



## POLICY FORUM

Land by this Little Laramie River branch, Wyoming, gives ecosystem services and cultural benefits.

### ECOLOGY

# Toward a national, sustained U.S. ecosystem assessment

Pieces are in place, but need coordination and policy focus

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**T**he massive investment of resources devoted to monitoring and assessment of economic and societal indicators in the United States is neither matched by nor linked to efforts to monitor and assess the ecosystem services and biodiversity that support economic and social well-being. Although national-scale assessments of biodiversity (1) and ecosystem indicators (2) have been undertaken, nearly a decade has elapsed since the last systematic assessment (2). A 2011 White House report called for a national biodiversity and ecosystem services assessment (3), but the initiative

has stalled. Our aim here is to stimulate the process and outline a credible framework and pathway for an ongoing assessment of ecosystem functioning (see the photo). A national assessment should engage diverse stakeholders from multiple sectors of society and should focus on metrics and analyses of direct relevance to policy decisions, from local to national levels. Although many technical or science-focused components are in place, they need to be articulated, distilled, and organized to address policy issues.

### ASSESSMENT: THE MISSING ELEMENT

The Obama Administration, recognizing societal threats from rapid environmental change and stressors, charged the President's Council of Advisors on Science and Technology (PCAST) with identifying priorities in research, informatics, and institutional arrangements. The 2011 report (3) made a series of recommendations, the first of which called for a "Quadrennial Ecosystem Services Trends (QuEST) Assessment," incorporating current conditions (including biodiversity), predicted trends, syntheses linking ecosystem properties to ecosystem services, existing and emerging threats, and potential policy responses (3). This assessment was intended

to serve as a foundation for the other recommendations, which were that the U.S. federal government (i) identify actions and policies affecting ecosystem services and biodiversity; (ii) incorporate ecosystem-services impacts into planning and management decisions; (iii) integrate, disseminate, and use relevant data and data products; and (iv) support and participate in relevant international initiatives. Substantial progress has been made on all of these recommendations except the national assessment; continued progress on the other recommendations is hampered in its absence. A systematic national assessment program is needed to identify potential risks, determine priorities, identify trends, and evaluate decisions and actions.

A government-wide milestone deriving from the PCAST report was a 2015 White House memorandum instructing federal agencies to incorporate ecosystem services into decision-making (4). Yet without context and reference points provided by a comprehensive national assessment, it will be difficult to assess government decisions aimed at enhancing or protecting ecosystem services.

The PCAST report (3) laid out an ambitious vision for Ecoinformatics-based Open Resources and Machine Accessibility (EcoINFORMA) to support and coordinate government-wide informatics related to biodiversity and ecosystem services and to facilitate assessments and other integrative activities. A Web-based platform has been established with three hubs to leverage partnerships with universities, nongovernmental organizations (NGOs), and other entities outside government. However, the national assessment they were intended to facilitate has failed to ma-

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terialize. EcoINFORMA would benefit from more comprehensive integration and direction of the kind provided by an assessment program. For example, the Biodiversity Information Serving Our Nation (BISON) hub provides an excellent resource for researchers, but is not designed to deliver products or metrics of direct use to decision-makers.

PCAST recommended U.S. participation in and support for international initiatives, notably the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (5). The United States has been involved in IPBES; the Department of State is recruiting U.S. scientists to participate. Scientists from federal agencies are involved in IPBES, including regional and global assessments. These assessments were intended to build on national assessments, and the regional assessment of the Americas (covering the entire Western Hemisphere) cannot substitute for a national assessment focused specifically on national policy concerns. Several countries have recently conducted ecosystem, ecosystem services, or biodiversity assessments (6–9) that have informed policy (10). By failing to implement a national assessment, the United States is missing an opportunity to provide leadership and contribute to and benefit from IPBES.

Most important, the accelerating pace of environmental change lends urgency to a comprehensive national assessment program. The 2012 RESTORE Act (11) includes objectives for ecosystem recovery in the Gulf of Mexico region, and better baselines are needed. Persistent drought in southwestern states is driving widespread forest dieback and disturbance (12) and placing severe stresses on water delivery systems (13). Rapid decline of native bees in Hawai'i has led to their recent listing under the Endangered Species Act (14). These and other dramatic changes in the past few years—largely dealt with on an ad hoc basis as they arise—speak to the need for systematic and comprehensive monitoring, which will help anticipate problems before they reach crisis stage and will identify losses and restoration targets when crises emerge. A national assessment would organize and aggregate baseline information that can prove useful in a crisis, and analyses of trends in indicators aggregated at local, regional, and national scales would help identify potential threats.

#### AWAITING A CONDUCTOR AND A SCORE

To date, no champions have emerged from within the federal government with sufficient resources for a national assessment at a meaningful scale. Progress has been made in characterizing ecosystem services (15) and identifying how they can be incorporated into federal decision-making (16, 17). Indi-

vidual federal science agencies, enforcement agencies, and resource-management agencies administer diverse monitoring and inventory programs. A 2013 White House directive (18) is driving development of platforms for data sharing and delivery in federal science agencies, which could be integrated into a national assessment program. Many states, tribes, NGOs, and private-sector entities have monitoring and analytical capacities, and the National Science Foundation supports ecological monitoring programs. Yet a centralized process—guided by policy-relevant questions, methodologies, and reporting structures—is lacking. A fully instrumented orchestra is seated in the concert hall, awaiting a conductor and a coherent score.

The transition to a new presidential administration represents a unique opportunity. A successful and well-vetted model for a national assessment was developed by the Federal Advisory Committee that prepared the third National Climate Assessment (NCA) report. Its members debated alternative structures, concluding that a sustained process, partnering government and nongovernment entities, would yield stakeholder-relevant products, capacity-building, and scientific credibility (19). This model was used in the third NCA, which provides a number of lessons for other assessments (20, 21). On the basis of this recent example, we suggest that a national ecosystem assessment can be more scientifically rigorous and more useful to decision-makers if it is developed as an ongoing process involving external partners, rather than a periodic event owned and prescribed entirely by the federal government. The goal is to achieve an evolving record of conditions, documented using well-articulated methodologies, in contrast to periodic assessments that may comprise shifting arrays of methods, assumptions, and priorities.

Although federal government leadership will be critical in providing links to policy and furnishing national-scale infrastructure and capacity, a biodiversity and ecosystem services assessment could be developed in a partnership between NGOs; philanthropic foundations; private-sector entities; agencies of the U.S. government; and selected state, local, and tribal agencies. A sustained assessment effort can be strategically phased to require relatively low levels of resources on an annual basis, with topical and regional assessments phasing in and out, and real-time links to NCA reports and public databases via EcoINFORMA. Inclusion of multiple institutional partners can bring an array of in-kind and funding resources, ensuring a stable future from a resource perspective (20).

Such an approach requires long-term commitment to the process and strong integration with at least one and prefer-

ably multiple federal science agencies. The community will need to be creative in bridging the public-private divide and should look to innovative models (e.g., the National Park Foundation).

Historically, the United States has been a leader in responsible management of public lands, stewardship of water and timber, conservation of migratory and endangered species, and protection of air and water quality. Similarly, it has led development and application of key indicators of economic performance, social welfare, and public health. We call on the White House transition team, and colleagues in government, academic, NGO, and business sectors, to build on this legacy by launching a national biodiversity assessment commensurate with our natural and cultural heritage and with our needs to preserve the natural systems that sustain us. ■

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