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The 50th anniversary of the first Earth Day prompts reflections on the changes in ecology, and in the Ecological Society of America, over the past half century. We invite your participation in a symposium at the upcoming annual meeting, “Earth Day Plus Fifty,” featuring talks by Jane Lubchenco and Hal Mooney, Ann Bartuska, Margaret Palmer, and Laura Petes.

The Long-Term Ecological Research Program turns Forty

2020 marks the 40th anniversary of the National Science Foundation’s Long Term Ecological Research (LTER) program. Initially described as a “pilot project” and an “experiment,” the program started modestly with only six sites in 1980, to which five more were added after a year. By 1987 five more sites joined the program, and three more in 1988, although two of the original sites were withdrawn in 1988. Some ecologists were unsure whether the program was a good idea, but NSF had high ambitions for its experiment. Research at these sites, it was hoped, would partly build on the biome studies conducted during the International Biological Program (1967-1974), but would take ecology to the next level of predictive, ecosystem-level science. Unsurprisingly, several early LTER projects did build directly on those biome studies, which focused on coniferous and deciduous forests, grasslands, deserts, and tundra. The LTER program now includes 26 sites, three of which were in the original group that began the program. A Symposium planned for the annual meeting in Salt Lake City will examine the scientific accomplishments of the LTER program.

At ESA’s annual meeting in 1987, a group of ecologists decided to petition ESA for the formation of a new section devoted to long-term studies. Jerry Franklin, Chair of the LTER Program’s Coordinating Committee, drafted the petition, and it was approved in 1988. As the new Long-Term Studies Section got organized, one of its early concerns during 1990-1991, as reported in ESA’s *Bulletin*, was to create an “EMAIL communication system” to link the computers of participating section members. It’s easy to forget how primitive our communication systems were in the 1980s when the program began.

As the program has matured, the business of archiving historical records has also ramped up, and we hope all sites will eventually organize and archive their valuable historical records. The LTER Network website has a digital archive (<https://lternet.edu/intranet/>) that provides access to many historical documents, as well as a historical timeline that includes some documents (<https://lternet.edu/network-organization/lter-a-history/>). An oral history project focused on the H.J. Andrews Forest LTER site has

been archived at Oregon State University:

<http://scarc.library.oregonstate.edu/omeka/exhibits/show/forestryvoices/collections/>

Toward the end of the LTER program's first decade, ecologists realized that the LTER sites could also contribute to broader-scale long-term monitoring of global change. At the ESA meeting in Toronto in 1989, one symposium provided an overview of how different federal agencies were approaching global monitoring, noting that long-term monitoring for global change was "a complex task that requires participation of scientists from a variety of scientific disciplines, an organized approach that will assure valid, integrated data, and easily accessible data for evaluation" (Baker 1990). Paul Risser (ESA's President in 1984) explained how the 17 sites in the LTER program could contribute to this effort. The symposium speakers argued that global monitoring was needed to provide information to policy-makers in cases where environmental changes could be mitigated by human action. Risser subsequently edited a volume on *Long-term Ecological Research: An International Perspective* (1991) that included chapters on the U.S. LTER program and several international networks for studying global change.

The years bracketing 1990 were also momentous years for ESA. The Sustainable Biosphere Initiative (SBI) was launched in 1988 during the presidential term of Hal Mooney (1988-1989). Jane Lubchenco, then ESA's Vice-President, chaired the steering committee, and the strategic planning process carried into the early 1990s and the Presidencies of Dennis Knight, Simon Levin, Ron Pulliam, and finally Lubchenco herself. Paul Risser also contributed importantly to these discussions (Risser et al. 1991). In her reflections on the SBI twenty years later, Lubchenco noted that at a time of meager funding for ecology, SBI set out to make a powerful argument about the relevance of ecology to multiple environmental problems. "What's shocking," she wrote in 2012, "is the very idea that 'relevance' was a shocking concept 20+ years ago" (Lubchenco 2012). The planning committee was unsure whether ESA's members would accept the committee's dual criteria of advancing both cutting-edge *and* relevant research, but ESA's membership did embrace these two objectives.

At the same time, Risser and Lubchenco co-chaired the committee that evaluated the U.S. LTER program after its first decade. The report (in the LTER Document Archive cited above) envisioned an expanded LTER program, arguing that the challenge of "designing and operating a sustainable biosphere could be most effectively and economically confronted with a newly defined LTER program." The existing LTER program, in their view, could be seen as the nucleus of a "vitaly important national effort." The report recommended significant expansion of the program to encompass more sites and a broader suite of scientific disciplines. Although the national program did not expand greatly, in 1993 NSF initiated the formation of an International LTER network, which now includes 700 sites across all continents. Ecological thought, in the words of Hal Mooney, was becoming "globalized."

A New Global Vision

In 1990 Hal Mooney received the Ecology Institute Prize in Terrestrial Ecology. This prize is awarded to outstanding research ecologists and rotates among the fields of marine ecology, terrestrial ecology, and limnology. Each laureate is expected to contribute a book to the series "Excellence in Ecology," and Mooney's book, entitled *The Globalization of Ecological Thought*, was published in 1998. It is an extended reflection on the changes occurring in ecology in the 1990s, especially in response to the new

appreciation of the global impacts of humans on biotic systems. Ecological studies were focusing on much larger dimensions than were customary in the past, and it was this broadened view that he referred to as the “globalization” of ecology. It meant the study of the Earth as a system.

The globalization of ecological thought was accompanied by international cooperative research efforts. Mooney drew attention to international groups that were engaging in research that transcended national boundaries. Comparative studies of Mediterranean-type ecosystems brought together scientists from around the world and led to the formation of the International Society for the Study of Mediterranean Ecosystems. The International Biological Program and UNESCO’s Man and the Biosphere Program both helped to promote cross-disciplinary and international collaborations. The International Council for Science (ICSU) (the acronym indicating its origins as the International Council for Scientific Unions) had many standing bodies that addressed diverse international issues, such as its Scientific Committee on Problems of the Environment or SCOPE.

Two problems in particular acted as wake-up calls in the late 1980s: evidence of the changing composition of the atmosphere, especially the rise in CO₂ levels, and collapse of the marine fisheries in the early 1990s. For problems of this type, which involved global “commons”, in one case the atmosphere and in the other case the oceans, the role of non-governmental organizations like SCOPE became very important. These committees brought together scientists from different disciplines, who provided expert assessments of emerging environmental problems. Their assessments often defined the field for future work and helped scientists of all nations and disciplines make the case for mobilization of effort to tackle problems of regional or global significance. This largely voluntary work resulting in authoritative assessment reports was of great service to science, and as Mooney warned, its loss would have a major impact on the direction and nature of national and international programs.

A large portion of Mooney’s book is devoted to the International Geosphere-Biosphere Program (IGBP), in which he was involved. In 1983 a group of scientists met at Woods Hole to explore the idea of a multi-disciplinary effort to study global change. The goal was to establish a common language and purpose between biologists and earth and atmospheric scientists, in order to create an Earth System science. Mooney’s interest arose from the fact that in the 1970s ecologists were called upon to serve as “firefighters”, tackling new problems like acid rain, forest dieback, or tropospheric ozone damage every couple of years. The promise of global change research and of Earth System science, he explained, was that scientists could draw on all of these problems in a more holistic context and determine if action on one was going to make the total picture better or worse.

The idea received the endorsement of the ICSU in 1986. Although the ICSU did not have funds to conduct research, it was able to help coordinate the international effort to study the Earth as a system. In the U.S., the National Science Foundation, NASA, and NOAA were all involved in funding research. Mooney notes that these efforts at coalition-building – enabling scientists to work together to solve complex problems that are beyond individual disciplinary boundaries -- are highly relevant to helping societies adapt to the changing global environment.

One area of research in which Mooney was heavily engaged concerned the effect of enhanced CO₂ on ecosystems. His book reflects on the considerable impediments to tackling this kind of problem in the early 1990s. The culture of biology, he noted, was not favorable to studying systems as a whole because

progress could be slow and it was difficult to get funding for long-term research in ecology. At a meeting at Asilomar, California, in 1991, scientists hammered out a plan, establishing priorities for what kinds of ecosystems should be studied. A decision was made to establish a network of independently funded studies around the world, and to help coordinate work by providing a means of communicating among the individual efforts, while also convening research synthesis meetings to focus these efforts. Mooney also discusses the efforts to inject more ecological research into the IGBP, since initially it emphasized the physical parts of the Earth System over the biological.

As he reflected on the development of this program over a decade, he also commented on the ongoing problems of cross-disciplinary work. Although the IGBP's initial framework was cross-disciplinary, he found that it became more structured around disciplines as the program developed. "The pull toward disciplinarity is a strong one," he observed, "aided by institutional structures, and great efforts need to be made continually to foster interdisciplinary interaction." He believed that the Earth System paradigm was helping to overcome this problem. Funding of Earth System science was also uneven at that time, with more funds going into climate and hydrological systems, less to ecological systems, and only a small fraction to human interactions. When a National Research Council study in 1994 focused more on ecological questions, it resulted in better funding of ecological research in relation to Earth System science.

Mooney ended with reflections on the public role of ecologists. A common view at that time was that scientists should not get involved in the science-policy interface until they were well established in their careers as researchers and had credibility as scientists. Mooney disagreed on the grounds that it took a long time to understand the complexities of science/policy issues, and therefore starting early was a good idea. As he wrote, "I suggest that always being aware of the societal relevance of one's own work, as well as that of one's discipline, and making appropriate contributions throughout a career will, in the long run, lead to a more effective contribution."

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