ABSTRACT

The widely-used Battelle Environmental Evaluation System [EES] for Water Resource Planning (1972) is being updated to reflect the state of ecological knowledge. The original conceptual framework includes ecology, environmental pollution, esthetics, and human interest defined by 78 environmental quality (EQ) parameters. Each parameter is scaled from 0 (bad) to 1 (good) to establish a common base in Ecological Impact Units (EIUs); weights are assigned to each parameter to reflect relative importance. Building on this approach, the updated ECOTREND™ EES establishes a conceptual model that links human stressors or restoration activities to resilience of ecosystem functioning, preservation of intrinsic value, and changes in human-valued natural resources and ecosystem services – collectively, the change in EQ from a human activity. The conceptual model is useful for estimating the impact of human activities on EQ using heuristics derived from empirical data. The output from the analysis can provide a baseline of EQ and project likely changes in EQ resulting from proposed human activities.

PURPOSE

The overall objective of this research is to update the Battelle EES by:

• Establishing a conceptual model for evaluating EQ consistent with the state of ecological and economic knowledge; and
• Developing ecologically-grounded heuristics for evaluating EQ.

The ECOTREND EES establishes baseline environmental conditions and projects environmental impacts of policy alternatives. The heuristic-based screening analysis can be supplemented with sophisticated ecological or economic modeling and analysis approaches, depending on the rigor required, and available time and funding.

APPROACH

Focusing on watershed-level aquatic-linked ecology within the U.S. temperate forest biome: (1) update the conceptual model; (2) select parameters; and (3) develop screening-level heuristics for parameters. (Ecosystem goods and services heuristics will be added in 2010.)

• Identify changes to the Battelle EES (1972) methodology needed to be consistent with current ecological and ecological economics perspectives.
• Develop an overall scale-independent conceptual model and general analytical approach for use in the ECOTREND EES.
• Select ecological parameters for inclusion in the aquatic ecology focused ECOTREND EES.
• Perform a literature review to update the assumptions and data for ecological parameters included in the ECOTREND EES; identify knowledge gaps.
• Update/create heuristics for selecting the EQ values corresponding to levels of parameters included in the ECOTREND EES.

CONCEPTUAL MODEL AND PARAMETERS

Assumptions: (1) observed ecosystem functioning depends on a small number of factors at each level in a nested hierarchy, from biome-level (precipitation, temperature, and substrate) to in-stream (e.g., oxygen and toxins); and (2) anthropogenic changes at any hierarchical level impact nested ecosystems.

KEY LEARNINGS, ISSUES, AND NEXT STEPS

• A robust and broadly applicable conceptual model has been developed.
• The rapid, low cost screening approach may be useful to indicate the direction and magnitude of EQ changes arising from human actions.
• Screening may include significant uncertainties that arise from synergies among parameters, location-specific factors, and confounds that may result in underestimates or overestimates of EQ in the screening approach; uncertainties may be reduced by incorporating models and analysis with greater scientific rigor.

Next Steps to Complete ECOTREND EES and Reduce Uncertainty:

• Add ecological economic heuristics (rules for use of benefits transfer method);
• Add biome-specific heuristics to improve location-specific accuracy;
• Establish social weights for parameters;
• Vet the approach with technical experts; and
• Evaluate utility for novel environments or stressors.

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