

THE NATIONAL ACADEMIES
Board on Environmental Change and Society

Values of Ecosystem Services and Climate Impacts in Decision-making

Importance and problem definition

Two national assessments of the potential impacts of climate change on the United States have been conducted (USGCRP 2000; Karl et al., 2009), and a third is nearly complete. These reports have all focused on potential impacts across a broad range of systems and sectors (e.g., various ecosystems and biological diversity, land and water resources, agriculture, transportation, energy, human health and welfare) and regions of the nation. Importantly, however, these reports have *not* included comprehensive economic assessments of potential impacts for sectors, regions, or the nation as a whole, although an interagency workshop has been held on the topic (USGCRP 2011).

Similarly, agencies are following directives (e.g., Executive Orders 13514, 13626, 13653; PCAST, 1998, 2011; OMB-OSTP Memos on Science and Technology Priorities) to include ecosystem goods and services, and their values, in their management of public lands and in interactions with private landholders and other interests. Several approaches are being taken, including the Biodiversity and Ecosystem Services Trends initiative (BEST), the work of the National Ecosystem Services Partnership (NESP), the Natural Capital Project (NCP), and others at agency or regional levels, as well as in academia and non-governmental organizations.

In none of these cases are there commonly agreed-upon, validatable methods for developing valuations and utilizing metric(s) other than dollars for market externalities, that are comparable across ecosystem types, regions, or the nation. Such information is critical to public and private sector decision making (just a few examples):

- in valuing the impacts associated with different scenarios of climate change, and thus the potential benefits of mitigation;
- in decisions about tradeoffs between one ecosystem service versus another in adaptation planning and action;
- in evaluating effectiveness of mitigation or adaptation actions, or habitat restoration or preservation; or
- in comparing costs and benefits by region across the nation.

Estimates of these kinds that are based on *ad hoc* methodologies can spark controversies that delay needed actions.

Why is an NRC BECS project needed?

The concept of “value” is defined and measured differently by different academic disciplines, and there is at present no single definition or approach that can be identified and used in a context as complex as the NCA or the nation’s array of ecosystems. “Valuation” is the process of assigning worth – often expressed in monetary terms but also using other measures such as mortality, loss of natural habitats or biodiversity, population dislocation, and even intangibles such as intrinsic enjoyment. It is, in fact, often not desirable to assign monetary metrics.

Just as there is no unique definition of or metric for value, there is no a single method for the process of valuation. Some approaches are appropriate to some types of assets, but not to others. The political, social and economic context for valuation matters a great deal and can affect the choice and appropriateness of metrics and methods. Regardless of method(s) chosen, it is necessary that it be possible to validate the results and to compare the results across instances of use (different ecosystems, different national regions, etc.).

There are a number of economic techniques that have been applied to assign values to a range of assets and outcomes that are appropriate when market goods or physical infrastructure are involved. However, strong reservations have been expressed regarding the extent to which these methods should be used to capture some categories of ecosystem goods and services, cultural changes, or impacts of change on communities. Even many economists point out that economic valuation faces significant challenges when applied to such problems as climate change. Therefore, a substantial body of research and practice in the decision sciences has focused on valuing the consequences of alternative management options in non-economic terms (Arvai and Post, 2012; Keeney and Gregory, 2006).

Challenges persist in the process of valuation as it relates to ecosystem services and to climate change, yet agencies are tasked with incorporating values into their decision-making. If valuation of market externalities such as environmental goods, services, and the costs of impacts on these is to become a significant component of planning, management, and assessments, a wider range of non-monetary, as well as some economic, valuation methods is needed. Application in different sectors on differing topics makes a range of techniques necessary, because of the difficulty of reliably collapsing different kinds of values into a single metric. It is also important that whatever techniques are used, the process must be transparent and reproducible.

There are numerous questions that need to be addressed, but at the same time, there is an expanding body of literature to be examined, and an array of experiences of federal agencies, cooperative extension units, non-governmental entities, and others that can be incorporated. An NRC study would bring together agency practitioners and a range of social and natural science expertise to compare and evaluate options and approaches, derive ideas about best practices, and make suggestions or recommendations for reproducibility, comparability, and transparency that would help alleviate controversies and inform decisions and policies.

An NRC project, with a statement of task crafted by the agencies so that it meets their needs in this area, would provide several benefits: 1) two or three inclusive workshop activities at which the agencies can contribute their current practices, discuss the challenges they face with academic experts and others, and be involved in developing best practices; 2) workshop reports that can provide interim guidance until a final report is issued; and 3) a final report that provides a standard for developing and reporting values that are reproducible and verifiable, that has the imprimatur of the National Academy of Sciences.

References

- Arvai, J. and K. Post. 2012. "Risk management in a developing country context: Improving decisions about point-of-use water treatment among the rural poor in Tanzania." *Risk Analysis* 32: 67-80.
- Karl, Thomas R., Jerry M. Melillo, and Thomas C. Peterson, eds., 2009. *Global Climate Change Impacts in the United States*. Cambridge University Press: New York.
- Keeney, R. L. and R. S. Gregory (2005). "Selecting Attributes to Measure the Achievement of Objectives." *Operations Research* 53(1): 1-11.
- PCAST. 1998. *Teaming with Life: Investing in Science to Understand and Use America's Living Capital*. <http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-teamingwithlife.pdf>
- PCAST. 2011. *Sustaining Environmental Capital: Protecting Society and the Economy*. http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_sustaining_environmental_capital_report.pdf
- USGCRP, 2000. *US National Assessment of the Potential Consequences of Climate Variability and Change*. Washington, DC, US Global Change Research Program.
- USGCRP 2011. *Valuation Techniques and Metrics for Climate Change Impacts, Adaptation, and Mitigation Options: Methodological Perspectives for the National Climate Assessment*. Washington, DC, US Global Change Research Program.