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National Ecosystem Services
PARTNERSHIP

ECOSYSTEM SERVICES CONCEPTUAL MODELS

Considering ecosystem services in decision-making can help identify how choices will enhance, sustain or degrade the benefits nature provides to people by

- Including additional outcomes that are not targeted but may be important (co-benefits or unintended consequences)
- Identifying who will be benefited or harmed by changes in nature's benefits
- Thinking beyond the biophysical effects to the social and economic outcomes to identify the options that yield the greatest benefits.

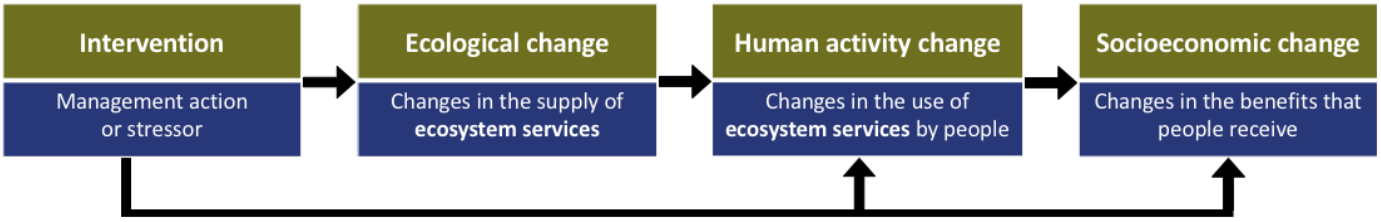
Evidence-Based Ecosystem Service Conceptual Models

Otherwise known as ESCMs, these models can help to simplify and streamline consideration of ecosystem services in decisions (Olander et al. 2016, NAS 2017; Bridge 2017; Potschin-Young et al 2017; Wainger and Ervin 2017; Salafsky 2011; Margoluis et al. 2013; Kelble et al. 2013). These conceptual models link changes in biophysical systems (like a wetland) caused by an intervention (like a stream reconnection) to changes in socio-economic and human well-being outcomes (like property damage and injury due to flooding) and can also include direct, not environmentally mediated, changes in human well-being (like restoration jobs created) (Figure 1) (Olander et al. 2017; TNC 2016). Evidence to support these conceptual models can be collected and documented in evidence libraries, which allows model refinement, estimations of the direction and magnitude of expected changes, and identification of major research gaps. These conceptual models can help managers use various ecosystem services models, analyses, and tools.

> "Ecosystem services are the benefits people receive from nature. Broadly defined, ecosystem services are the benefits that flow from nature to people, for example, nature's contributions to the production of food and timber; life-support processes, such as water purification and coastal protection; and life-fulfilling benefits, such as places to recreate or to be inspired by nature's diversity. There can also be ecosystem disservices, such as mosquito-borne diseases and pollen-induced allergies.
> *— Federal Resource Management and Ecosystem Services Guidebook*

The models can be developed for any given site or management action, or they can be created as general reference models for a type of management or intervention. They can be used to compare effects of different interventions or impacts in different systems. Given a constrained set of ways in which managers manipulate the natural environment and a fixed number of effects such management can have on the environment and people, it appears possible to establish a reference set of evidence-based conceptual models

Figure 1. Illustrative conceptual model showing direct benefits to people and environmentally mediated ecosystem services



that become a go-to resource, thereby providing desired efficiency and consistency in application. For example, typical national forest plans include goals such as fire risk reduction, wildlife support, timber productions, drinking water provision, healthy forest systems, and increased recreational opportunities. Each of these goals tends to have a related and often overlapping set of management activities; for example, healthy forest management may focus on invasive species and pest management, which can overlap with fire risk reduction and timber production activities. As a result, a fixed set of related conceptual models can potentially cover the most common management needs for national forest planning. These reference models can form a simple, credible, and consistent starting place for exploration of ecosystem services by resource managers, and they can be adapted to the specific circumstances and needs of users.

Examples of our work include:

- An ESCM and evidence library for large-scale solar installations, developed with the U.S. Bureau of Land Management
- ESCMs and socioeconomic metrics for oyster reef restoration in the Gulf of Mexico
- ESCMs for timber and fire management developed with the U.S. Forest Service

ESCMs CAN:

- Provide an intuitive entry point for those new to considering ecosystem services
- Get stakeholders and experts on the same page
- Capture priorities and link them to interventions in a transparent and systematic way
- Ensure that no critical outcomes/impacts are missing from consideration
- Provide an evidence-based qualitative assessment of the ecosystem services implications (magnitude and direction of change) of potential interventions/alternatives/scenarios
- Provide a common foundation of best available science to reduce time and expertise requirements and to reduce duplication of effort
- Identify critical information or research gaps that generate significant uncertainty for decision makers
- Identify a subset of socioeconomic metrics that best capture important endpoints
- Provide consistency in services assessed, evidence considered, and metrics selected
- Provide, when desired, a consistent and credible foundation for qualitative assessment, quantitative assessments, or monetary or non-monetary valuation

L. Olander, D. Urban, R.J. Johnston, G. Van Houtven, and J. Kagan, "Proposal for Increasing Consistency When Incorporating Ecosystem Services into Decision Making," National Ecosystem Services Partnership Policy Brief 16-01, Durham, NC: Duke University, 2016; National Academies of Sciences, Engineering, and Medicine, Effective Monitoring to Evaluate Ecological Restoration in the Gulf of Mexico (Washington, D.C.: The National Academies Press, 2017); H. Tallis, K. Kreis, L. Olander, and C. Ringler et al., Bridge Collaborative Practitioner's Guide: Principles and Guidance for Cross-sector Action Planning and Evidence Evaluation (Washington D.C.: The Nature Conservancy, 2017); M. Potschin, R.H. Haines-Young, C. Görg, and C. Schleyer, "Understanding the Role of Conceptual Frameworks: Reading the Ecosystem Services Cascade," Ecosystem Services 29C (2017): 428–440; L. Wainger and D. Ervin, eds., The Valuation of Ecosystem Services from Farms and Forests: Informing a Systematic Approach to Quantifying Benefits of Conservation Programs, Council on Food, Agricultural and Resource Economics (C-FARE) Report No. 0114-301, Washington, D.C., 2017; Nick Salafsky, "Integrating Development with Conservation: A Means to a Conservation End, or a Mean End to Conservation?" Biological Conservation 144 (2011):973–978; R. Margoluis, C. Stem, V. Swaminathan, M. Brown, A. Johnson, G. Placci, N. Salafsky, and I. Tilders, "Results Chains: A Tool for Conservation Action Design, Management and Evaluation." Ecology and Society 18, no. 3 (2013):22; C.R. Keble, K.R. Loomis, S. Lovelace, W.K. Nuttle, P.B. Ortner, P. Fletcher, G.S. Cook, J.J. Lorenz, and J.N. Boyer, "The EBM-DPSER Conceptual Model: Integrating Ecosystem Services into the DPSIR Framework," PLOS One 8, no. 8 (2013):1–12.

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