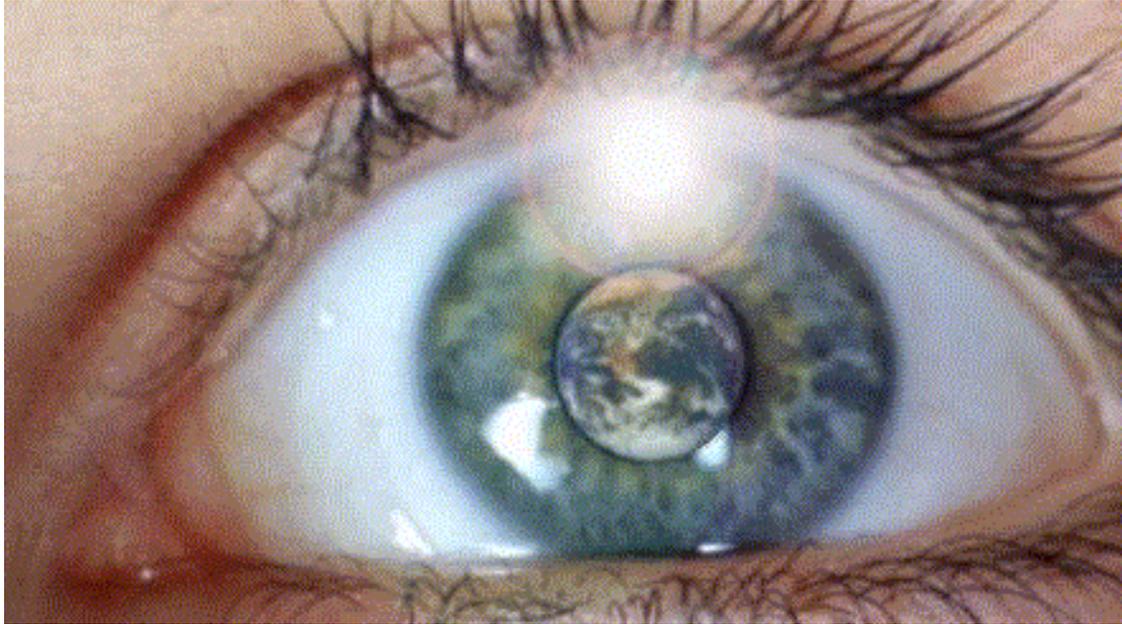


Eliciting Expert Mental Models of Ecosystem Risk



W.G.B. (Bill) Smith

SRA - Europe 1999

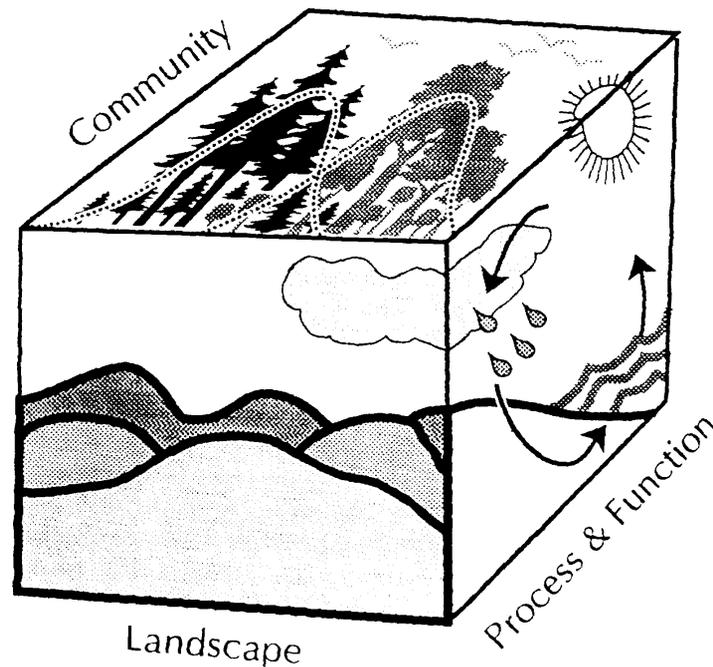
Rotterdam - The Netherlands

Overview

- ▼ Ecosystems
- ▼ The Ecosystem Approach
- ▼ The Importance of Values
- ▼ The Role of Expert Perception
- ▼ Whose Mental Model will save the World?
- ▼ Eliciting Mental Models of Risk
- ▼ RepGrids - Our Tool kit
- ▼ Values - The Key to Integration

An Ecosystem- What is it?

- ▼ Definition - a bounded set of dynamic relationships between living organisms and their environment



The Ecosystem Approach

- ▼ Goal driven
- ▼ Holistic - Placed Based - Multi-Issues
- ▼ Seeks to replace existing piecemeal approaches to conservation, protection & resource management
- ▼ Accepts biophysical constraints to growth
- ▼ Treats ecosystems as a dynamic, integrative systems
- ▼ Adaptive - Recognises our limited knowledge, and demonstrates a willingness to learn from experience

The Importance of Values

- ▼ Values influence what we see and guide our choices & action
- ▼ Shared values could provide a basis for cooperation and collaboration
- ▼ Valued ecosystem components describe what people care about and think is at risk
- ▼ We lack an expert consensus about which VEC's to protect, and how to measure & represent them

Expert Perception of Eco-Risk

- ▼ Any definition of risk is based on value judgements
- ▼ Expert & lay perceptions of risk differ
- ▼ Experts play a leading role in defining the criteria used to evaluate risk, and
- ▼ In this role, their personal values, and worldviews may come into play
- ▼ Experts often express their values through the use of metaphors and mental models of risk

Metaphors & Mental Models of Risk

- ▼ Metaphors are popular images or beliefs about what the world should be like
 - Eg. Carrying Capacity, Ecological Integrity, Health
- ▼ Models provide a focus of concern and a conceptual framework for organising data
 - Eg. Pressure-State-Response

Carrying Capacity

- ▼ DEFINITION -Maximum rate of resource consumption or waste discharge that an ecosystem can absorb
- ▼ METAPHOR - Limits to Growth, EcoFootPrint
- ▼ CONCERNS :
 - Consumption of energy and natural resources should not exceed natural rates of renewal
 - Waste generation should not exceed the assimilative capacity of the environment

Biological Integrity

- ▼ DEFINITION- the capacity of an ecosystem to support natural self-regenerating communities of species characteristic of the region
- ▼ METAPHOR - Wilderness Conservation
- ▼ CONCERNS :
 - Biodiversity - Species extinction, habitat loss
 - Contamination or collapse of foodwebs

Ecosystem Health

- ▼ DEFINITION- attempts to link a critical set of ecosystem functions and services to the health and wellbeing of human populations and the economic welfare of communities
- ▼ METAPHOR- Medical Diagnosis, Sustainability
- ▼ CONCERNS:
 - Spread of Disease
 - Job and income loss

Policy Making & Decision Taking

Criteria

CARRYING CAPACITY	BIOLOGICAL INTEGRITY	ECOSYSTEM HEALTH
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Utilitarian -

What's good for
indiv's will benefit
society as a whole

OPTIMAL
SOLUTION

Moralistic-

Social equity and
fairness to future
generations

SAFE MINIMUM
STANDARDS

Altruistic-

Greatest good for
the greatest
number

TRADE-OFFS

Mental Models of Ecosystem Risk

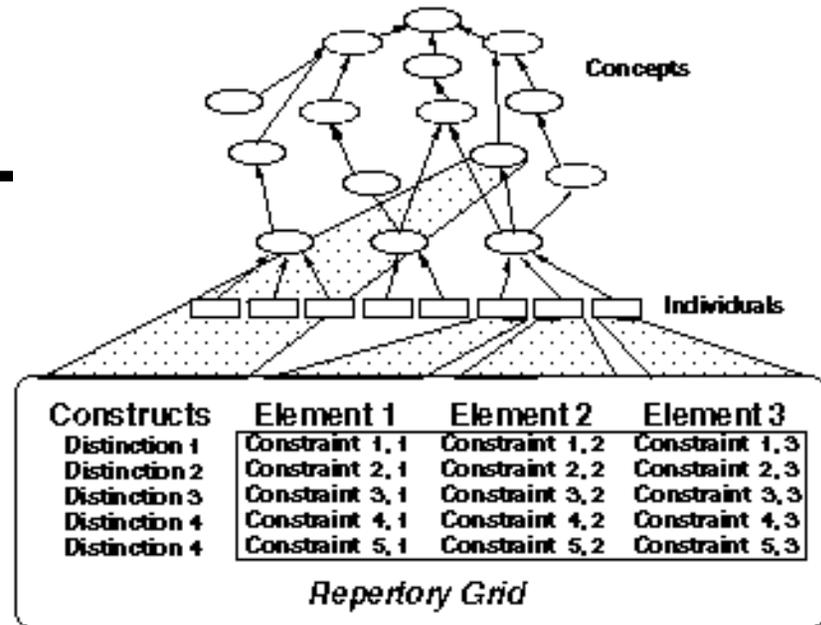
- ▼ Lack a Common Policy Goal
- ▼ Lack Shared Decision Taking Criteria
- ▼ Lack a Consensual Database & Knowledge Framework
- ▼ Lack Shared Beliefs about Driving Forces of Change

MODEL/METAPHOR	ROLE OF JUDGEMENT	SHORTCOMINGS
Ecosystem Health	<ul style="list-style-type: none">• Targets for Action• Diagnostic Indicators	<ul style="list-style-type: none">• Short-run concerns & tradeoffs increase risk of cumulative effects
Biological Integrity	<ul style="list-style-type: none">• Natural Benchmarks	<ul style="list-style-type: none">• Downplays human health & economic concerns
Carrying Capacity	<ul style="list-style-type: none">• Sustained Yield• Threshold Limits	<ul style="list-style-type: none">• More vulnerable to catastrophic ecological change

Mental Models

- ▼ Are our representations of objects, events and processes
 - How things look
 - How they work
- ▼ Acquired through training and experience
- ▼ Help us to understand and anticipate the effects of our actions and a changing world
- ▼ In a constant state of renewal and sometimes discarded

Repertory Grids



Are matrices of concepts, elements and constraints

STEPS in Eliciting Mental Models

- Identify all the “constructs” used to describe the domain (Entities)
- Make and name the “distinctions” (Attributes)
- Classify all the entities in terms of the attributes - “range of convenience” (Values - ‘Hi-Lo’)

Eliciting Mental Models of Ecosystems

ENTITY-ATTRIBUTES	VALUES (Range Hi-Lo)	
<p>Landscape</p> <ul style="list-style-type: none"> • Biomass • Nutrient cycling • Buffering capacity • Habitat 	<ul style="list-style-type: none"> • Accumulates • Retention • Decomposition • Adequate 	<ul style="list-style-type: none"> • Decreases • Leakage • Bioaccumulation • Fragmentated or lost
<p>Community- Guild</p> <ul style="list-style-type: none"> • Species <ul style="list-style-type: none"> - Abundance & diversity • Foodwebs 	<ul style="list-style-type: none"> • Native • Stable - Increasing • Larger -long lived life forms 	<ul style="list-style-type: none"> • Exotics • Unstable - Decreasing • Shorter-lived smaller life forms
<p>Populations</p> <ul style="list-style-type: none"> • Dynamics • Age-class survival • Range 	<ul style="list-style-type: none"> • Growth • Balanced-representative • Normal 	<ul style="list-style-type: none"> • Decline • Skewed -juvenal or mature • Decrease or displaced

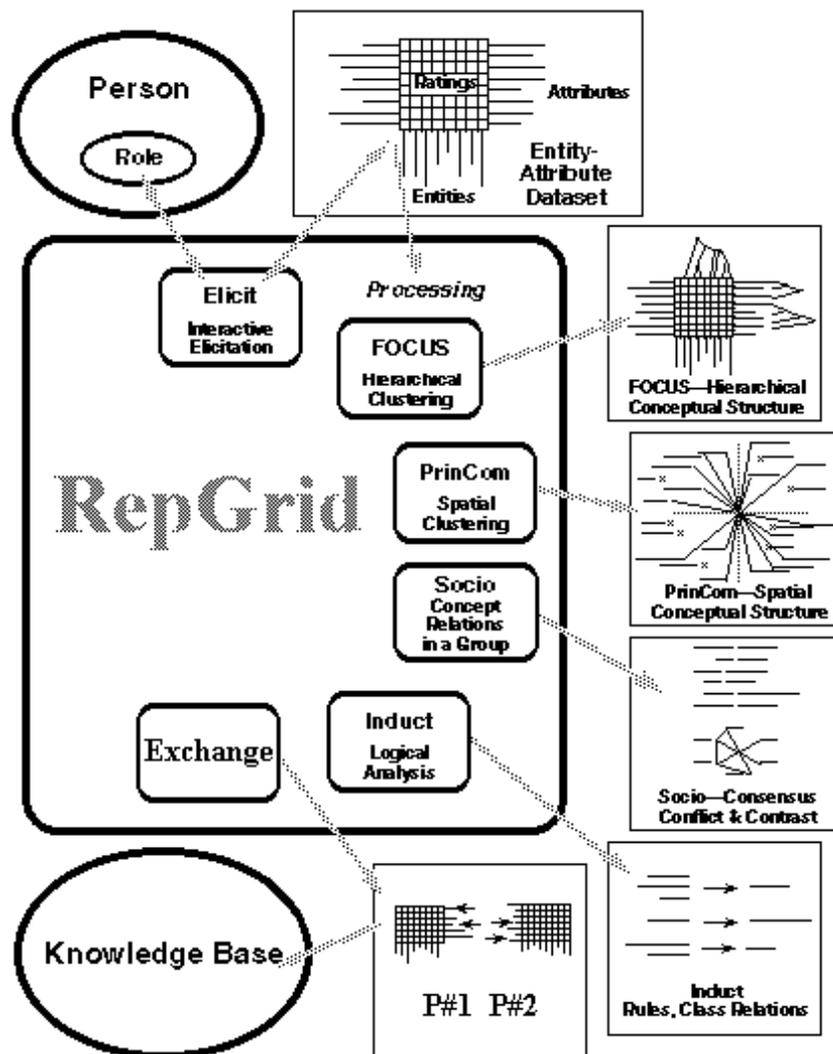
Comparing Mental Models

- ▼ If multi-experts describe the same domain in different ways it is important to highlight these differences for discussion

		Terminology	
		Same	Different
Attributes	Same	<i>Consensus</i> Experts use terminology and concepts in the same way	<i>Correspondence</i> Experts use different terminology for the same concepts
	Different	<i>Conflict</i> Experts use same terminology for different concepts	<i>Contrast</i> Experts differ in terminology and concepts

- ▼ There are 4 possible combinations of ways that different experts can describe relationships among the entities and attributes comprising a conceptual system

RepGrid - The Tool Kit



Online Analysis with RepGrid

MODULES

FUNCTIONS

ELICIT

- ▼ Entity-Attributes-Values

FOCUS

- ▼ Hierarchical clustering
 - grouping similar entities and attributes

PRINT-COM

- ▼ Spatial clustering
 - add-higher order attributes

SOCIO

- ▼ Entity-attribute comparisons

INDUCT

- ▼ Logical Structuring
 - missing classes & rules
 - premises, predicates and exceptions

EXCHANGE

- ▼ Expertsⁿ - Expert-Lay RepGrids

Use Values as the Basis of Integration

- ▼ Our system of governance is equipped to accommodate differing interests not differing views of reality
- ▼ Ecosystem concerns engage us only when more fundamental life domains or core values are threatened: our health & well-being; our standard of living; our way of life; our fundamental understanding and expectations of the world around us

“the real debate is not about science but about whose values will dominate”

Grumbine 1994

Value-focused Thinking

- ▼ What people want vs. what they don't want
- ▼ Represents values as a set of planning objectives
- ▼ Define measures to evaluate achievement of these objectives
- ▼ Investigates tradeoffs that represent different stakeholders' views about priorities among these objectives and about the ways & means of achieving these objectives

The Steps in the Process

- ▼ Identify important concepts and relationships
- ▼ Clarify the values they represent
- ▼ Organise them in a means-ends hierarchy
- ▼ Suggest possible evaluation criteria
- ▼ Identify important working hypotheses
- ▼ Act on them
- ▼ Learn from the experience