Adaptive Management for Ecosystem Services

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Self organization in ecosystems

- Humans are reliant on ecosystems
- Humans manipulate ecosystems
- Ecosystems are complex adaptive systems
- This manipulation can lead to catastrophic ecosystem collapse
Soil ped (cm)

RULES
- Climate
- Biological activity
- Relief
- Parent material
- Time

Self organization in ecosystems
soil as an example

Self organization in ecosystems

Feedbacks matter, and yield ES

• Primary production
• Atmosphere and climate regulation
• Waste processing
• Erosion control
• Medicinal resources
• Pest control
• Disease mitigation
Ignoring Cross Scale Dynamics
Lessons from History
Now what?

- Humans are reliant on ecosystems
- Humans manipulate ecosystems
- Ecosystems are complex adaptive systems
- This manipulation can lead to catastrophic ecosystem collapse
Adaptive Management

A structured approach to managing natural resources while avoiding critical thresholds

![Adaptive Management Diagram]

- Define the Problem
- Identify Objectives
- Formulate Evaluation Criteria
- Estimate Outcomes
- Decide
- Implement
- Monitor
- Evaluate
- Adjust

Uncertainty
- Low
- High

Controllability
- Low
- High

Scenario Planning
- Prepare
- Apply Best Practice

Adapted for natural resources management.
How to produce multiple ecosystem services?
- Primary production
- Atmosphere and climate regulation
- Waste processing
- Erosion control
- Medicinal resources
- Pest control
- Disease mitigation
Evaluate Tradeoffs

 Corn Soybean Rotation

 Tallgrass Prairie

 Cedar Woodland

Habitat for Native Species
Fuel
Fresh Water
Food
Carbon Sequestration
Pollination
Erosion Protection
Spiritual & Cultural Benefits

Define the Problem
Identify Objectives
Formulate Evaluation Criteria
Estimate Outcomes
Decide, Implement, Monitor, Evaluate, Adjust

Evaluate Tradeoffs

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Research article

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ABSTRACT

Management of natural resources for the production of ecosystem services, which are vital for human well-being, is necessary even when there is uncertainty regarding system response to management action. This uncertainty is the result of incomplete controllability, complex internal feedbacks, and non-linearity that often interferes with desired management outcomes, and insufficient understanding of these systems. Adaptive management processes, which allow for reactive adjustment of management actions based on new information, may be the most effective means to manage ecosystem services in the face of uncertainty.
Thank you