) that science is 'value-free' and universally valid or objective. By contrast, there are numerous identically accredited (usually social) scientists (not to mention entire cultures), who maintain that the refusal to recognize the dual nature of science as culture and method jeopardizes science's coveted claim of political neutrality. The growing literature and research in natural and social sciences<sup>2,3</sup> supports the idea that there are many valid ways of knowing (e.g. western science, Native science<sup>4,5</sup> and experiential), and that none is dispensable given the compelling multicultural socioecological questions faced today. Without such recognition, many practices of current science will be unable to address the multitude of boundary issues that characterize most research programs<sup>6</sup> (e.g. sustainability, ecological restoration, genetically modified organisms and biocomplexity). In lieu of pro- versus antiscience debates, it was suggested that efforts focus on developing conceptual frameworks that accommodate the spectrum of perspectives

and processes offered by human, natural and indigenous sciences to achieve successful integration.

Second, reductionist approaches are most effective when explicitly and consciously linked with a holistic conceptual framework that integrates nature and humans. Although providing a powerful analytic tool, the mechanistic reductionist paradigm, which dominates much of current science, tends to fragment biological and human systems into parts. By focusing on the 'pieces', and when practiced in isolation from holistic concepts, reductionism in *extrema* has left science grasping for methods and theories of how to reconnect humans to nature.

Integration – that is, the creation of holistic solutions to holistic problems – was found to apply not only to interdisciplinary efforts but also across internal boundaries within an individual scientist. These challenges are faced in the day-to-day practice of science: personal–professional beliefs, intuition, mind and spirit. From the perspective of the holistic framework suggested by integrating theories of social and natural sciences, many of the boundary issues scientists find themselves confronting today<sup>7,8</sup> (e.g. debates on advocacy, ethics and values) could be advanced with the acceptance of a parallel 'internal' integration – a recognition that scientists can operate both with their minds and their social conscience, and can preserve scientific integrity and ethics. The path to achieving a holistic framework is not unprecedented. Models of interdisciplinary and internal integration are numerous, particularly 'hard' scientists who are renowned not only for their scientific contributions but also for their insights into the nature of life, spirituality, social responsibility, ethics, philosophy of science and holistic theories (e.g. Richard Feynmann, Paul Davies, David Suzuki, Freeman Dyson, David Bohm and Albert Einstein). By accepting the existence of the intertwining of science and values, scientists are better positioned to address such difficult questions as, how to translate human values into the language of biological and physical systems. For example, one participant asked, 'How do we decide how many values does it take to make a "fact" in public land-use planning and decision making, or how many trees and owls does it takes to satisfy a First Nation's need for sacredness?' Integration implies combining not only the two formerly separate objects of study (humans and nature), but also the subjects (human observer and scientist).

Engaging in integration also implies considering a tangle of topics that do not necessarily fit neatly into any single

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arena. It is at these boundaries where integration becomes difficult, and decoupling between social and natural scientists most often occurs (e.g. the concept of objectivity and its implications for framing science questions). Decoupling derives from apparent conceptual clashes, as well as from insufficient institutional support for nontraditional endeavors. Because so-called boundary topics often challenge deep-seated cultural paradigms and require exploration into nontraditional waters, it is necessary for institutions to support and to provide opportunities that legitimize such discussions as part of mainstream science. Failure to provide such support will prevent meaningful dialogue and encourage quick-fix-it solutions that merely amalgamate existing ideas, but avoid critical and difficult questions. In this context, integration involves rigorous examination by natural and social scientists of the concepts, beliefs and politics in which science is embedded. This is not to say that integration demands the absence of any process of evaluation and acceptance; indeed, the existence of boundaries and tension is an essential part of a dynamic process. However, without such self-reflection, not only does science become a tool for cultural domination, but also it severely undermines its own credibility in the eyes of nonscientists.

To this end, the group developed a 'declaration of independence'. This declaration expresses some of these goals, and defines the position of an integrated science relative to society and relative to the relationship of humans and nature. The declaration can be summarized as follows: science is social knowledge and, as such, demands practice within the scientific community, which does not restrict research, ways of knowing, citizen inclusion and respect for nonhuman animals. Ecology and environmental sciences are recognized as interdisciplinary endeavors in which cooperation among the diverse sciences, the humanities and human culture is necessary.

It was also affirmed that research is accountable not only to funding institutions but also to the broad membership of the people and nature who are its recipients<sup>9</sup>. Knowledge must be used responsibly in the service of life. Furthermore, to stimulate and sustain such science, a parallel institutional shift is needed, which removes a monopoly of privilege, and allows for a system of accountability and decision making that reflects the cultural kaleidoscope in which science is embedded. Diversification at all levels in the process of knowledge generation and implementation

is necessary to respond to these new socioecological needs.

Many of the ideas discussed at the workshop are not new. However, what is new in science today is the degree to which traditionally disparate fields have become consensual and are engaging in formerly nontraditional collaborations, such as the recent conference 'The Good in Nature and Humanity' held by the Schools of Forestry and Divinity at Yale University. These efforts reflect the desires of both the science community and society to move beyond platitudes, and to tackle subjects formerly taboo to science. The challenges with which natural and social scientists are faced are difficult and complex, but the collective bodies of knowledge accessible to science, in conjunction with its own method of inquiry, can create an effective cadre of scholars responsive to pressing socioecological issues. An honest and open effort to reintegrate social and natural sciences has the potential to bring definition and meaning to achieving sustainable and ethical relationships with nature<sup>10</sup>. Participation in such collaborative research and discussion shows that science is well equipped to take this lead. The challenge remains whether science is willing to assume this role.

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