The Economic Feedback Loop for Ecosystem Service Policy Changes: The Glenn Canyon Dam Example

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Overview

- What are Ecosystem Services?
- The Economic Connection
- Logic Model for Policy Change
- So What?
What are Ecosystem Services?

- **Natural resources:** tangible assets provided by nature (collectively, ecosystems)
- **Functions:** biophysical processes of natural resources that can be assessed independently of any human context
- **Services:** beneficial outcomes of functions that are appreciated by people
What are Ecosystem Services?

Examples

<table>
<thead>
<tr>
<th>Resource</th>
<th>Function</th>
<th>Service</th>
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</thead>
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<td>Wildlife</td>
<td>Reproduction</td>
<td>Hunting</td>
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<tr>
<td>Wetlands</td>
<td>Hydrologic processes</td>
<td>Flood control</td>
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<tr>
<td>Vegetation</td>
<td>Photosynthesis</td>
<td>Aesthetics</td>
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</tbody>
</table>

This distinction is important

- People understand the beneficial outcomes they appreciate (services), but probably not the underlying biophysical processes (functions)
- Functions are necessary - but not sufficient - for the provision of services
The Economic Connection

- The economy and the environment are interrelated
  - *Law of conservation of mass-energy (Einstein)*: the total amount of mass and energy is constant (although mass and energy can interconvert)
    - The environment, broadly defined, is a closed system
    - Environmental inputs to the economy must either accumulate as durable goods or be returned as residuals
The Economic Connection

Economic System

Production
Firms

Goods

Labor

Consumption
Households

Extraction

Residuals

Ecological System
Air, Water, Minerals, Biota, and Amenities

Energy

Sun
The Economic Connection

The strength of the economy depends on the functional integrity of the environment for its:

- Ability to provide inputs
- Ability to assimilate residuals
The Economic Connection

The economy functions best when it recognizes the economic values provided by the environment

- **Economic efficiency**: a market maximizes net benefits
  - Prices signal the value of resources in alternative uses
  - Self-interest naturally guides the allocation of resources to their highest valued uses

- **Market failure**: a market fails to maximize net benefits
  - Many ecosystem services have no prices to guide their allocation to higher valued uses
The Economic Connection

- Types of economic values
  - **Direct use values**: net benefits derived from direct interaction with resources
    - Examples
      - **Consumptive uses**: values for hunting
      - **Non-consumptive uses**: values for wildlife viewing
    - Involve observable behavior
    - Current or future use
    - On or off-site use
Types of economic values (cont.)

- **Passive use values**: net benefits derived independently from direct interaction with resources
  - Value of knowing resources exist or will be preserved in a given condition
  - Motivations include bequest, altruism, and ethics
  - Examples
    - Concern for resources injured by the Gulf of Mexico oil spill
    - Concern for threatened or endangered species

- Also known as “non-use” and “existence” values
The Economic Connection

- Types of economic values (cont.)
  - **Regional economic impacts**: levels of local economic activity
  - Types
    - Jobs
    - Sales revenues
    - Tax revenues
  - These are generally “gross” values and not appropriate for cost-benefit analyses
  - However, these are the most salient economic values to the public, and thus to policy-makers
Logic Model for Policy Change

Resource Management Decisions

Equity Considerations

Visitor Demand (Direct Use Values)

Local Economic Activity (Jobs, Sales Revenues, Tax Revenues)

Efficiency Considerations

Quantity & Quality of Ecosystem Service Provision

National Significance (Direct & Passive Use Values)

Cost-Benefit Allocative Significance
Logic Model for Policy Change

Example: Glen Canyon Dam Operations EIS

- Dam completed in 1963 to promote water storage, irrigation, flood control, and hydro power
- By the 1980s the dam had adversely impacted native and non-native fish populations
  - Reduced sediment transport
  - Decreased water temperatures
- Operations alternatives intended to:
  - Reduce further adverse impacts
  - Enhance valuable ecosystem components
Logic Model for Policy Change
Logic Model for Policy Change

- This EIS was (probably) the first to analyze the full scope of economic values, including passive use values.
- All alternatives considered provided similar direct use values.
- Passive use values were decisive in the ROD.
  - Selected alternative:
    - Hydro power: *loss* of $15.1 - $44.2 million per year
    - Passive use: *gain* of $3,375.2 million per year
In other words, passive use values were key to the function of the economic feedback loop.

... nonuse value results are an important contribution of [the analysis] and deserve full attention as decisions are made regarding dam operations.

National Research Council
So What?

- The economy and the environment are interrelated
  - The economy functions best when it recognizes the economic values provided by the environment

- All economic values are influential
  - Failing to account for some values can bias policy decisions

- The full economic valuation of ecosystem services is key to their provision
References

- http://www.ecosystemvaluation.org
  - Brief non-technical explanations

  - http://www.humboldt.edu/~envecon/ancil.htm
  - Comprehensive discussion accessible to general audiences