

## Developing and Testing a USACE Ecosystem Services Analysis Framework

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Because the US Army Corps of Engineers (USACE) provides hundreds of millions of dollars in federal cost share for large- and small-scale ecosystem restorations, the methods it uses to assess and quantify ecosystem service benefits of environmental restoration, including nature-based solutions, could strongly influence restoration decisions in the US. To provide a strong scientific basis for decision-making, a team of researchers from academia and the USACE applied evidence from ecological, economic and decision sciences to develop a framework for ecosystem service (ES) benefit measurement. The framework shares elements with other national assessment frameworks but was adapted to the planning needs of the USACE in multiple ways. For example, the ecosystem service typology that was developed uses final services, to the extent possible, to clearly communicate the social benefits being produced through restoration actions.

The core of the framework is a conceptual model that establishes a series of causal relationships to link biophysical changes to social benefits. Biophysical changes are projected as a function of project design and expected performance using location context. Benefits are communicated using monetary and non-monetary benefit relevant indicators (BRIs). Both types of benefit measures incorporate magnitude of ecological changes, scarcity of services, public preferences, and other economic determinants of value.

A test of the framework using a case study revealed that a key benefit is improving the breadth of ecosystem services evaluated during project scoping and also communicating how project design was informed by expected benefits. Using the system can elevate stakeholder concerns that fall outside of project authorities which otherwise have the potential to derail implementation. Further, the approach generates products that communicate how tradeoffs among ES benefits were weighed during planning, rather than leaving connections and assumptions implicit, as is common in current planning communications.

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