

Natural Resources Roadmap to Guide Research, Education, Policy Decisions

A “Science, Education, and Outreach Roadmap for Natural Resources” calls for an integrated approach to natural resources education, research and management across funding agencies and academic disciplines, and better communication of research results to the public, including policy makers.

The Association of Public and Land-grant Universities’ strategy document details six “grand challenges” facing the United States in the areas of natural resources sustainability, water, climate change, agriculture, energy, and education. The report recommends actions to meet these challenges over the next decade.

“While there have been many high-level reports and strategic plans written about the topics covered by this report, most have tended to break natural resources into sub-disciplines representing particular resources: atmospheric, coastal, fisheries, forests, marine, rangelands, water, wildlife and others. Although universities frequently segregate these fields through disciplines, the resources themselves are all interrelated and need to be dealt with as a whole,” the report says.

The goals of the Roadmap are to chart a path for natural resources research, education, and outreach; provide direction for public universities for the next 5 to 10 years; identify major challenges, knowledge gaps and priorities; provide guidance for policy makers in strategic planning and investment; support natural resources agencies, professional societies, and nongovernmental organizations in advocating for the use of sound science in natural resources decision-making; and facilitate the development of interdisciplinary research, education and outreach teams focused on natural resources challenges.

Scientists writing in the climate change response chapter noted that, “In general, our understanding of the response of individual organisms or characteristics to a single component of climate change is relatively good;” however, “complex interactions must be studied in the context of entire ecosystems to be understood.” The chapter called for “encouraging interdisciplinary teams that will link climate change models to habitat models to models of population and community dynamics.”

The Roadmap emphasized, “Combinations of uncertainty mean that the challenge of natural resource management in a changing climate is fundamentally an exercise in risk management. Understanding the potential impact of climate change and the benefits and costs of proactively managing climate change risks is the ultimate challenge for economic research on climate change.”

Recommendations include identifying signals of climate change, improving climate-based models, and defining the impacts of uncertainty and irreversibility and their impacts on management strategies and public policy. The chapter concludes, “Research efforts to address cumulative impacts of climate change, and to quantify and understand uncertainty related to the impacts, will enable us to effectively use our limited resources to prioritize mitigation strategies and manage climate change risks at a scale that will lead to the best outcome. Research, teaching, and outreach are the key components to preparing for, mitigating, and adapting to future climate changes.”

The chapter about responding to the education challenge also calls for incorporating uncertainty and the need for models. It identifies six natural resources goals as “including natural resources in youth education by incorporation into STEM (science, technology, and math) curriculum and activities; strengthening natural resources curricula at the higher education level; improving the scientific literacy of the Nation’s citizens; communicating scientific information to the general public in efficient and

effective ways; promoting the sustainability of natural resources; and promoting diversity in the natural resources profession.”

Fundamental concepts of natural resources science and management can be embedded within K-12 curricula. But students also need hands-on experiences outside the classroom, the chapter points out. Designers, developers, educators, political leaders, and citizens throughout society should make changes in our modern built environments to provide children with positive contact with nature.

The authors of the chapter on meeting the education challenge were particularly adamant about the need for scientific literacy beyond K-12 -- among the America public in general. They wrote that controversy over science and technology policy, such as in response to climate change, is an example of not understanding that science is a process of building and testing theory.

They point out that traditional methods of communicating scientific information about natural resources have not been as effective as they could be. “Flood is an example,” they write. “Flood damage remains high as property development continues in flood-prone locations. Hurricane Sandy’s impact on coastal New Jersey in October 2012 is a recent example.”

Education must promote critical thinking skills, such as the ability to use this knowledge to assess specific issues and evaluate options. With a more robust investment in science education, natural resources decision-making will prove less controversial, less contested in the nation’s courts, and more defensible to broad segments of the public.

Recommendations to improve education and communication include integrating natural resources management into courses about the natural sciences, determining why so few women and minorities do not choose natural resources studies and careers, doing research to better understand how individuals make decisions in order to increase the effectiveness of scientific communications, developing better methods for communicating uncertainty and probability to the public, and having a broader range of federal grants that require a comprehensive plan for communicating results to decision makers. Experts in communication, Extension, outreach, decision science, and other social scientists should be part of the proposal team from the beginning, and involved at a level that makes a real difference, not as an afterthought.

The team of 35 scientists who authored the roadmap had received significant feedback from researchers at public and land-grant institutions across the country. The U.S. Department of Agriculture sponsored the report through a grant to Oregon State University, which then partnered with the Association of Public and Land-grant Universities.

The six grand challenges addressed in the report are:

1. **Sustainability:** The need to conserve and manage natural landscapes and maintain environmental quality while optimizing renewable resource productivity to meet increasing human demands for natural resources, particularly with respect to increasing water, food, and energy demands.
2. **Water:** The need to restore, protect and conserve watersheds for biodiversity, water resources, pollution reduction and water security.

3. **Climate Change:** The need to understand the impacts of climate change on our environment, including such aspects as disease transmission, air quality, water supply, ecosystems, fire, species survival, and pest risk. Further, a comprehensive strategy is needed for managing natural resources to adapt to climate change.
4. **Agriculture:** The need to develop a sustainable, profitable, and environmentally responsible agriculture industry.
5. **Energy:** The need to identify new and alternative renewable energy sources and improve the efficiency of existing renewable resource-based energy to meet increasing energy demands while reducing the ecological footprint of energy production and consumption.
6. **Education:** The need to maintain and strengthen natural resources education at our schools at all levels in order to have the informed citizenry, civic leaders, and practicing professionals needed to sustain the natural resources of the United States.

“Scientists at our public and land-grant universities have developed this report to more clearly identify the challenges we face and prioritize our research, education and outreach efforts,” Association of Public and Land-Grant Universities President Peter McPherson said. “It provides a needed framework and should help guide policy decisions in the coming years.”

“The recommendations proposed in this roadmap should justify increased funding and collaboration for research, education and outreach in the natural resources,” the document states. The Science Education and Outreach Roadmap for Natural Resources may be accessed at: <http://www.aplu.org/page.aspx?pid=2952>.

The Association of Public and Land-grant Universities is a research, policy, and advocacy organization representing 235 public research universities, land-grant institutions, state university systems, and affiliated organizations. Founded in 1887, the association is North America's oldest higher education association with member institutions in all 50 U.S. states, the District of Columbia, four U.S. territories, Canada, and Mexico. Annually, association-member campuses enroll 4.7 million undergraduates and 1.3 million graduate students, award 1.1 million degrees, employ 1.3 million faculty and staff, and conduct \$41 billion in university-based research.

##

The Association of Public and Land-grant Universities contact is [Jeff Lieberson](#), 202-478-6073 (office) or 202-236-2372 (cell)