# It's a Good Time to Get Involved: Perspectives on the ESA, from Aldo Leopold to Today

## Introduction

In preparation for this address, I researched past ESA Presidential addresses, and this resulted in some interesting discoveries. First, I learned that the past-Presidential Address is a custom, not a requirement. There is no mention of it in either the Constitution or Bylaws. This led me to wonder if the "advent of the new millennium" might be an appropriate time to break this tradition! Second, and more seriously, I learned that at least one ESA President and one of the great leaders of our Society—Aldo Leopold—did not give this address. Leopold died of a heart attack in April 1948 while fighting a grass fire on a neighbor's property (*ESA Bulletin* 1948:35; see also <http://www.aldoleopold.org>, and so was unable to present the scheduled past-Presidential address at the Annual Meeting at the University of Maryland in September 1948.

I also learned that, at the time of Leopold's presidency, the ESA was deeply divided regarding what the goals and emphasis of the Society should be. I discovered some interesting parallels (and differences) between the ESA then and now. Many of the issues that were considered critical ecological challenges at the time of Leopold's presidency are still being discussed at this meeting.

So in this address, I would like to do two things. First, I want to provide an overview of what the ESA was like at the time of Leopold's presidency, and to consider what might have been the content of his Presidential address, if he had presented it. Then, I want to use this as the perspective to reflect on how we, as individual members and a scientific society, are currently addressing the challenge of applying the science of ecology to problems that continue to face the world today. Are we any closer to meeting those challenges than we were 50 years ago?

## Aldo Leopold and the ESA

Aldo Leopold served as Vice President of the ESA in 1946, and was elected President in the following year at the Annual Meeting at Woods Hole, Massachusetts (*ESA Bulletin* 1947). The ESA in the 1940s was a much smaller, more regional society (Dexter 1978) than it is today. In 1947 (the year the first Directory was published), there were 711 members; most were men (*ESA Bulletin* 1947:79). The major challenges faced by the Executive Committees following World War II were to rebuild the membership base that had declined during the war, and to more clearly define the ESA as a scientific society. Of particular concern was determining how activist the ESA should be in working to protect and preserve natural areas in the United States (Shelford 1944).

In 1944, the ESA had only six committees. These included the Committee on the Study of Plant and Animal Communities and the Committee for the Preservation of Natural Communities. Many of the members of these two committees believed that the ESA should actively promote legislation that would lead to greater preservation of natural areas (*ESA Bulletin* 1944:38–39). This included supporting specific legislation and purchasing land that would preserve and protect species. However, others in the Society felt that such activism diminished the effectiveness of the ESA as an unbiased scientific society, and argued that political action was inappropriate. There was considerable debate at the 1944 Annual Meeting about the ESA's role in the growing conservation movement—specifically, whether the activities of the Committee for the Preservation of Natural Communities should be limited or expanded (*ESA Bulletin* 1944).

In 1945, the Executive Committee submitted a referendum to the membership (apparently one of the first mail ballots taken by the Society) to amend the bylaws to restrict the activities of the Committee for the Preservation of Natural Communities as follows:

> *It shall encourage the preservation of natural conditions by providing information and advice to those interested in securing sound legislation for this purpose but shall not have authority to take direct action designed to influence legislation on its own behalf.* (*ESA Bulletin* 1946:12).

The Executive Committee argued that the ESA would have a greater impact by maintaining a position as an unbiased scientific expert, and that its effectiveness would be damaged when the Society made itself felt as a pressure group (*ESA Bulletin* 1946). The referendum passed (213–115) and was incorporated into the Constitution in 1946.

In response, several members of the Committee for the Preservation of Natural Communities formed the Ecologists Union in March 1946, as a separate organization that would work to preserve natural areas both by purchasing land and by supporting legislation to preserve plant and animal communities. At the ESA Annual Meeting in 1946, they submitted a motion to discontinue the Committee for the Preservation of Natural Communities, which passed (*ESA Bulletin* 1946). A second motion was passed that defined the responsibilities of the Committee on the Study of Plant and Animal Communities to "be construed to include the furnishing of disinterested ecological information and advice to groups or individuals requesting it from the Society" (*ESA Bulletin* 1946:43). The Ecologists Union remained fairly closely affiliated with the ESA, often meeting at the same place as the Society. In 1950, the Ecologists Union was renamed The Nature Conservancy (Dexter 1978).

## Aldo Leopold, ESA President

What does this have to do with Aldo Leopold? Well, he was Vice President of the ESA in 1946 and thus would have been a member of the Executive Committee that put forward the contentious amendment to the Society bylaws. In the year following the decision to limit the activities of the Committee on the Preservation of Natural Communities, Aldo Leopold—regarded by many as the founder of the conservation movement in the U.S.—was elected president of the Ecological Society of America. It was during these years that he apparently wrote the essays that would be compiled after his death and published as *A Sand County Almanac*.

In lieu of the traditional past-presidential address at the Annual Meeting at the University of Maryland, Dr. Paul Sears, then President of the ESA, read from a manuscript prepared by the late past-President entitled "The land ethic." About 100 members attended the banquet at the Annual Meeting, and the audience may have included the young E. P. Odum, from the University of Georgia; he had presented a paper at this meeting entitled "Niche relations and the southward expansion of *Vireo solitarius*" (*ESA Bulletin* 1948). No doubt this essay moved and inspired his friends and colleagues in attendance. The first issue of the *ESA Bulletin* in 1949 included a note in response to inquiries about the publication of the address, informing the membership that "The Leopold essays will be published by Oxford University Press; their tentative title is *Great Possessions;* their tentative date is 1949." (*ESA Bulletin* 1949:7).

The philosophy articulated in that essay and others in *A Sand County Almanac* clearly continue to resonate for ecologists and conservation biologists. For many, the statement from the essay:

> *A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends to do otherwise.*

is a central ethical tenet of the environmental movement. The ESA Governing Board has approved a modification of another quotation from *The Almanac* as the theme for the 2001 Annual Meeting at Madison, Wisconsin: "Keeping all the parts: preserving, restoring and sustaining complex ecosystems."

## Leopold's legacy and the ESA today

*A Sand County Almanac* has long been considered a hallmark of conservation biology, and ecologists have read, and have been influenced by, the book for decades. Many of my colleagues have told me that reading Leopold's work as a student influenced their decision to pursue ecology as a career. Others regularly use it in classes as a way of instilling in students the idea that ecology and conservation are intimately linked.

As I read *A Sand County Almanac* this summer in preparation for this address, I found myself wondering: Would Leopold have selected "The land ethic" or some other essay as the theme for his presidential address? Would he have used this as an opportunity to highlight the challenges and opportunities that he foresaw for the Society? Would he have encouraged his colleagues to "get involved" (as *he* clearly was) in becoming more of an activist in the emerging field of conservation biology?

I can only speculate on that subject, but I learned some interesting things about what the ESA was like as an organization in the late 1940s (at the time of Leopold's leadership) that bear on this issue. It also provides an interesting comparison to the way in which we, as a Society, are today approaching the challenges of how best to "get involved" with the application of ecological science to resolve the worldwide environmental problems that face us.

Reflecting over the summer on my own experiences on the Governing Board regarding how activist the ESA should be, in the context of the events that preceded Leopold's presidency, I was struck by the section of the book entitled "Wilderness for science." The ESA Governing Board is frequently asked to support petitions or to sign letters supporting particular legislation regarding changes in management practices. Uniformly, our response to these requests is that our role is to support and communicate the science that is critical to these issues, and not to take an advocacy role.

Arguably, this is the view that Leopold would have taken as well. In "Wilderness for Science," Leopold stresses the importance of doing research that will contribute to a better understanding of the remaining wilderness areas. He is forthright in voicing his concerns that many conservation efforts at that time were based on a superficial understanding of the magnitude and complexity of the problem.

> *The practices we now call conservation are, to a large extent, local alleviations of biotic pain. They are necessary, but they are not to be confused with a cure. The art of land doctoring is being practiced with vigor*, but the science of land health is yet to be born. (pages 195–196; emphasis added)

I was struck by the similarities of this statement to the central theme of the Sustainable Biosphere Initiative (SBI) proposal (Lubchenco et al. 1991). Those who attended the ESA Annual Meeting at Snowbird, Utah, are aware that we celebrated the 10th anniversary of the SBI at this meeting. The SBI was proposed as a research agenda to the ESA at the 75th Annual Meeting of the ESA at Snowbird in 1990. It was a remarkable effort by a group of our colleagues, who took what seemed at the time to be an incredible risk to present to the Society an agenda for future ecological research, and to call for its endorsement by the ESA membership.

As radical as this idea seemed in 1990, the research priorities set forth in the SBI proposal—global change, biological diversity, and sustainable ecological systems—are remarkably similar to themes and issues stressed by Leopold in *A Sand County Almanac*. I won't focus here on SBI activities, but instead will highlight the work of our colleagues and those activities of the ESA that address Leopold's challenge to develop the "science of land health."

## Progress in developing the "science of land health"

Over the past 50 years, we have—as individual researchers and a scientific society—made tremendous progress in the development of a "science of land health." As examples, I want to highlight here three areas of research on environmental challenges that are representative of these efforts. These projects show how ecological research can be cast in a broader context to address issues that are important for improving conservation and/or resource management practices. Admittedly, this is only a small sampling of the work that could be highlighted. But these examples clearly make the point that the ESA has been—and can continue to be—effective in providing and promoting the scientific knowledge used to develop policies to effectively address environmental issues.

## Species conservation

Aldo Leopold was passionate about the importance of preserving and protecting species and habitats reflecting the wealth of biological diversity of this country. But it was not until 25 years after his death that the U.S. Congress passed the Endangered Species Act (in 1973), setting into motion what have become highly contentious debates about the value of individual (often nondescript and not particularly charismatic) species. Ecologists have been drawn into this debate, and we often find ourselves in a difficult place as we attempt to justify "scientifically" the value or importance of specific rare, endangered, or threatened species.

The list of endangered species in the United States is growing. On 30 June 2000, the U.S. Fish and Wildlife Service listed over 1700 threatened and endangered species in the USA <http://www.usfws.gov/wildlife.html>. Despite the attention of a large number of our colleagues in private and public institutions and a variety of agencies, only a fraction of these species have recovery plans. Unfortunately, the science behind recovery or habitat conservation plans is not always as strong as we would hope (Karieva et al. 1999). Too often, our knowledge about a particular species is inadequate because of its limited geographic distribution or habitat specificity or small population size.

As scientists, we are often reticent to make recommendations about how to manage or protect a particular species without sufficient data on which to base those recommendations. But we must. There are a growing number of statistical and technological tools to help us understand what stages of the life cycle and what characteristics of habitats are most critical in preserving and restoring viable populations of endangered or threatened species. We can also use these tools to develop scientifically based recommendations regarding the effectiveness, or lack thereof, of specific policies or actions being considered to preserve and protect endangered species.

*Sea turtles*

My current favorite example demonstrating how basic science has contributed to changes in policy to protect an endangered species is the work done on sea turtles by Larry Crowder and his colleagues at the Duke University Marine Lab. While they are not the most charismatic of species, concern about the decreasing numbers of Kemps, loggerheads, and other sea turtles has attracted growing attention from environmentalists and policy makers. A particularly intriguing aspect of this project is the debate that has emerged over whether loss of nesting sites or mortality from bycatch from shrimping operations are more important sources of mortality (Heppel et al. 1996).

It is difficult to obtain the data for a demographic analysis of species like sea turtles. They have a prolonged juvenile period and long-lived adults. They are migratory and spend considerable periods of their life in the open sea. (They are not the type of organism that Harper [1977] would recommend for demographic analysis!) Despite the small sample sizes and limited time series data available, Crowder and his colleagues were able to build a stage-structured matrix model of loggerhead sea turtles (Crouse et al. 1987). Using elasticity analysis, they showed that changes in annual survival rates of subadult and adult sea turtles would probably have the greatest effect on their population growth (Crowder et al. 1994). Their demographic analysis and modeling provided scientific support for the adoption of a policy to require installation of TED's (turtle exclusion devices) on shrimp boats as a means of reducing adult mortality.

In further work, they have shown that "head-starting" efforts are not likely to work, particularly when population sizes are low. The increases in juvenile survival that would probably be achieved by head-starting could not compensate for the low subadult and adult survival rates experienced by this species, most likely as a consequence of bycatch mortality (Heppell et al. 1996). These results have important consequences for establishing policy for management of sea turtles, and provide scientific support for allocating the limited funds available for sea turtle recovery for TEDs, rather than for head-starting programs.

## Biological invasions

Throughout *A Sand County Almanac*, Leopold makes references to the dramatic negative effects of invasive species, particularly plants, on native diversity. Despite long-standing awareness of the potential detrimental effects of invasive species, their numbers continue to increase. The U.S. Fish and Wildlife Service web site <http://invasives.fws.gov> currently lists more than 6300 invasive species of plants and animals in the United States.

I was particularly intrigued to see Leopold refer specifically to the detrimental effects of *Bromus tectorum* on Western grasslands in *A Sand County Almanac*. The impacts of *B. tectorum* on Western grasslands were apparent to all who attended the ESA meetings in Spokane, Washington, in 1999. Unfortunately, despite the efforts of plant ecologists, range scientists, conservation biologists, and restorationists, this species continues to spread and extend its range in the western United States.

There is a long history of ecological research on *B. tectorum* as an invasive species. Using JSTOR to search past issues of *Ecology* and *Ecological Monographs*, I found 181 "hits" on *B. tectorum.* Frederick E. Clements, in his seminal paper on the nature of the climax community (Clements 1936), referred to the modification or displacement of native grasses by *Bromus tectorum* in the Great Basin as an example of a *disclimax*. Among the first papers on the ecological impacts of *Bromus tectorum* as an invasive species was one published by Stewart and Hull (1949) in *Ecology*.

*Invasive grasses in montane forests on Hawai'i*

Clearly, invasive species are a global problem, with unknown consequences. There are probably few (perhaps no) areas on the earth that are not at some risk of being invaded by alien species. Land managers are increasingly aware of the need to adopt, and adapt, management techniques to reduce invasive exotics and restore both native species composition and the ecosystem functions that are often disrupted by an invasive species (Mack et al. 2000).

The Hawaiian Islands provide some of our best examples of the negative impacts of invasive species. Large areas of these islands are impacted by human alterations to the landscape—both from agricultural use and from human population expansion. Accompanying these land use changes is the increasing establishment of invasive exotics, which are transforming the dwindling number of natural areas in Hawai'i at an alarming rate, including those in Hawai'i Volcanoes National Parks.

For nearly 10 years, Carla D'Antonio and her colleagues have been studying the impacts of invasive exotic plant species on seasonal montane forests of the Hawai'i Volcanoes National Park (D'Antonio et al. 2000, Mack and D'Antonio 2001). Since the 1960s, exotic $C_4$ grasses have increasingly invaded these forests. These grasses outcompete the native shrubs and woody species, and consequently decrease the native biodiversity (D'Antonio et al. 2001). They also increase the probability of fire, which enhances the establishment of the exotics. As a consequence, the native dry forest is transformed initially into a savanna-like parkland, and with continued fire, it eventually becomes a grassland that is dominated by exotics (Mack and D'Antonio 2001).

D'Antonio's work has shown the critical role that fire plays in this transformation by facilitating the establishment of exotics and reducing the recruitment of the native shrubs, as well as by influencing nitrogen dynamics (D'Antonio et al. 2001). In unburned sites, exotic species have little effect on productivity or nitrogen cycling. In burned sites, productivity and litterfall are reduced, but N mineralization rates are increased, and total N uptake by the plant community is only a small fraction (17%) of that mineralized. This research provides strong evidence that the indirect effects of exotic species on N cycling may be an important mechanism driving the degradation of ecosystems that are strongly nitrogen limited (Mack and D'Antonio 2001).

## Agriculture and ecology

No discussion of Aldo Leopold would be complete without some reference to agricultural systems. Clearly, land use changes associated with modern agriculture have had dramatic effects on native communities.

Unfortunately, ecologists have not always recognized the unique opportunities that agricultural systems provide for research, although that perspective is clearly changing. At the 2000 ESA Annual Meeting, several symposia and contributed paper sessions focused on ecological work in agricultural and managed systems.

Two new sections of the ESA, Agricultural Ecology and Rangeland Ecology, were approved by the Governing Board at the 2000 Meeting. Clearly, there is growing recognition of the value and potential for ecological research in managed systems by the Society's membership.

Much of the ecological research in agricultural systems to date has focused on system-level questions, largely driven by the interest in determining constraints on crop yield and the underlying nutrient cycles that control this under different types of management (Robertson and Paul 1998). Such a focus is certainly justified, especially as we become increasingly aware of how agricultural management systems may influence global fluxes of greenhouse gases and other sources of global warming (Robertson et al. 2000). However, there is increasing interest in population- and landscape-level questions in agricultural systems, driven in part by concerns over the positive and negative impacts of species introduced for biological control of agricultural pests (Louda et al. 1997).

*Genetically modified organisms*

An emerging issue in agricultural systems of concern to the public and policy makers is how the introduction of genetically modified crop species (GMOs) may impact nontarget species, particularly native species, and even human health. Recall the considerable attention attracted by John Losey's paper (Losey et al. 1999), published in *Nature* last May, on the potential lethal effects of Bt corn pollen on monarch butterfly caterpillars. The paper spurred a great deal of research this year, particularly in the Corn Belt, on the potential impacts of Bt crops on target insects. On the Web, I found 32 sites describing new studies on this issue, and I expect that there will be more.

Corn is not the only transgenic crop being introduced into North American agriculture. Sunflowers may be a less commercially important crop in North America (although they are arguably more visually attractive than corn). Cultivation of transgenic sunflower (*Helianthus annuus*) has the potential to strongly influence native sunflower populations in the Midwest and western United States. Gene flow from cultivated Bt sunflowers can result in enhanced seed production in the wild populations because of a reduction in seed head herbivory (Cummings et al. 1999). Allison Snow (Ohio State), Helen Alexander (Kansas), and Diana Pilson (Nebraska) are examining impacts of the introduction of transgenic traits on wild, weedy populations of sunflower across its range in the midwestern United States. Understanding the impact of an introduced transgenic crop on local, wild relatives across its range is critical to developing policy on risk assessment for such species, which is likely to increasingly dominate agricultural production systems (Snow and Moran-Palma 1997).

These are questions of basic interest to plant population biologists, and have been for decades. They are the kinds of questions John Harper encouraged us to address over 30 years ago (Harper 1967). They take on new importance, however, when the results can be used by regulatory agencies to determine expected and "worst case" scenarios resulting from deregulation of transgenic, insect-resistant crops such as sunflowers.

## ESA action and outreach

Presenting these results to each other as papers and posters at meetings, or published in our leading journals, is not enough. To convince the public that the science of ecology can contribute to the solution of environmental challenges, we need to summarize, synthesize, and communicate this information to the public and policy makers. The challenge is to find ways to effectively, and strategically, make this information available to the people who develop and implement policies that will, in the long term, provide the solutions to environmental concerns.

Over the past decade, the ESA has vastly increased its involvement in the communication and translation of science to make it more accessible to the public and policy makers. On each of the issues that I have described here, the ESA, working with the SBI and Public Affairs Office, has made a concerted effort to communicate the science to policy makers and the public.

### *ESA outreach on environmental issues*

White papers are an important mechanism used by the Society to synthesize knowledge on an environmental issue. White papers summarize both the science that is known and what needs to be known, to develop and implement sound environmental policy. In some cases, white papers have formed part of a Special Feature or Forum that includes a series of papers on a topic. Committees of ESA members have prepared white papers on each of the issues that I have described here.

The first white paper ever published by the ESA was on the potential ecological and evolutionary impacts of genetically engineered organisms (Tiedje et al. 1989). At the time, this was considered by the ESA leadership to be a high-profile issue on which the ecological perspective needed to be summarized (Mooney and Risser 1989). The paper was published as a Special Feature and was introduced by a lead article written by H. A. Mooney, then President of ESA, and P. G. Risser, Chair of the Public Affairs Committee of the Society. Although much of the world seems to have been caught off guard regarding the risks posed by incorporation of genetically modified crops into large-scale agriculture, the ESA was out in front on this issue.

Interestingly, since the publication of that white paper, only about 20 articles on genetically engineered or transgenic organisms have appeared in the print journals of the ESA (*Ecology*, *Ecological Applications*, and *Ecological Monographs*). This is not a particularly overwhelming response to the call for more research by the authors of the Special Feature! Perhaps the complex nature and multidisciplinary issues involved in assessing the ecological impacts of GMOs have made other journals the preferred outlet for this research. A recent issue of *Conservation Ecology*, an online journal originally affiliated with ESA that focuses on cross-disciplinary ecological issues, included a series of papers on the promises and risks of GMOs <http://www.consecol.org/Journal/vol4/iss1/index.html>. Clearly, the nature of the issues raised by arguments for and against the introduction of GMOs calls for further ecological research, which we hope will be published in our journals.

The ESA also has produced white papers on endangered (Carroll et al. 1996) and invasive species (Mack et al. 2000). The recent white paper on invasive species was a follow-up to a Special Feature edited by Karieva (1996) that grew out of USDA-sponsored research on the predictability of invasion ecology. However, to inform policy makers, land managers, and the public of the science behind these issues, a less technical presentation of these papers is needed. The *Issues in Ecology* publications on biotic invasions (Mack et al. 2000), the relationship between biodiversity and ecosystem function (Naeem et al. 1999), and ecosystem services (Daily et al. 1997) provide a nontechnical summary of the scientific issues that need to be considered in developing policy to preserve and manage natural systems. These papers and fact sheets prepared by the ESA provide effective mechanisms for translating complex scientific information to the public. The Public Affairs Office and the Sustainable Biosphere Program of the ESA use these documents in meetings, conferences, and hearings with policy makers, demonstrating the ecological principles that can be brought to bear on legislation and policy to effectively address these environmental problems.

### How do you get involved?

The ESA today is clearly a very different society than it was in the late 1940s, when Leopold was involved in its leadership. We have more members, whose interests reflect a greater diversity of areas of ecology. This is reflected in the growing number of sections and chapters. Less than a decade ago, *Ecological Applications* was specifically launched with the goal of "moving the science of ecology in directions that can support informed decision-making" (Levin 1991). As we move ahead in this arena, there may be a need for other ESA journals to be developed that have broader disciplinary appeal and that focus on policy as well as scientific aspects of environmental issues.

Clearly, there are many ways in which individual members can work with the Society toward the development of the "science of land health." But to be successful, we need the involvement and support of the membership. So what can you do?

First, *join the Society*. Membership is the core of the ESA. This is a member-driven organization. The issues addressed, the priorities set for the Society, and how they are addressed will be determined by the activities and interests of the membership.

Second, *support the Society publications*. Submit, review, and subscribe to the publications of the ESA. Send us your best work! Read and cite papers that are published in ESA journals. Thoughtfully review the work of colleagues submitted to the journals (in a timely manner!) and serve on the Editorial Boards. Most importantly, subscribe to the Society journals. Encourage libraries at your institutions to maintain their subscriptions—electronically or in print. As a nonprofit Society, the income from subscriptions is critical to our ability to maintain the ESA and to pursue new options and activities.

And finally, *serve on committees and join sections and chapters*. The sections and chapters provide tremendous opportunities for networking, particularly for students and new members. Here you will find people with a shared interest in the questions and issues that fascinate you—and opportunities for students to win awards, grants, and potential future employment!

All of us choose our own professional paths. Some will choose to emphasize research, with no consideration about its impact on conservation, management, or related policy issues. Others will focus their careers almost entirely on issues that have clear and immediate application. Many members of the ESA have a gift for teaching and have been generous in sharing effective and novel teaching methods with other members. At the 2000 Annual Meeting, we have presented the first award for Excellence in Education—appropriately named in honor of Eugene Odum, whose career typifies the dedication of the Society to excellence in research and education.

A growing number of ESA members are becoming more involved in outreach to the public and policy makers, by writing position papers, giving testimony at Congressional and other hearings, and finding ourselves interacting with the media about these issues. There are more and more opportunities for ecologists to communicate our science to new audiences and support decision makers. The Aldo Leopold Leadership Program is providing training for individuals who have an interest in developing these skills <http://www.leopold.orst.edu/>.

I hope that my comments here will motivate you to "get involved in the ESA." It is as good a time as any, and it can be extraordinarily rewarding.

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