

Ecological Economics

Introduction: Ecological Economics and Sustainability¹

This special section of *Ecological Applications* contains six papers that lay out the problems and challenges of developing an integration of ecology and economics for achieving the goal of sustainability. The papers come from several different perspectives, and are only the beginning of what will be a difficult yet absolutely essential merger.

Homo sapiens is at another turning point in its relatively long and (so far) inordinately successful history. Our species' activities on the planet have now become of so large a scale that they are beginning to affect the ecological life-support system itself. The entire concept of economic growth (defined as increasing material consumption) must be rethought, especially as a solution to the growing host of interrelated social, economic, and environmental problems. What we need now is economic and social *development* (qualitative improvement without growth in consumption) and a direct and explicit recognition of the interrelatedness and interdependence of all aspects of life on the planet. We need to move from an economics that ignores this interdependence to one that acknowledges and builds upon it—an economics that is fundamentally ecological in its basic view of the problems that now face our species at this crucial point in its history.

This new *ecological economics* is, in a very real sense, a return to the classical roots of economics. It is a return to a point when economics and the other sciences were integrated rather than academically isolated as they are now. Ecological economics is an attempt to transcend the narrow disciplinary boundaries that have grown up in the last 90 yr in order to bring the full power of our intellectual capital to bear on the huge problems we now face (Costanza 1991, Jansson et al. 1994).

The current dilemma of our species can be summarized in ecological terms as follows:

¹ Reprints of this 59-page group of papers on ecological economics are available for \$9.00 each. Order reprints from the Office of the Executive Director, Ecological Society of America, 2010 Massachusetts Avenue, NW, Washington, D.C. 20036.

Homo sapiens has moved from an early successional "empty world," where the emphasis and rewards were on rapid growth and expansion, cutthroat competition, and open waste cycles, to a maturing "full world," where the emphasis and rewards are on qualitative improvement of the linkages between components (development), cooperative alliances, and recycled "closed-loop" waste flows.

Can we recognize these fundamental changes and reorganize our society rapidly enough to avoid a catastrophic overshoot? Can we be humble enough to acknowledge the huge uncertainties involved and protect ourselves from their most dire consequences? Can we effectively develop policies to deal with the very tricky issues of wealth distribution, population control, global warming, international trade, and energy supply in a world where the simple palliative of "more growth" is no longer a solution? Can we modify our systems of governance at international, national, and local levels to be better adapted to these new and more difficult challenges?

Homo sapiens has successfully adapted to huge challenges in the past. We developed agriculture as a response to the limits of hunting and gathering. We developed an industrial society to adapt to the potential of concentrated forms of fossil energy. Now the challenge is to live sustainably and well, but within the material limits of a finite planet. Humans have an ability to conceptualize their world and foresee the future that is more highly developed than any other species. We (the authors) are hopeful that we (the species) can use this skill at conceptualization and forecasting to meet the new challenge of sustainability. Ecological economics is an attempt to meet that challenge.

The six papers that follow are by well-known ecologists and economists and were originally presented as a symposium that we organized at the August 1994 Ecological Society of America (ESA) annual meeting in Knoxville, Tennessee, USA titled "Ecological economics: building a new paradigm for sustainability." The symposium was cosponsored by several sections of ESA as well as by the American Institute of Bi-

ological Sciences (AIBS) and the International Society for Ecological Economics (ISEE). Even though the symposium was scheduled for the last day of the meeting, the room was packed well beyond overflowing, indicating the growing interest among ecologists in these issues.

These papers take up the issues from several different perspectives. R. Costanza outlines what ecological economics is trying to do, why it is so important, and how it differs from conventional approaches. A key difference is that ecological economics is a "transdiscipline." It not only employs multiple disciplinary perspectives, but it tries to push the envelope to the point where disciplinary boundaries are transcended and problems can be addressed in the more open and free manner that the magnitude and complexity of the problems require. Some of the basic assumptions of both conventional economics and ecology about the way the world works are no longer useful if the goal is sustainability. Achieving this goal requires acknowledging the interconnected, nonlinear, sometimes chaotic nature of complex systems that include both humans and other natural systems, and building models and institutions that are consistent with that vision.

G. C. Daily and P. R. Ehrlich concentrate on the linkages among equitable distribution of resources, carrying capacity, and sustainability. They address the difficult question of whether a more equitable world would also be a more sustainable world. They conclude that, indeed, increasing equity would enhance sustainability and would not also require increases in aggregate consumption.

R. Goodland and H. Daly focus on the concept of environmental sustainability, as opposed to social and economic sustainability. They make the point that these three aspects of sustainability can be defined separately, and that environmental sustainability has a priority, non-negotiable role since it is a prerequisite for either social or economic sustainability. They go on to rigorously define environmental sustainability and provide recommendations as to how it can be secured. (Robert Goodland and Herman Daly were recently awarded the first Kenneth Boulding Memorial Prize in Ecological Economics by the International Society for Ecological Economics.)

C. Folke, C. S. Holling, and C. Perrings address the relationships among biological diversity, ecosystem structure and function, and human welfare. They argue that biological diversity is crucial in maintaining ecosystem services on which humans and their economies depend. They

elaborate by pointing out that the functional diversity of ecosystems may be more important than the species diversity in maintaining resilience and critical services, and that the linkage between these two is very unclear. Resilience in this context is a measure of the "magnitude of disturbance that can be absorbed before the system changes its structure by changing the variables and processes that control behavior" (Holling et al. 1995). They conclude that the aim of biodiversity conservation should be to conserve the capacity of ecosystems to continue to deliver life-support and other ecological services of value to humanity under a wide range of environmental conditions and not merely to preserve a "genetic library."

C. S. Russell argues that the most productive course, at least for the short run, is "weak" integration of ecological and economic models. By this he means linking separate models of the ecological and economic components of the system created by each discipline, so that the strengths and accumulated understanding of each discipline are not discarded, but used in a more effective integration. He concludes that there is a huge demand for this sort of integrated modeling to address many of the sticky environmental-policy questions that show up in our newspapers every day. But the supply of integrated models is very small because those who do such work are still considered "fringy" by their disciplinary colleagues (who also still control the academic reward system).

Finally, R. V. O'Neill discusses some of the problems of remaining in our comfortable disciplinary ruts and the problems of trying to get out of them. He notes (p. 1032) that "the time is upon us when neither discipline in isolation can be viewed as a complete world view or a sufficient explanatory paradigm." We have no choice but to pursue the merger, but it will be difficult for both ecologists and economists. Ecologists will have to "give up their favorite fiction: the 'natural' world . . . isolated from large-scale human impacts," which exists only in our imaginations. Economists, for their part, will have to give up the fiction that humans are immune from the laws that govern all of nature, including *Homo sapiens*. In our striving toward the common goal of sustainability, we seek a multiple-scale theory of the dynamics of the complex ecosystems inexorably linked with human societies (Costanza et al. 1993). Neither will do in isolation.

We therefore issue a challenge to ecologists

and economists and thoughtful people of every stripe. Stop procrastinating and join the quest for sustainability. Get involved in research and action that moves our understanding and effective management of linked ecological-economic systems further. Help *Homo sapiens* to survive and prosper in a sustainable partnership with the other species with whom we share the planet. There is no time to lose.

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