SUSTAINABILITY:

AT WHAT SCALE

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Perspectives on Scale

More and more writers on environmental problems acknowledge the central role of **scale** in**:**

identifying
monitoring
analyzing

environmental problems.

Sustainable Living

Learning to think and live sustainably is a matter of adjusting the SCALE at which we perceive, care for, and manage natural systems.

Historically, Newtonian-influenced scientists have assumed:

- "objective space" as stable spatial coordinates that objects can be located in
- "reductionism“ = the assumption that larger scale phenomenon can best be understood by analysis into smaller phenomena

So, space was understood as:

- **Homogenous**
- **Perspectiveless**

QUESTION: When was the last time you used the phrase, “basic science”?

- *“Basic” science and “applied” science have merged*
- *There is no “basic” science*
- *There is no “basic” scale*

Funtowicz and Ravetz[1] distinguish between:

- **Curiosity driven science**: peer-reviewed by discipline

- **Mission-oriented science**: broadened peer review by multiple disciplines and stakeholders

[1]Funtowicz, Sylvio and J. R. Ravetz. 1995. “Science for a Post-Normal Age,” in L. Westra and J. Lemons, Eds. Perspectives on Ecological Integrity, pp. 146-161. (Dordrecht, The Netherlands: Kluwer Academic Publishers).

So how do values manifest themselves in scientific, descriptive literature?

Values manifest themselves in the transition from academic, curiosity-driven science to mission-oriented science.

Environmental Pragmatism

The Problem of Problem Formulation

- **You don’t have a “problem” until you have a social value at risk**
- **Specification of social values can be the key to clearer problem formulation**

Pragmatism:

Language and action are intertwined, and concepts and models are TOOLS for understanding—but understanding is relative to one's goals and purposes.

William James' Pluriverse:

Every phenomenon can be

- **looked at from multiple perspectives**
- **modeled in different & incommensurable ways**

There is no perspectiveless perception

- So models—and data-bases—need to be built:
  - from some "perspective"
  - At some scale
- How should we choose that perspective and scale if our goal is to achieve sustainability?

Conclusion of this part:

- **We do not FIND scale in nature, we CHOOSE a scale on which to understand, monitor, model and manipulate nature.**
- **But this conclusion leads immediately to another question:**

QUESTION: On what basis do we choose the scale at which we monitor and model natural and human systems?

ANSWER:

The scale at which we choose to monitor, understand, and manage is ultimately a function of human purposes and values.

What tools do we have to study values, goals and purposes?

Valuation Studies Today:
Two Monistic Approaches

- Economic models based on pricing
- “Deep Ecology” models based on saving nature for its own sake

Monism

Monism
all values must be of the same general type, and all problems can be resolved by a single principle

- **For Economists, all values are "commodity" values, measured by price (as proxy for "welfare")**

- **For Environmental Ethicists, all moral considerability depends upon "intrinsic value" (to count morally, a being must be considered "an end in itself")**

We are at an Impasse:

- We must understand social values (such as a normative commitment to sustainability) if we are to get scale and perspective right

- But when we turn to Valuational Studies, the tools to study environmental values:
  - Are highly controversial
  - and offer no hints as to proper scale to address problems

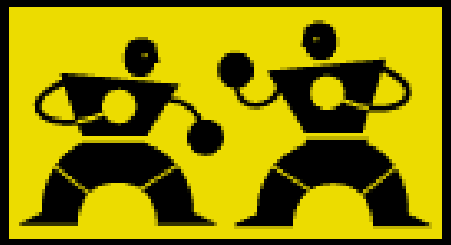
The Great Debate

The discussion of environmental values has, since the 1970s, been polarized across the disciplinary divide:

Environmental Ethics.

vs.

Environmental Economics



Big-Picture Look at a New Approach to Environmental Ethics:

- if developed in a certain way, the ideas of ***adaptive management*** can provide a way out of the quandary about valuation.

Environmental Ethicists:

- Believe that most (or at least many) environmental problems are irreducibly moral problems
- Often appeal to "non-anthropocentric" values
- Deny that economic calculations can capture the essential **moral** aspects of environmental problems

Environmental Economists:

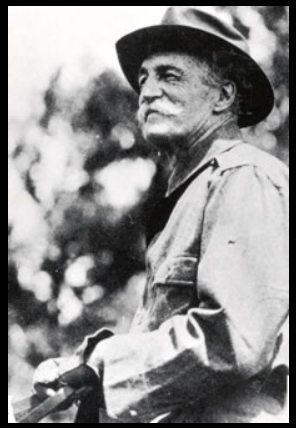
- Believe that all or most environmental values can be measured in economic terms
- “Reduce" moral values to consumer preferences (wtp), to protect a moral value (Contingent Valuation)
- Treat all environmental goods as "commodities" that can be assigned a price

They differ ontologically:

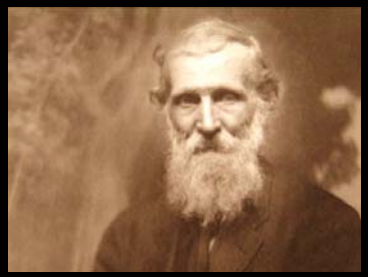
- **Economists attribute value to only humans, and believe human preferences determine value**
- **Most Environmental Ethicists believe natural objects deserve moral consideration, and that many of our actions should be based on moral principle**

This difference corresponds to another divide:

- Those who favor Cost-Benefit Analysis (CBA) as the central methodology of environmental decision making (Gifford Pinchot)



- Those who believe environmental goals should be set by political means, which includes a public debate about aesthetic and moral values, including "non-instrumental" value (John Muir)



I call these two approaches:

CHUNK-AND-COUNT

and

CHUNK-AND-SORT

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Intrinsically valued

Instrumentally valued

These two theories of environmental value share two related assumptions:

- Nature can be discretized (chunked) and
- Some of these discrete chunks have, while others lack, moral "standing" (sorted)

They sort objects differently, however:

- Economists give standing to humans only
- Ethicists count other elements of nature (chunks) as having standing as well.

The end of chunking

- I propose to reject their common assumption—that the values in nature and in resources can be **c**hunked.

- This rejection undercuts the whole debate by making moot the question:

  - ***Which things are morally considerable?***

We do not have to answer this question in order to evaluate environmental change.

- This opens the way for a new approach to evaluation:
  - Evaluating various **"development paths,"** according to **multiple criteria**

The Alternative: Adaptive Management

The 4 pillars of “adaptive” management

- **A Commitment to a Unified Method:**
  - Naturalism; rejection of fact / value dichotomy, reliance on scientific method
- **An Empirical Hypothesis:**
  - Environmental values are expressed in the ways in which people “**bound”** natural systems, and “**model”** their dynamics
- **A New Approach to Scaling and Environmental Problems:**
  - “Modeling” and “bounding” choices are expressions of the values of residents of a **place**
- **A Darwinian Approach to Knowledge, Value & Choice**
  - Adaptive management: the application of a Darwinian analogy to human communities

Aldo Leopold

- Thinking Like a Mountain:
  - a multi-scalar approach to environmental management
  - Accepting responsibility for long-term impacts
- The first “adaptive manager”

Definition of Adaptive Management

- **Experimentalism:**
  - AMs respond to uncertainty by undertaking reversible actions and studying outcomes to reduce uncertainty at the next decision point
- **Multi-Scalar Modeling:**
  - AMs model environmental problems within multi-scaled (“hierarchical”) space-time systems
- **Place-Orientation:**
  - AMs address environmental problems from a “place”; embedded in local natural and political contexts

Values and Scale

So how do values manifest themselves in scientific, descriptive literature?

Adaptive management is mission oriented science.

Values and interests are coded in the choices participants make:

- ***to "model the problem"***
- ***to bound the problem spatially***
- ***to form a temporal horizon, and***
- ***to describe a physiology of a system***

NSF Grant: Ecological Boundary-Setting in Mental and Geo-physical Models[1]

- We are undertaking research to understand:
  - How scientists and stakeholders bound the systems to which they attribute problems, and
  - How those boundaries change in response to political dynamics and social learning

[1]Human Spatial Dynamics Program, NSF Grant, Ecological Boundary-Setting in Mental and Geophysical Models, 2004-2007

Spatio-temporal modeling and values

Values and interests are coded in the choices participants make to "model the problem" – to bound the problem spatially, to form a temporal horizon, and to describe a physiology of a system that is considered problematic.

Thinking Like a Watershed

General hypothesis:

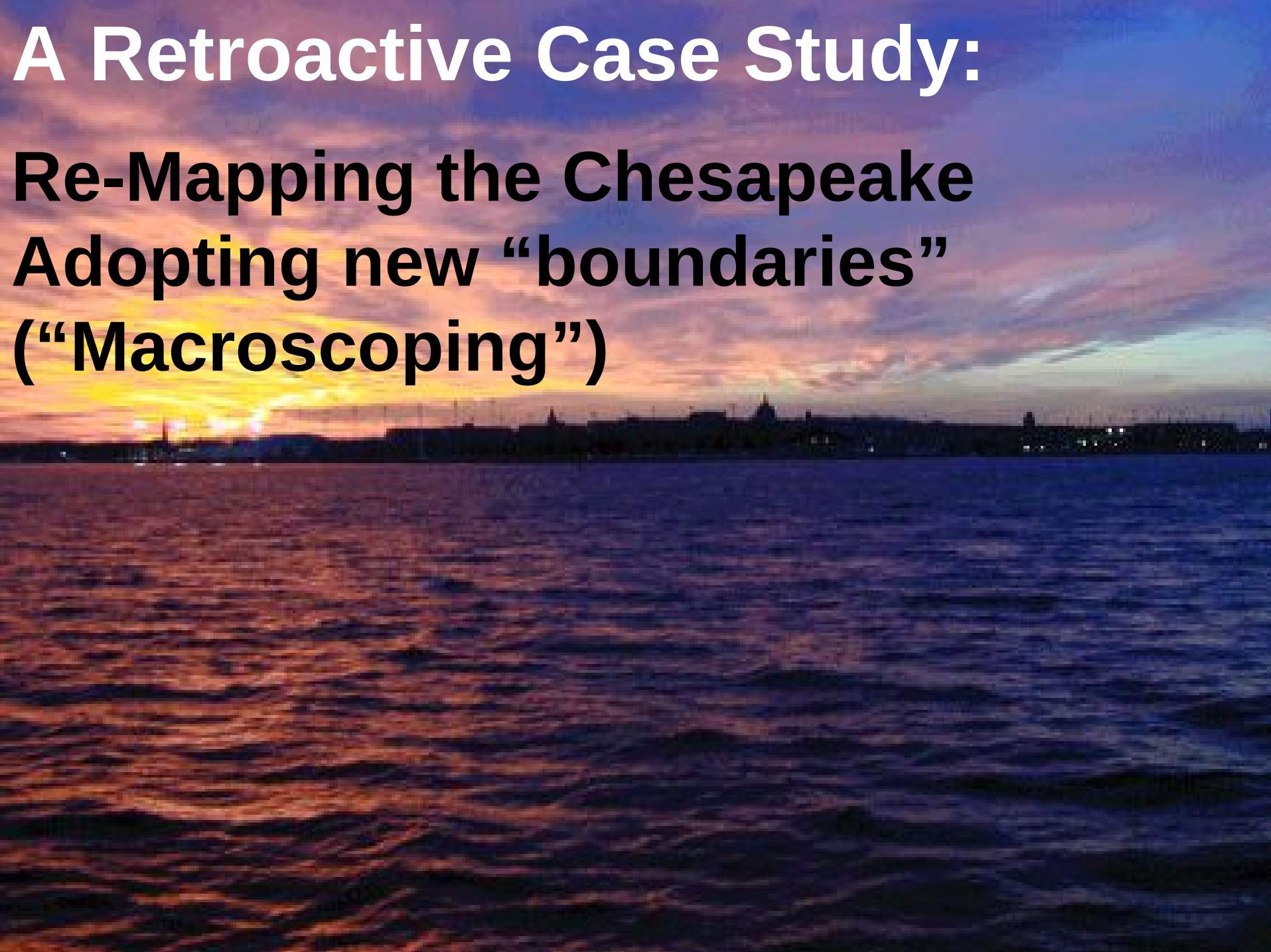
- Values are embedded in the choices individuals and groups make when they choose a “mental model” of the problem at hand.

Specific hypothesis:

- The values of individuals and groups are embodied in the spatio-temporal scales they attribute to the system that is identified as problematic.

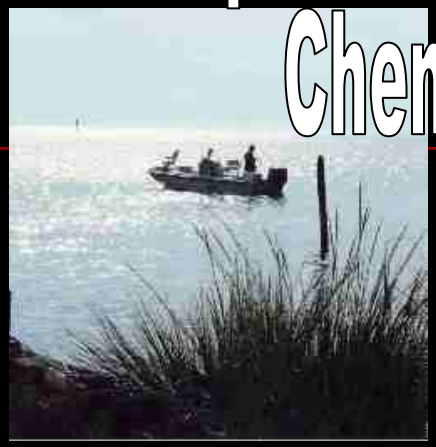
A Retroactive Case Study:

Re-Mapping the Chesapeake
Adopting new “boundaries”
(“Macroscoping”)



Worried about . . .

Oil Spill

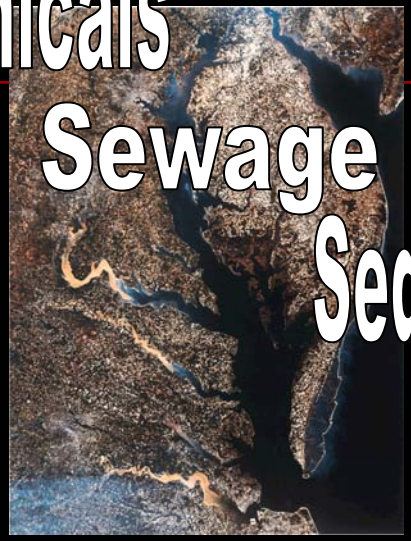


Bay

Chemicals

Sewage

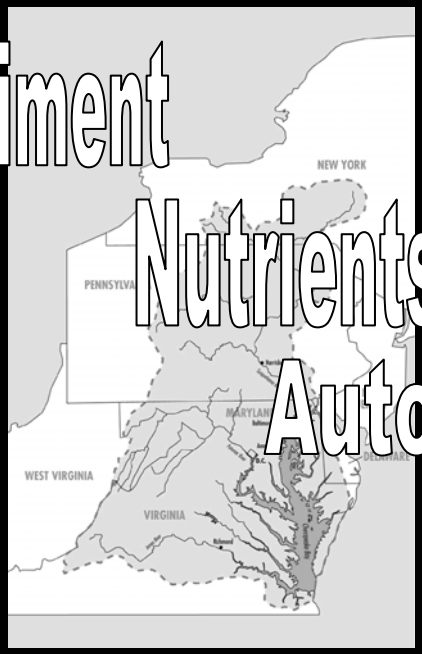
Sediment



Bay and its tributaries

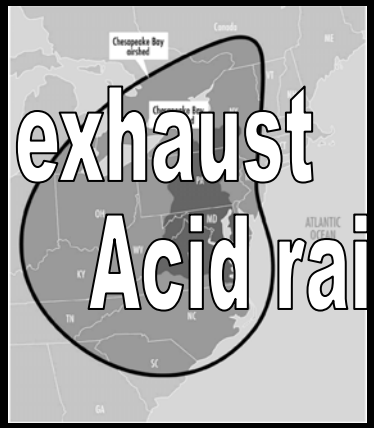
Nutrients

Auto exhaust



Watershed

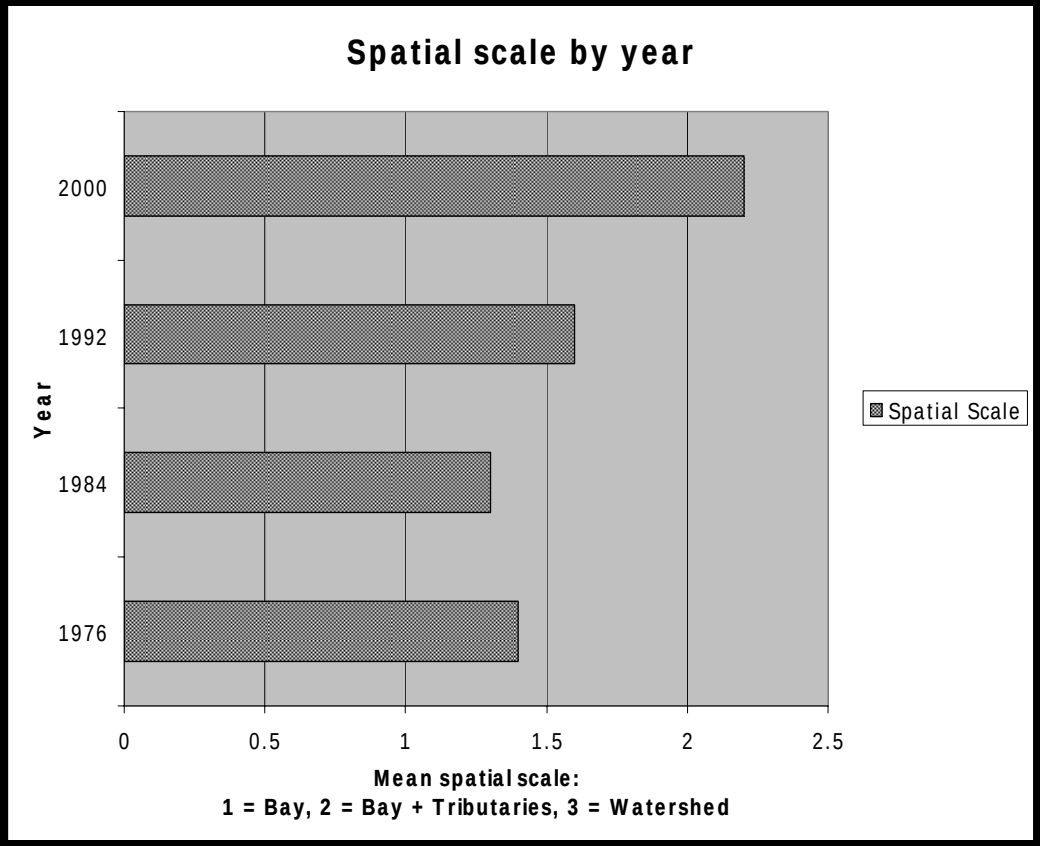
Acid rain



Air-shed

Thinking like a . . .

"We are throwing out our old maps of the bay. They are outdated not because of shoaling or erosion or political boundary shifts, but because the public needs a radically new perception of North America's greatest estuary"[1]



A content analysis of newspaper articles from a local Annapolis, MD paper, 1976 – 2000.

Key: 1= Bay only

2= Bay plus specific tributaries

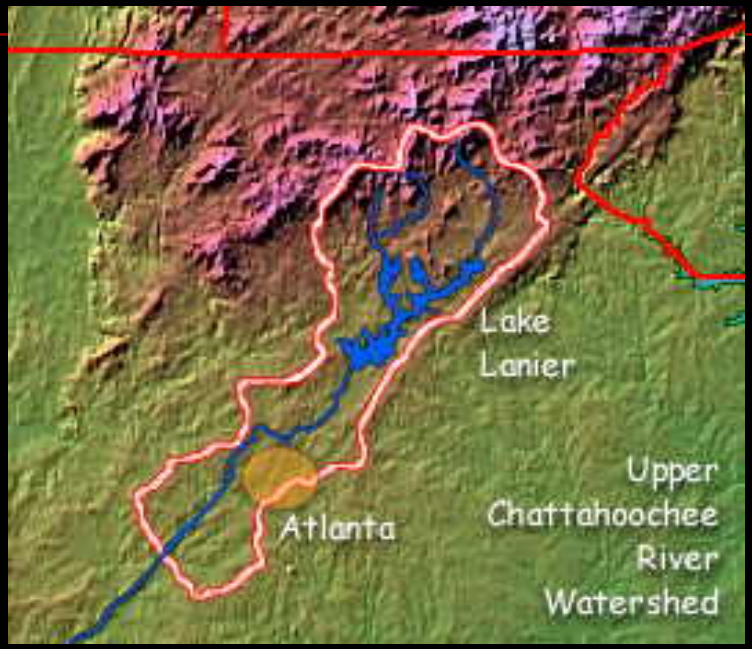
3= Watershed

[1]Horton, Tom. "Remapping the Chesapeake," The New American Land September-October, 1987:7-8.

Macroscoping

- Sometimes intransigence of environmental problems is due to the adoption by participants of inappropriately scaled “mental models” of environmental problems

Current Research:
Management of Lake Lanier, Georgia.



- Sense of place
- System boundaries
- Mental models of pollution dynamics

<u>Working Hypothesis</u>: Lake Lanier stakeholders, unlike Chesapeake Bay stakeholders, do not currently "think like a watershed."

Re-Thinking Environmental Problems

- As “Wicked”
- As “multi-scalar”
- As competition among multiple goods

Rittel and Webber[1] distinguish between "benign" and "wicked" policy problems:

- **Benign problems:**
  have determinate answers

- **Wicked problems:**
  no determinate solution

[1]Rittel, H. W. J. and M. M Webber. 1973. "Dilemmas in a General Theory of Planning," Policy Sciences 4: 155-169.

Environmental problems are wicked problems

- *No agreement on problem formulation*
- *Perceived differently by different interest groups*
- *Resolution = temporary balance among competing interests and social goals*
- *As society addresses one set of symptoms, new symptoms emerge*

Temporal aspects of wicked problems

- One aspect of wicked problems is temporal open-endedness.
- This requires that we choose a temporal horizon over which we characterize a problem.

- **<u>Hierarchy theory</u>: a theory by ecologists used to organize spatio-temporal relationships in complex, dynamic systems.**

Hierarchy Theory

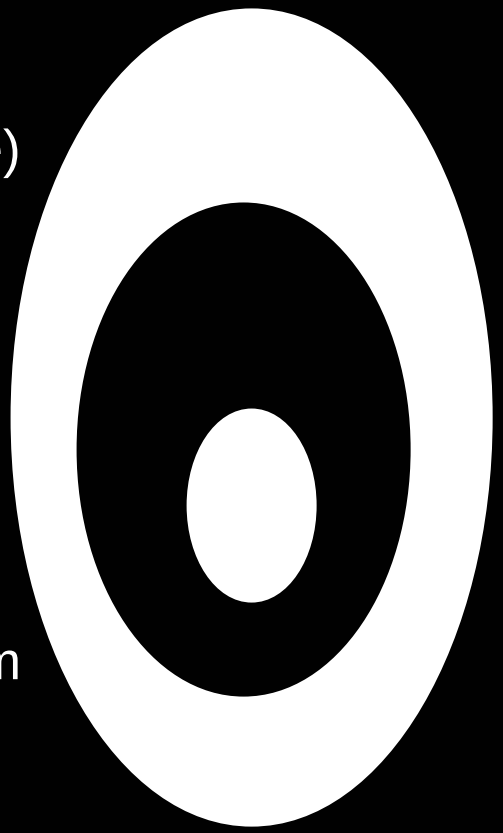
Hierarchy theory models space-time relationships in a useful way.

Axioms of Hierarchy Theory

(i) A system is conceived as composed of nested subsystems, such that any subsystem is smaller (by at least one order of magnitude) than the system of which it is a component

(ii) All observations of a system are taken from a particular perspective within the physical hierarchy

(ii') All observations **<u>and evaluations</u>** are taken from a particular perspective within the physical hierarchy



A Process-Oriented, Multi-Criteria Approach

2 approaches to environmental values: “Entities” vs. “Process”

Entities approach:

- Economists and environmental ethicists argue about which entities have moral value and which don’t.
- These arguments assume nature can be “chunked” and treated as discrete entities.

2 approaches to environmental values: “Entities” vs. “Process”

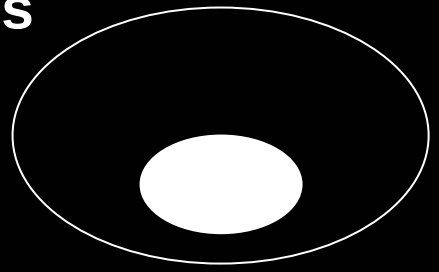
Elements of a process approach:

- Development pathways
- Scenarios
- Back-casting
- Multiple criteria

A new approach to evaluating changes in human dominated systems

- **Environmental management takes place within systems embedded in larger and larger – and progressively slower changing – super-systems**

- **Each generation is concerned for its short-term well-being, but also must be concerned to leave a viable range of choices for subsequent generations**



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Adaptation embodies at least two “scales” of time

Toward a Pragmatist Epistemology for Environmental Science and Policy

John Dewey

- Unified Method of Experience:
  - A claim that some thing or some process is *valued* is a hypothesis that the thing or process is *valuable*.

- Unified Method of Experience

  = Naturalism

Pluralism: a continuum

PLURALISM:

We accept that citizens in diverse democratic societies value nature

- *in multiple ways*
- *and over multiple scales*

Values	Examples
Spiritual	Solitude
Sustainability	Bequest
Non-consumptive recreation	Photography
Recreation	Fishing
Consumptive	Food and Fiber

Multi-Criteria Analysis

- **We avoid the Dilemma of the Chunkers by evaluating**

DEVELOPMENT PATHS

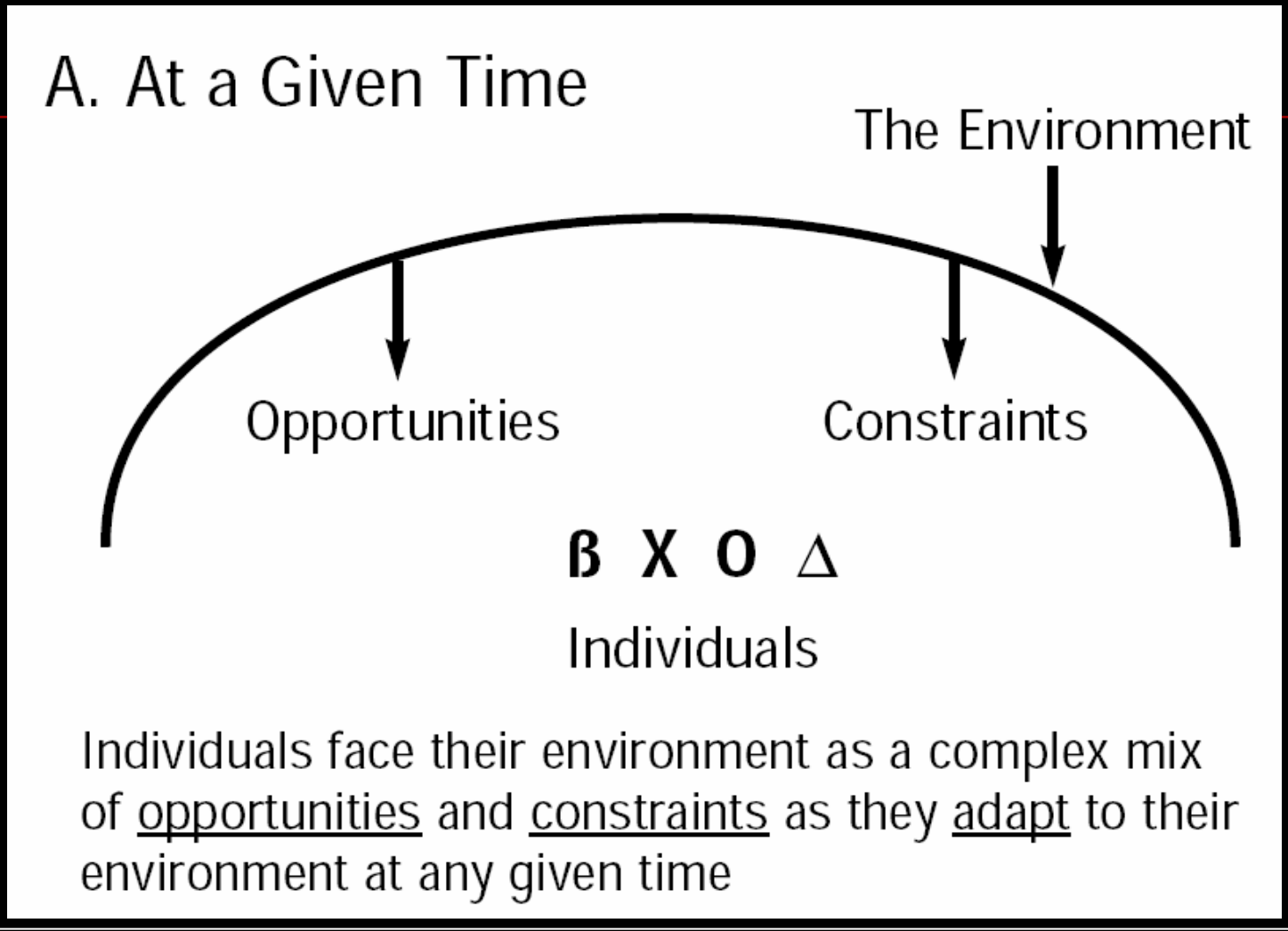
  - ***WITHIN AN OPEN AND DELIBERATIVE PUBLIC POLICY PROCESS***
  - ***ACCORDING TO MULTIPLE CRITERIA***

The Evaluation Process:

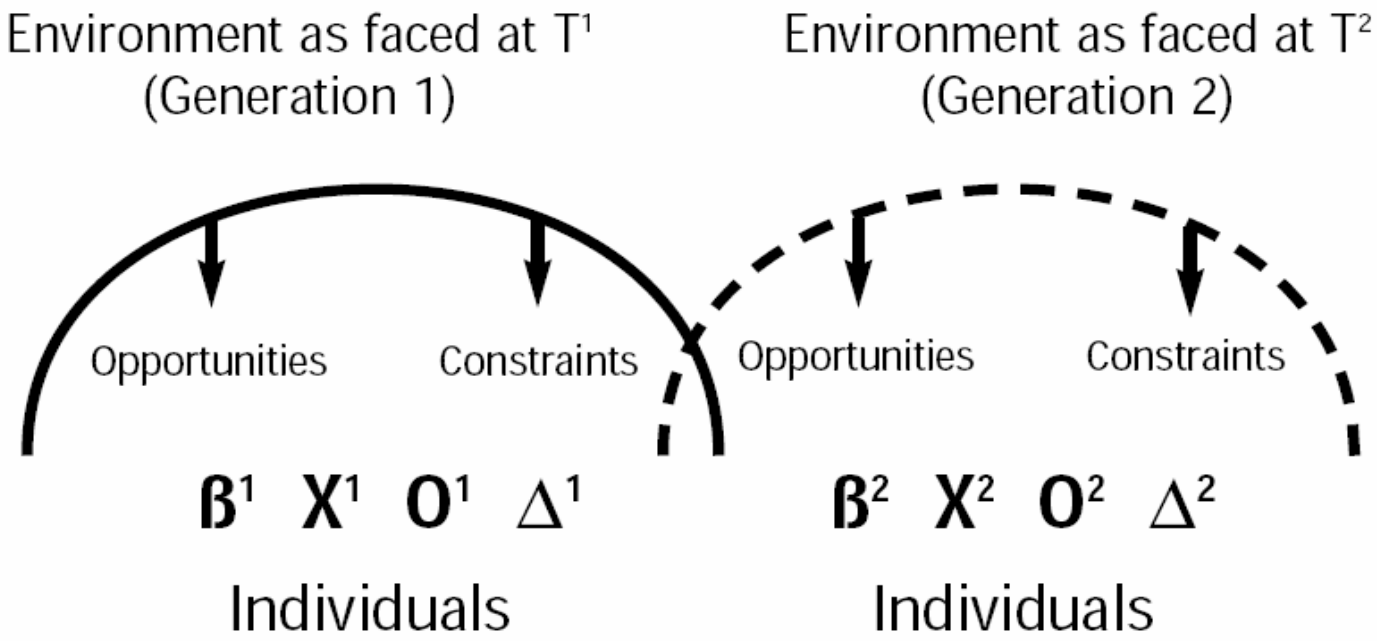
- **Driven by a community-based discussion of which *ENVIRONMENTAL INDICATORS* will be monitored and measured**
- **Community values will be expressed as arguments that a given indicator is important to social values**
- **Indicators chosen reflect what is important to stakeholders in a <u>place</u>**

Sustainability in Multi-Scalar Systems

A Hierarchical Model of Resource Use



B. The Cross-Scale Dynamic across Time



Choices made by members of an earlier generation can change the mix of opportunities and constraints faced by subsequent generations, limiting the latter's choices in their attempt to adapt

“Schematic definition” of sustainability

Generation G_1 is living sustainably over a given time horizon if and only if they fulfill their needs without reducing the ratio of opportunities to constraints as faced by Generation G_2, G_3. . . G_N.

VII. Synoptic Criteria

- GOAL: To embed value articulation within an Adaptive Management Approach

- This can be accomplished by focusing attention on choosing appropriate indicators[1]

[1]See Judith E. Innes and David E. Booher, "Indicators of Sustainable Communities: A Strategy building on Complexity Theory and Distributed Intelligence,"Planning Theory and Practice, 1:No. 2 (2000): 173-186

Why Synoptic Indicators?

- One criterion (e.g. economic impacts) is not enough
- Most attempts by communities to specify indicators lead to huge lists that are unmanageable. What can adaptive managers do with 150 indicators?
- Synoptic indicators are just right: Choosing them leads to iterative deliberation about goals.

An Example:
Some criteria for growth in Atlanta

- Economic indicators: job growth
- Smart Growth Indicators: percentage of land surfaces that remain pervious
- Regional Indicators: maintenance of traditional forest cover/natural history

Goal-Setting process now involves a public debate about three questions:

1. What indicators should we track?

2. What management goals should we set with respect to the chosen indicators?

3. How should we weight the various criteria?

Example: De-centralized tree planting programs

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

- **WANGARI MAATHAI, winner of the Nobel Prize for her work in establishing the Green Belt movement in Kenya in 1977**
- **The National Tree Growers Cooperative Federation has organized cooperatives in three Indian States**
  - **Partially supported by the Canadian International Development Agency:**
  - **Cooperatives have 35,00 members (many of them families)**
  - **They have impact at the village level**

From the NTGCF website:

- **“The main challenge is to design and implement a forestry and agriculture production system that generates employment.” (www.rcfa-cfan.org)**

The federation helps members to:

- Secure land tenure or gain access to marginal and degraded lands
- Gain access to credit
- Training
- Technical assistance provided by CIDA

Design programs with multi-scaled benefits in order to:

- Create win-win situations
  - Economic benefits almost immediately (firewood is a salable commodity)
  - Improves ecology
  - Reduces birth rates by reducing household chores
- Strengthen institutions
- Ensure access to land and resources

Environmental Benefits:

- Degraded land systems are reclaimed
- Productive forests and woodlots are established
- Erosion is reduced
- Water retention is improved
- Reduction in birth rates

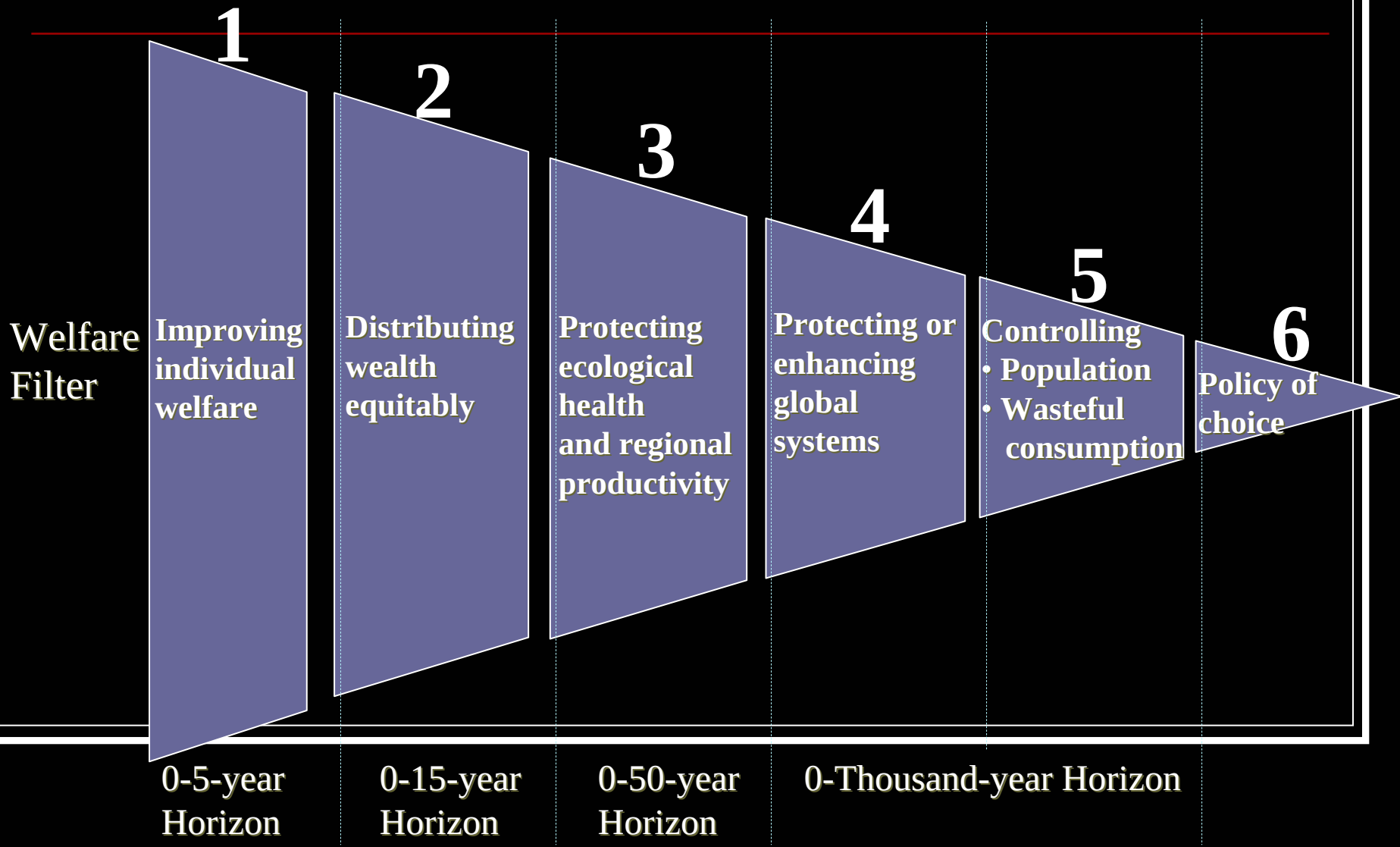
Characteristics of these programs

- They are often organized and carried out mainly by women
- Provided a small loan to invest, women form cooperatives and engage in planting and managing forests on degraded and abandoned lands

Environmentalism as Clever Solutions:

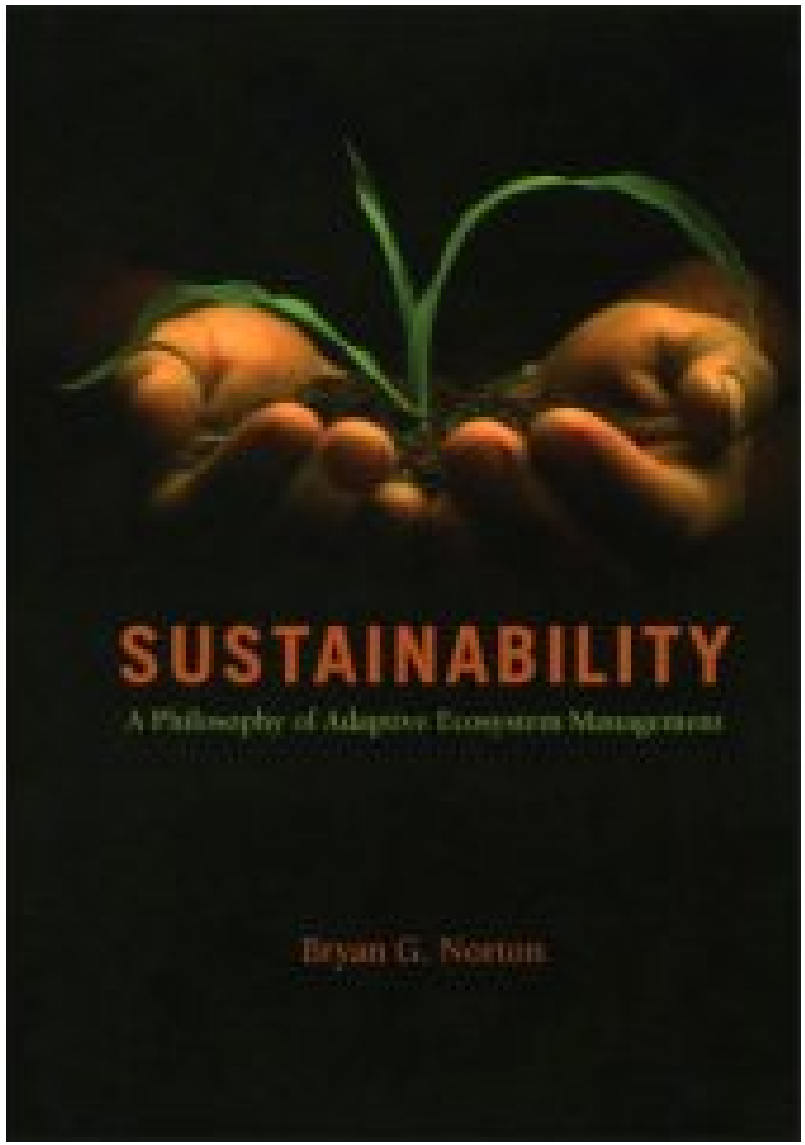
- **I put the emphasis on smart institutions and individuals who can devise solutions that are good for the present and the future**
- **We need to be able to assess impacts of policies on multiple scales of time**

A 6-Filter Evaluation Model for effective policies:



Conclusion:

- Make evaluation endogenous to Adaptive management
- Evaluate changes to processes, not entities (“Development Paths”)
- Develop multiple indicators associated with social values
- Apply multiple criteria (can be associated with multiple scales, horizons, and dynamics)



University of Chicago Press, 2005