

# **Environmental Planning and Management in the 21<sup>st</sup> Century**

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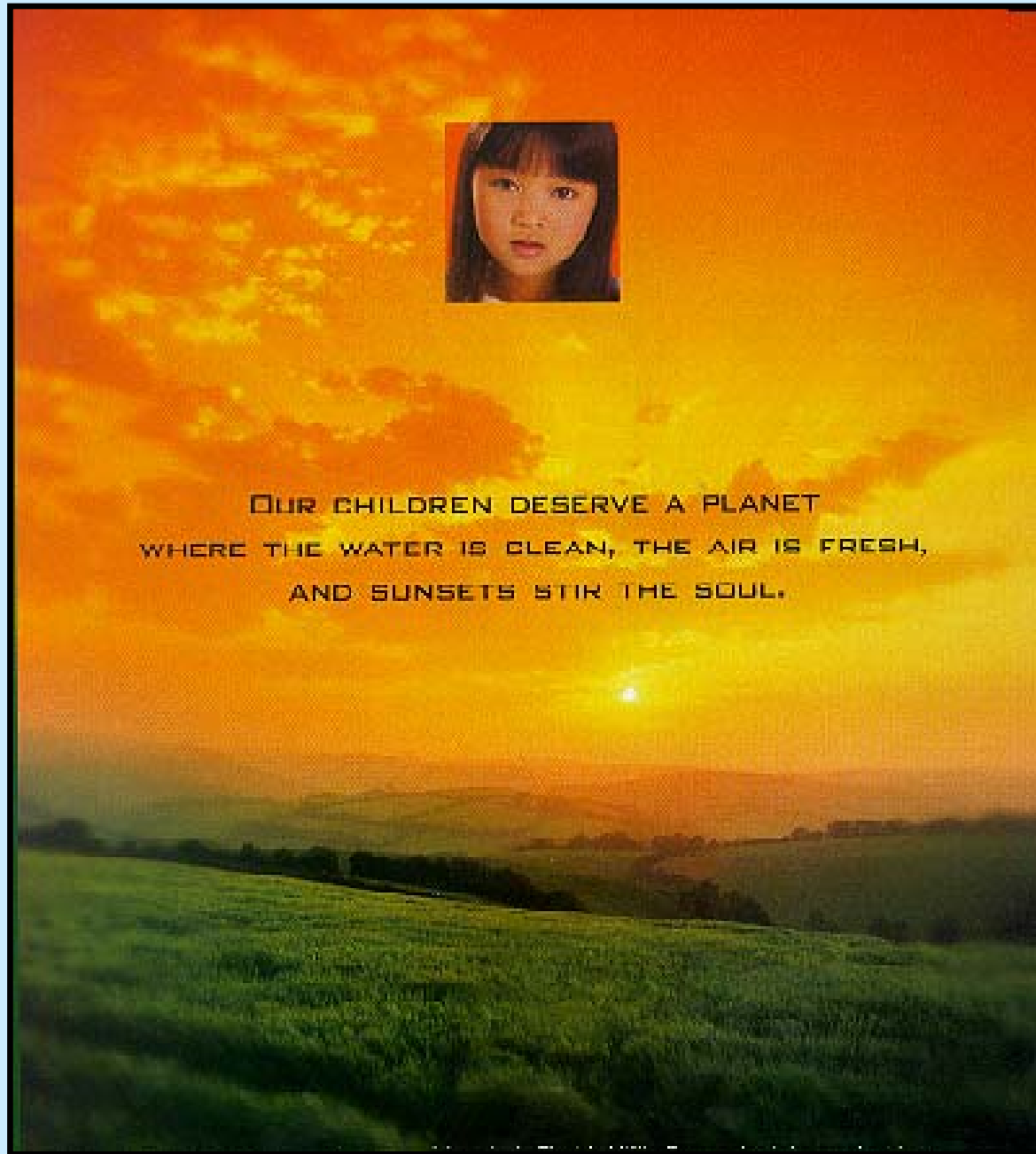
# *Outline Argumentation*

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- **1.0 The Changing Environmental Context**
- **2.0 Emerging and Shifting Paradigms: Panarchy, Coevolution, and Ecodaptation**
- **3.0 The Challenges of Sociogeographic Vulnerability**
- **4.0 Implementing Action and Preserving Ecosystemic Integrity**



OUR CHILDREN DESERVE A PLANET  
WHERE THE WATER IS CLEAN, THE AIR IS FRESH,  
AND SUNSETS STIR THE SOUL.



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# Categories of Concern

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- **Eco-metabolism**  
Ecosystemic changes
- **Human-Induced Disasters**  
Industrial developments, dams, resource degradation
- **Eco-political Upheavals**  
Including shifting, fading, or disputed frontiers
- **Socio-economic Dislocations**  
International economy, bad development strategies,  
etc.

# The Variety of “Shocks” in Current Society

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- **Cultural Shock**  
= technophobes and technophiles
- **Future Shock**  
= “raplexity”
- **Information Shock**  
= data and knowledge
- **Geopolitical Shocks**  
= fragmentation and globalization

## SOURCES OF CHANGE

### CHANGES IN VALUES

- culture
- institutions

### MORPHOLOGICAL CHANGES

- population
- technological
- biological

### EXOGENOUS CHANGES

- climatic shifts
- interdependence

## COMPLEXITY + TURBULENCE

UNCERTAINTY

CONTROL

COPE

ADJUST / ADAPT

[ SHIFTING PARADIGMS  
FLEXIBILITY ]

# Six Billion ... and Counting



On Oct. 12, give or take a few days, the world's population reaches an alarming milestone. But the growth rate has begun to ease, and next century's rise will not be as steep as modern-day Malthusians once predicted

## ► The worst crunch is coming to the poorest regions



### Growth is slowing ...

As recently as 1957, the total count rose by 1.7%, or 86 million. In 1999 the increase is down to 1.3%, or 78 million. Experts think the population may stabilize at 10 billion after 2200 if the deceleration continues

### ... for diverse reasons ...

Increased education and use of family planning have pushed down fertility rates all over the globe. On the negative side, mortality has been driven up by the spread of AIDS, especially in Africa

### ... but threats remain

If poor countries develop their economies in the same wasteful way industrial nations have, population growth will put an increasing burden on food and water supplies and the habitat of endangered species

## ► In the future, a new world order looms

### Most populous countries, 1999

1. China	1,267 million
2. India	998 million
3. U.S.	276 million
4. Indonesia	209 million
5. Brazil	168 million
6. Pakistan	152 million
7. Russia	147 million
8. Bangladesh	127 million
9. Japan	127 million
10. Nigeria	109 million

Population will keep soaring in less developed countries. North America's will plateau, and Europe's will start to fall



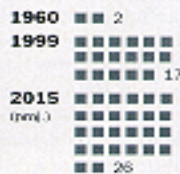
1999		2050 (proj.)	
Asia	61%	Asia	60%
Africa	13%	Africa	30%
Europe	12%	S. America	9%
S. America	9%	Europe	7%
N. America	5%	N. America	4%

### Most populous countries, 2050

1. India	1,529 million
2. China	1,478 million
3. U.S.	349 million
4. Pakistan	345 million
5. Indonesia	312 million
6. Nigeria	244 million
7. Brazil	244 million
8. Bangladesh	232 million
9. Ethiopia	169 million
10. Congo	160 million

## ► Megacities will multiply

The number of cities with 10 million or more people is expected to keep surging



Sources: Keith Clarke and Ann Beckmann (MOGA), Jason Simpson (AOL/UC at Santa Barbara, United Nations Population Fund, TIME Graphics by Joe Zeff

1992 projection  
11.5 billion  
by 2150

Current projection  
9.8 billion  
by 2150

6 billion

Expected  
Oct. 12,  
1999

5 billion

Reached  
in 1987

4 billion

Reached  
in 1974

3 billion

Reached  
in 1960

2 billion

Reached  
in 1927

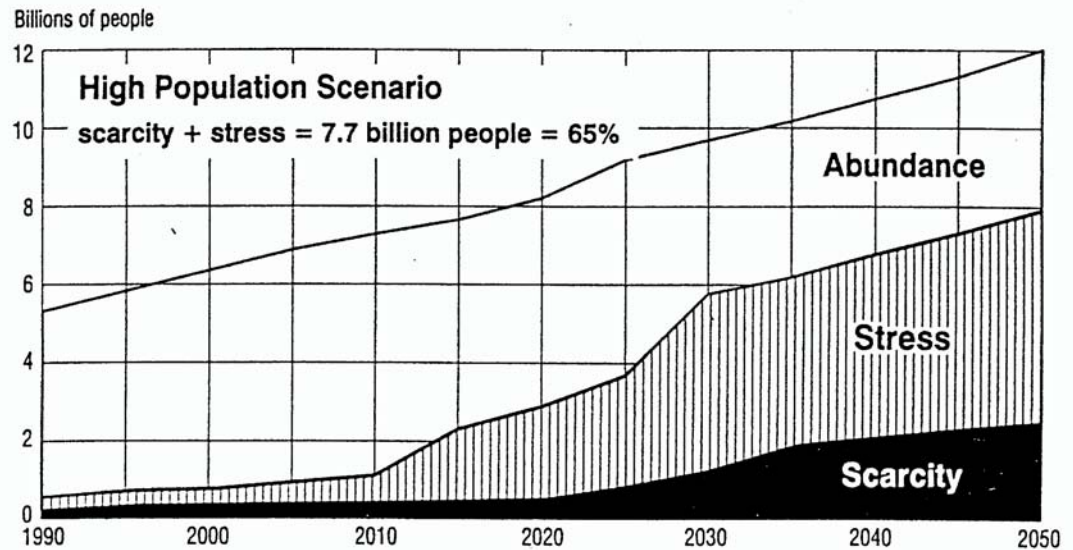
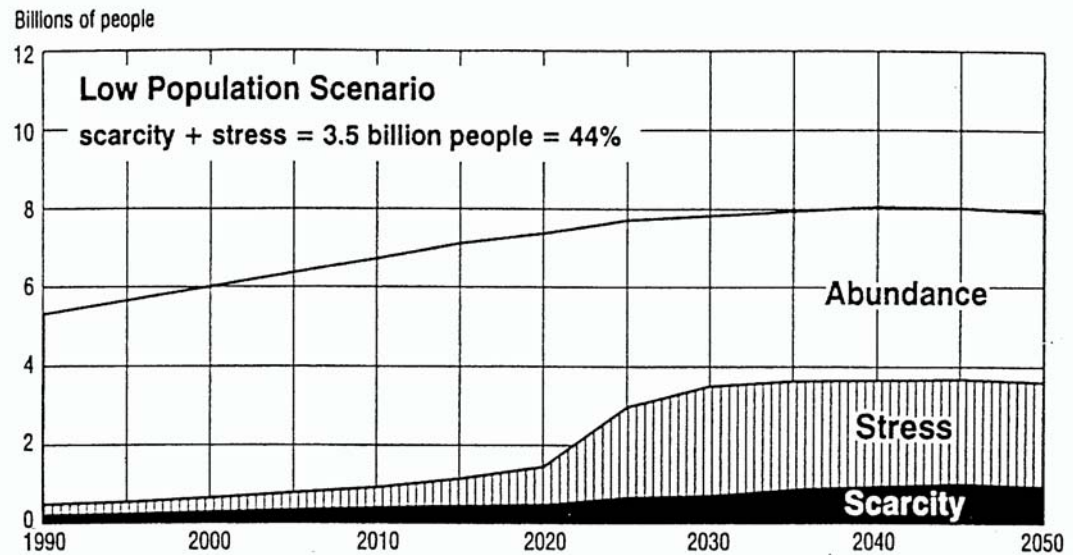
1 billion

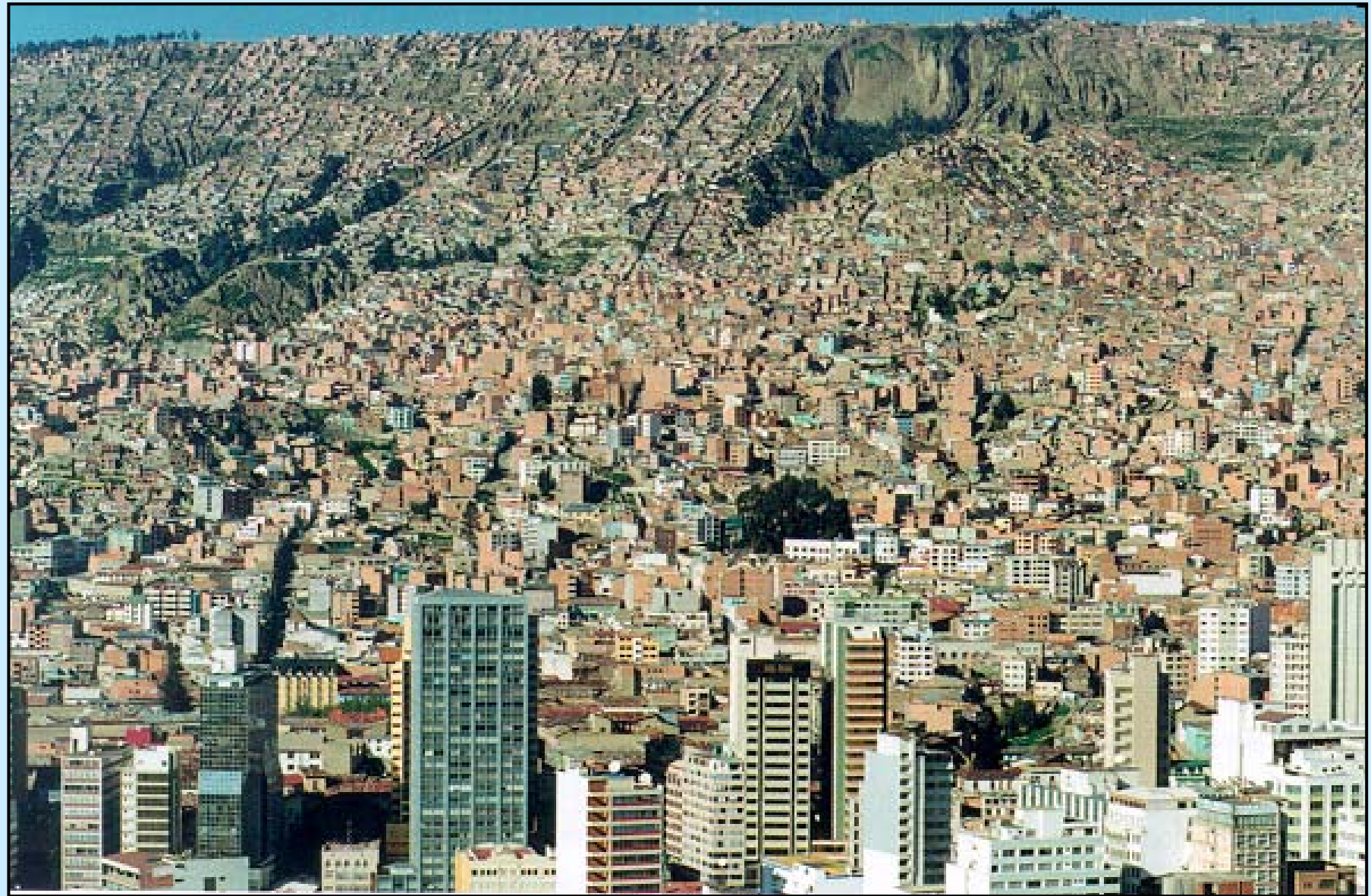
Reached  
in 1804

0 500 1000 1500 2000

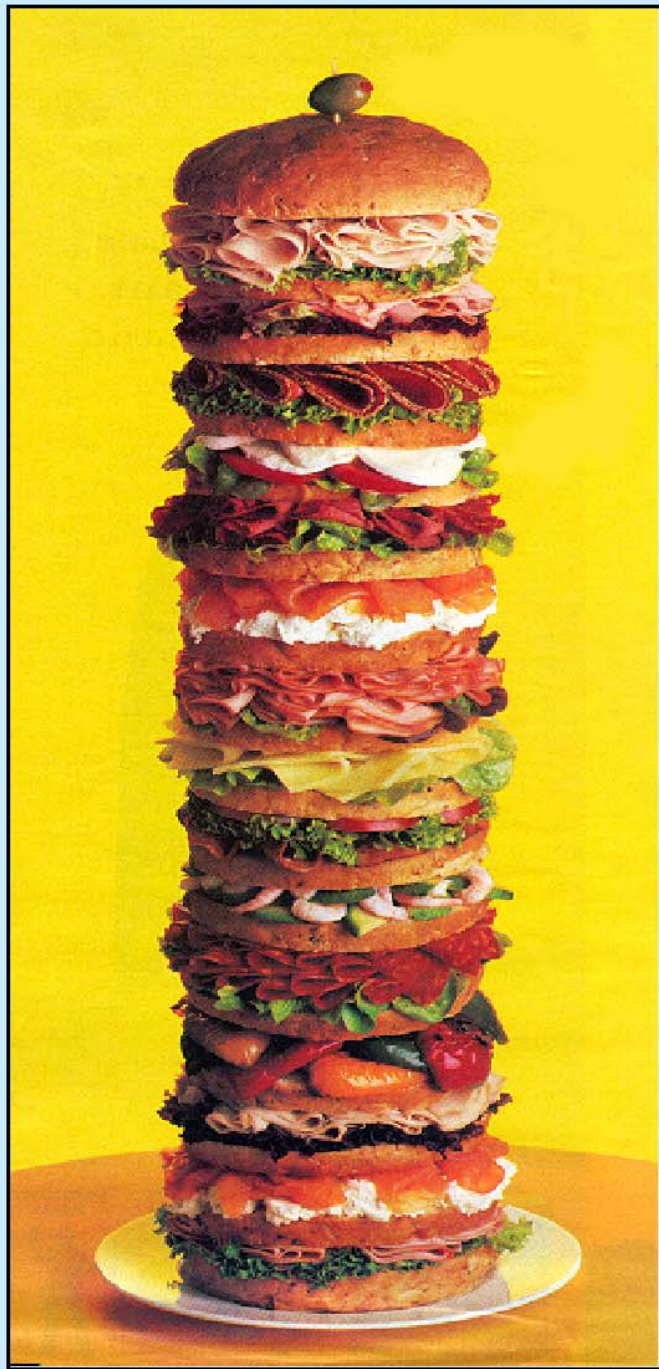


# Population Experiencing Freshwater Scarcity, 1990 - 2050.











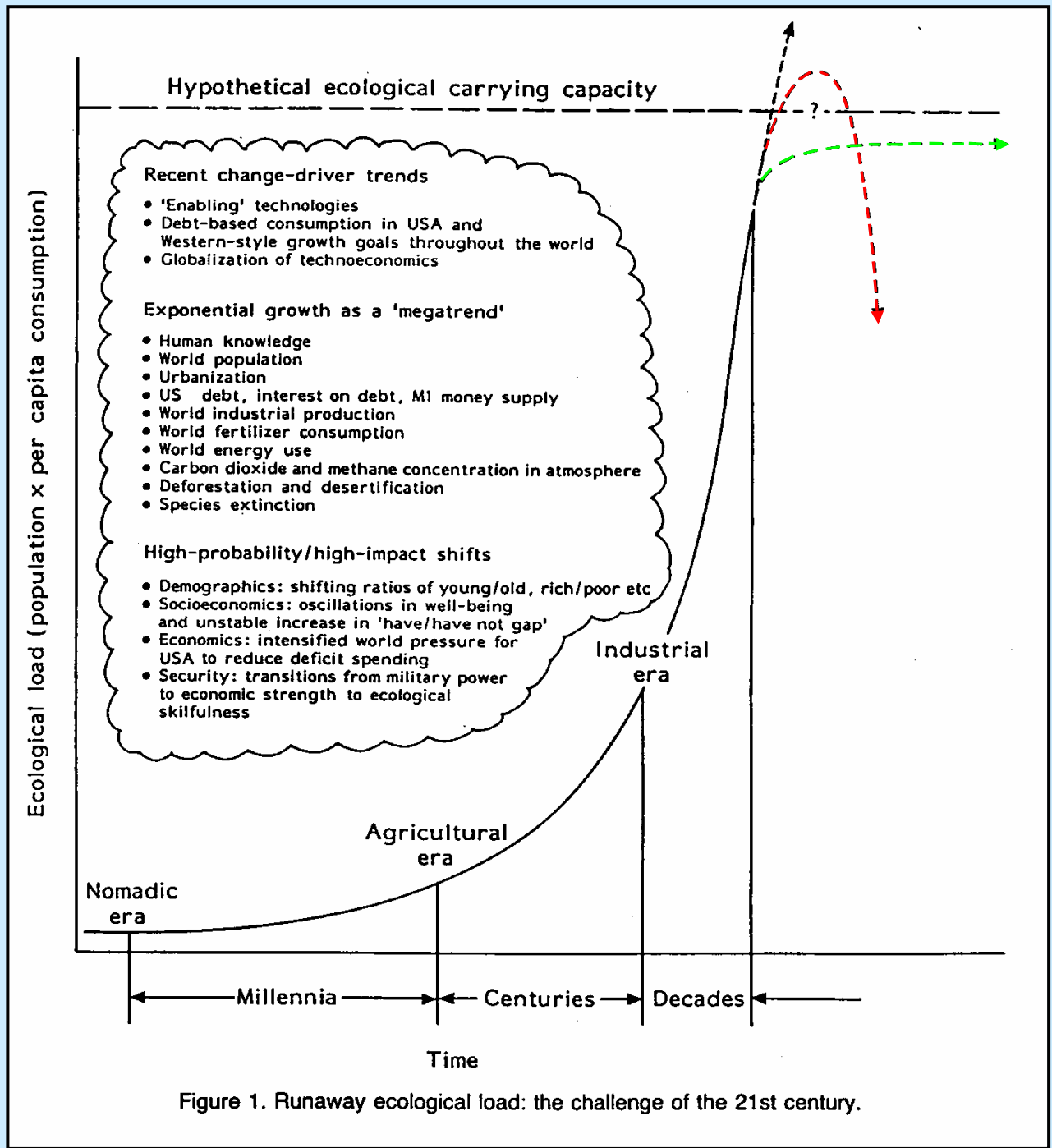
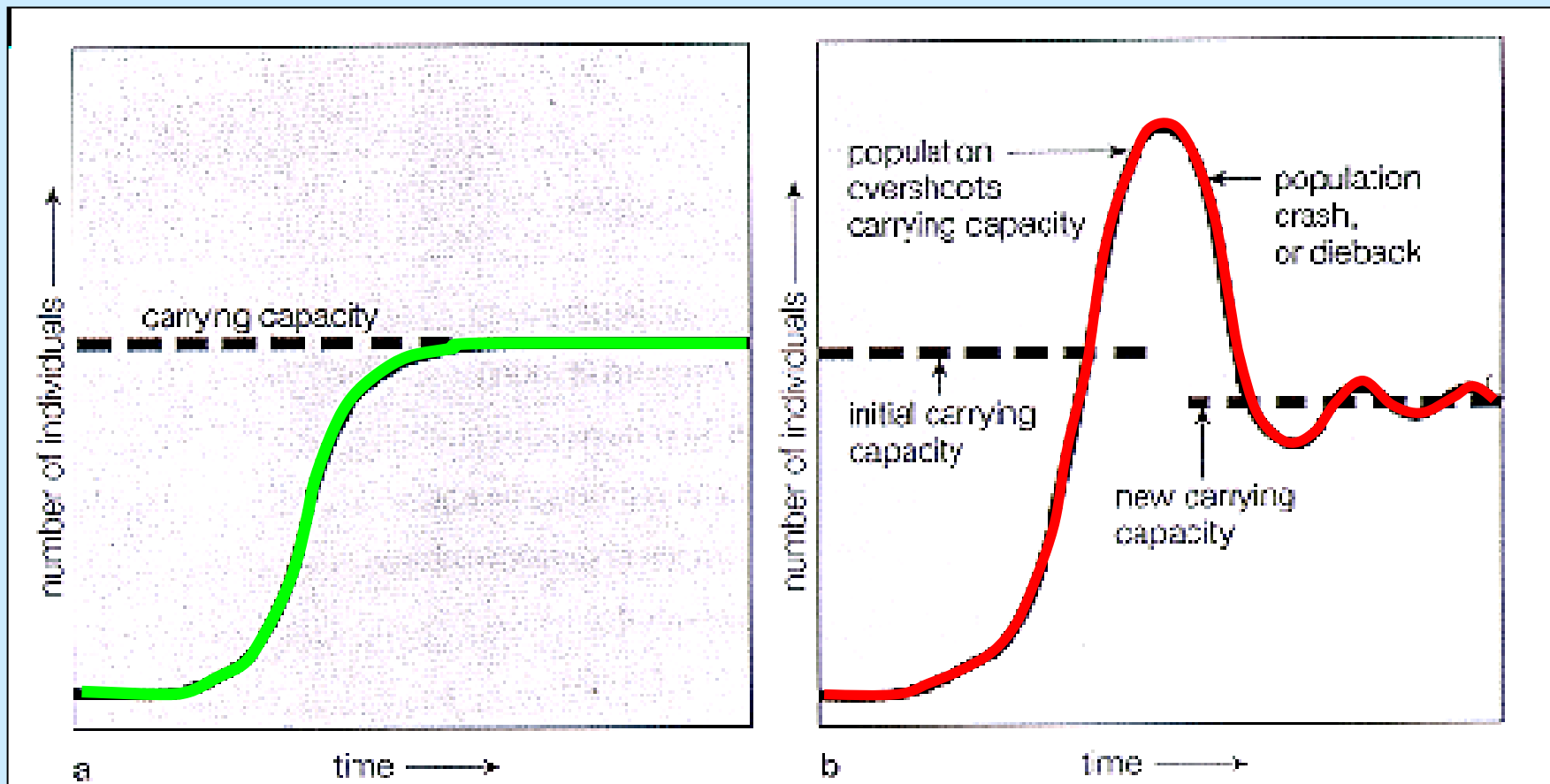


Figure 1. Runaway ecological load: the challenge of the 21st century.



(a) Idealized S-shaped curve of population growth. (b) Overshoot and dieback occur when a rapidly expanding population temporarily overshoots the carrying capacity of its environment, or when a change in environmental conditions lowers that carrying capacity. The population size may fall roughly to the size supported by the area's carrying capacity. If the excess population destroyed or degraded vegetation, soil, or other resources, the carrying capacity of an area may be lowered. Then the population dieback or crash is more severe. These idealized curves only approximate what goes on in nature.

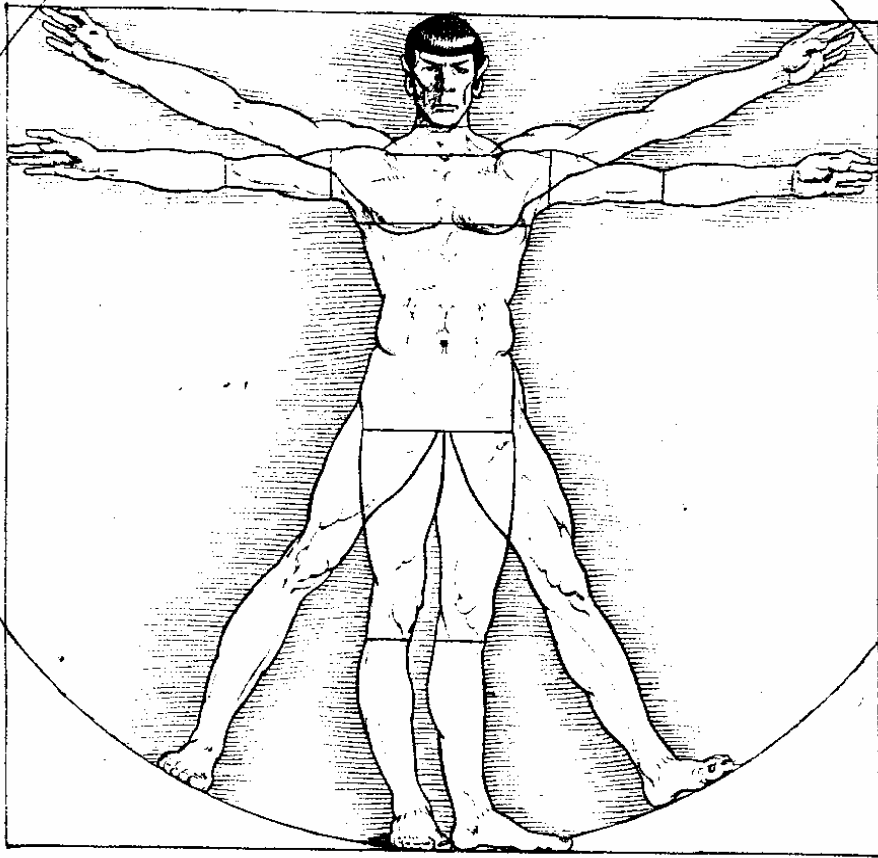
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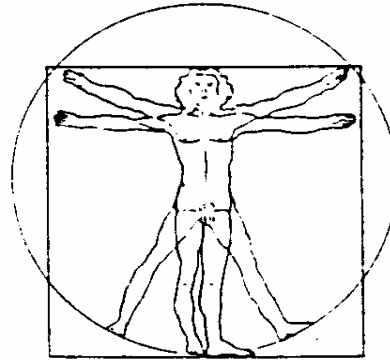
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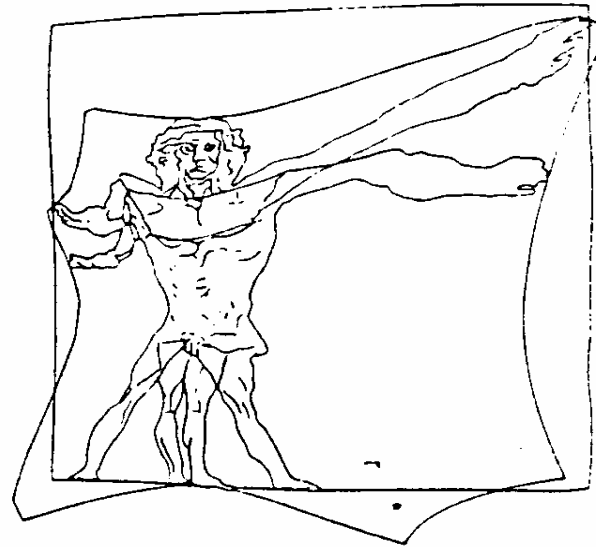
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Leonardo

## The Distortion of Homo Sapiens

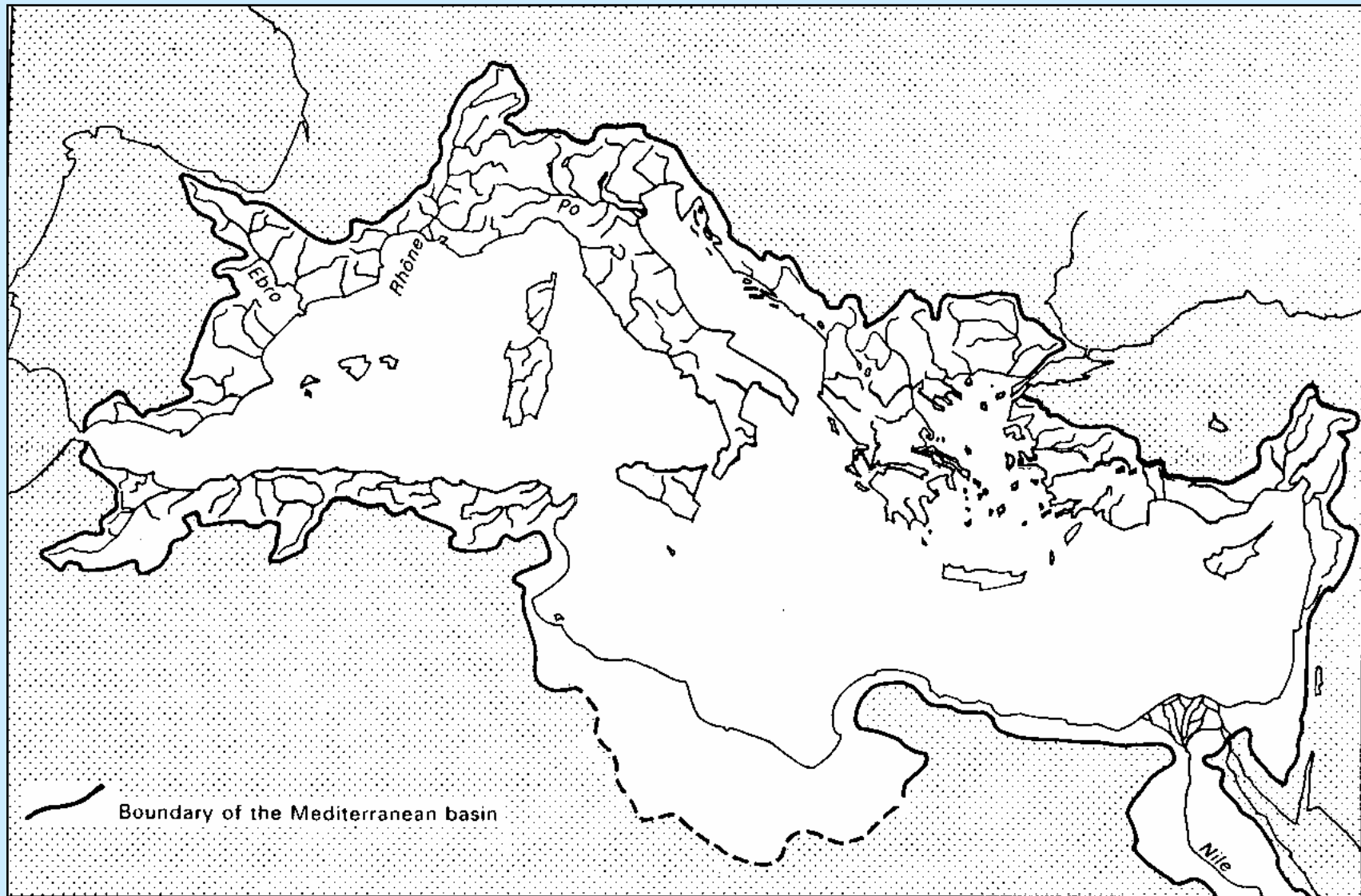


Harmonious, framed in a circle and a square, as he was seen by Leonardo da Vinci after Roman models.



Distorted, in order to adapt him to a freakish frame. The reality created by man is probably even more freakish than this drawing.

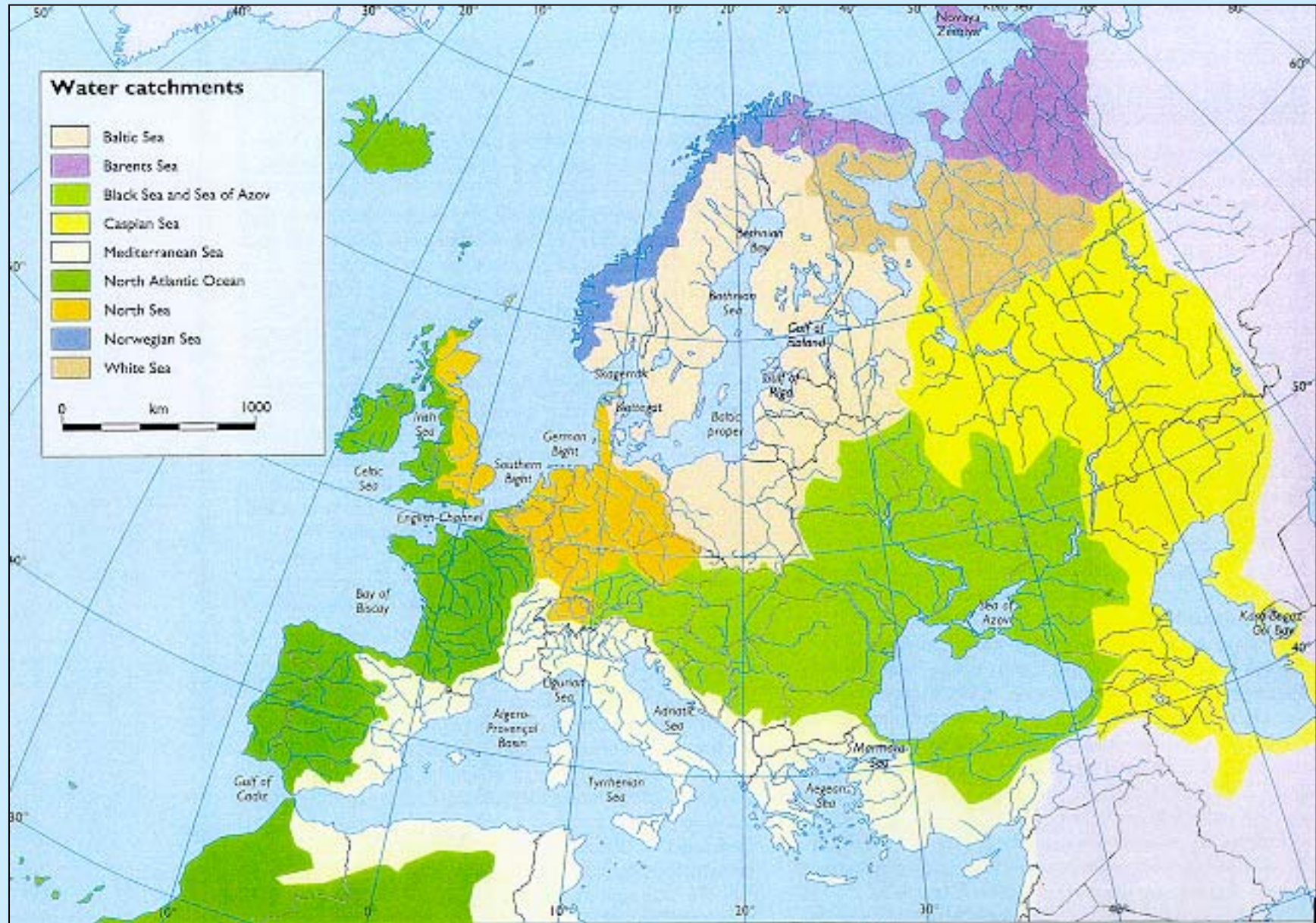
Source: Robert Guiducci, *La Societa Impazzita*, Rizzoli, Milan (1980).



Boundary of the Mediterranean basin

The Mediterranean watershed. For the sake of clarity small rivers are not indicated on this map. Watershed boundaries in very arid areas are approximate.

Source: adapted from J. Margat (1988).



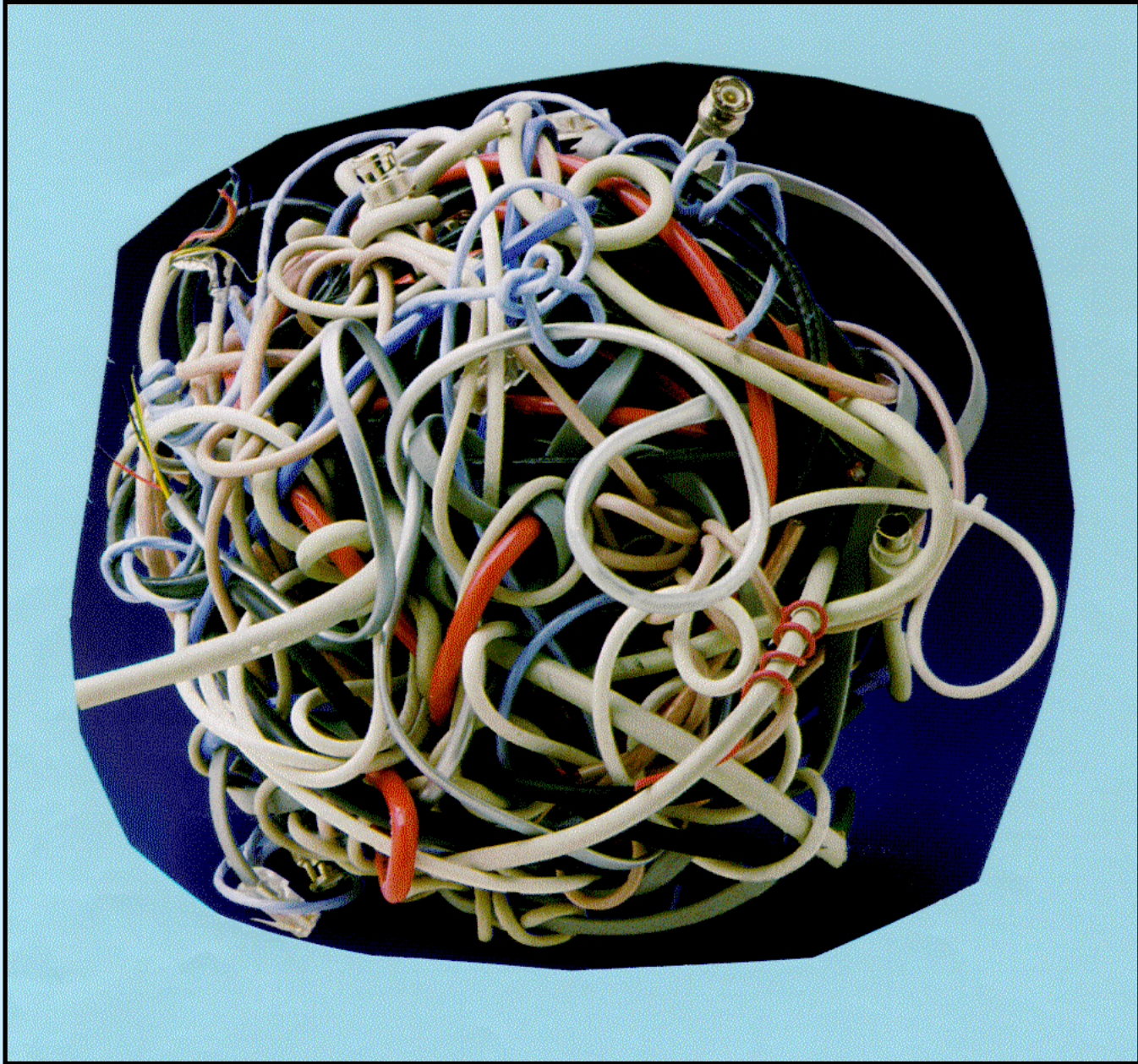
# The Grand Transformation

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- Globalization
- Complexity
- Interdependence
- Uncertainty
- Vulnerability
- Turbulence



**Complexification**



# Changing Approaches to Planning and Management

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- |              |  |
|--------------|--|
| <b>1960s</b> | Feasibility studies, Elitist planning, Extrapolative orientation                         |
| <b>1970s</b> | Environmental Impact Assessment, Indicators/Principles & Standards, modeling/data        |
| <b>1980s</b> | Cumulative Impact Assessment, foresight emphasis, “User pays,” “Polluter pays” principle |
| <b>1990s</b> | Sustainability, Equity/Efficiency/Effort, Normative Planning                             |
| <b>2000s</b> | Globalization, Integrated/Holistic/Comprehensive, “Co-evolution”                         |

# Emerging Key Notions

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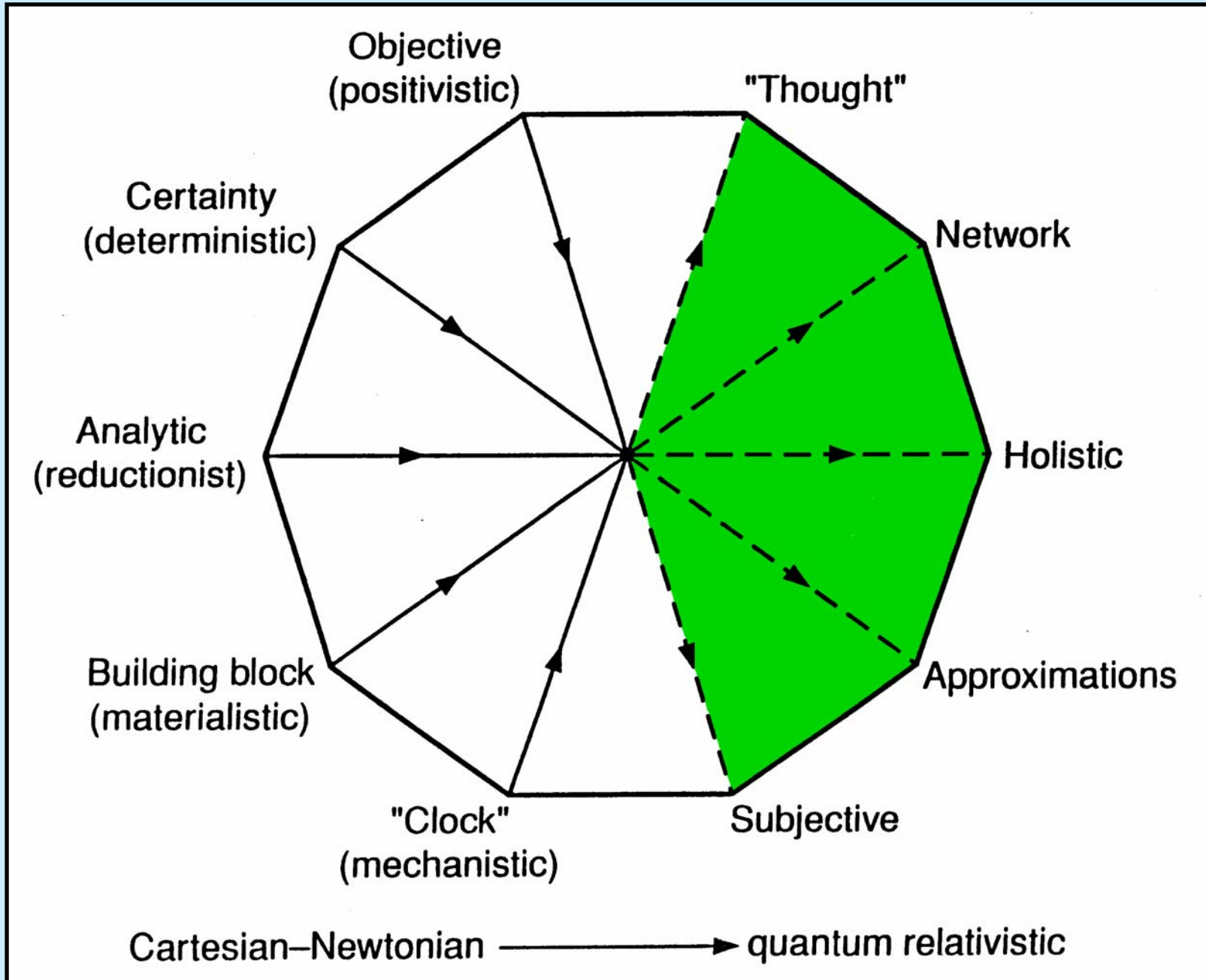
- Integrated management
- Water security
- Transparency of governance
- Policy reform
- Transboundary interdependencies
- River basin focus
- True costing
- Interdisciplinary approaches



# Basics of the New Paradigm

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- Duty to Cooperate
- Conjunctive Management
- Integrated Management
- Equitable Utilization
- Sustainable Use
- Minimization of Environmental Harm



## VARIETIES OF ENVIRONMENTAL EXPERIENCES

- |                             |            |                         |
|-----------------------------|------------|-------------------------|
| <b>1. ECOCENTRISM</b>       | <b>VS.</b> | <b>ANTHROPOCENTRISM</b> |
| <b>2. GRADUALISM</b>        | <b>VS.</b> | <b>APOCALYPTICISM</b>   |
| <b>3. MATERIALISM</b>       | <b>VS.</b> | <b>IDEALISM</b>         |
| <b>4. PRIMITIVISM</b>       | <b>VS.</b> | <b>PRESENTISM</b>       |
| <b>5. WORLDVIEW</b>         | <b>VS.</b> | <b>ISSUE</b>            |
| <b>6. GLOBAL</b>            | <b>VS.</b> | <b>LOCAL</b>            |
| <b>7. NORTH</b>             | <b>VS.</b> | <b>SOUTH</b>            |
| <b>8. WISE USE</b>          | <b>VS.</b> | <b>FOREVER WILD</b>     |
| <b>9. GOVERNMENT-DRIVEN</b> | <b>VS.</b> | <b>MARKET CHANGES</b>   |

## Variations on the basic themes.

Ecocentrists		Technocentrists		
<p><b>Deep Environmentalists</b></p> <ul style="list-style-type: none"> <li>• Lack faith in modern, large-scale technology and its need for elitist expertise, central authority, and inherently undemocratic institutions</li> <li>• Believe that materialism for its own sake is wrong and that economic growth can be geared to provide for the basic needs of those below subsistence levels</li> </ul>	<p><b>Soft technologists</b></p> <ul style="list-style-type: none"> <li>• Recognize the intrinsic importance of nature to being fully human</li> <li>• Believe that ecological (and other natural) laws determine morality</li> <li>• Accept the right of endangered species or unique landscapes to remain unmo- lested</li> </ul>	<p><b>Accommodators</b></p> <ul style="list-style-type: none"> <li>• Emphasize small scale (and hence community identity) in settlement, work, and leisure</li> <li>• Attempt to integrate work and leisure through a process of personal and communal improvement</li> <li>• Stress participation in community affairs and the rights of minorities</li> </ul>	<p><b>Cornucopians</b></p> <ul style="list-style-type: none"> <li>• Believe that economic growth and resource exploitation can continue indefinitely given (a) a suitable price structure (possibly involving taxes, fees, and so forth); (b) the legal right to a minimum level of environmental quality; and (c) compensation for those who experience adverse environmental or social consequences</li> <li>• Accept new project appraisal techniques and decision review arrangements to allow for wider discussion and a genuine search for consensus among affected parties</li> <li>• Support effective environmental management agencies at the national and local level</li> </ul>	<p><b>Cornucopians</b></p> <ul style="list-style-type: none"> <li>• Believe that humans can always find a way out of difficulties, either through politics, science, or technology</li> <li>• Believe that scientific and technological expertise is essential on matters of economic growth and public health and safety</li> <li>• Accept growth as the legitimate goal of project appraisal and policy formulation</li> <li>• Are suspicious of attempts to widen participation in project appraisal and policy review</li> <li>• Believe that any impediments can be overcome given the will, ingenuity, and sufficient resources (which arise from wealth)</li> </ul>

## ALTERNATIVE PARADIGMS

**EXCLUSIONIST PARADIGM** → **Neoclassical Economics**  
"Frontier economy"  
unlimited resources

\* attacked in the 1960's (e.g. Silent Spring)

**SUSTAINABLE DEVELOPMENT** → **Finite capabilities**  
"intergenerational  
equity"  
environmental  
accounting

1987 Our Common Future ("Brundtland Report")

• two subpaths:

→ technological innovation for reconciling  
economic growth

→ lifestyle changes and greater global equity

## DO NOTHING

### PERSISTENT POLLUTION

INDEX: 1970=100

### INDUSTRIAL OUTPUT

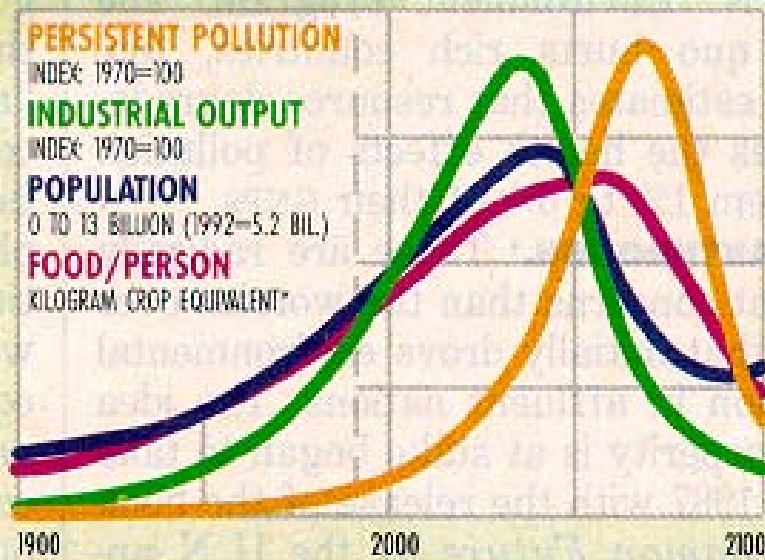
INDEX: 1970=100

### POPULATION

0 TO 13 BILLION (1992=5.2 BIL.)

### FOOD/PERSON

KILOGRAM CROP EQUIVALENT\*



**E**conomic and population growth follow their historical patterns. World population rises to more than 9 billion in 2040, and pollution increases. Huge investments are needed to boost agricultural production and to compensate for the depletion of nonrenewable resources such as fossil fuels. Economic growth finally stalls under the weight of those investments, food production falls, the world death rate rises

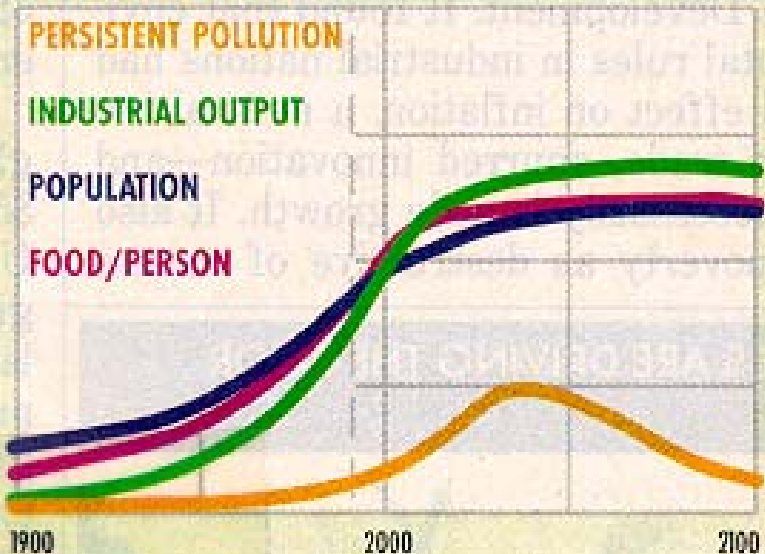
## SUSTAINABLE DEVELOPMENT

### PERSISTENT POLLUTION

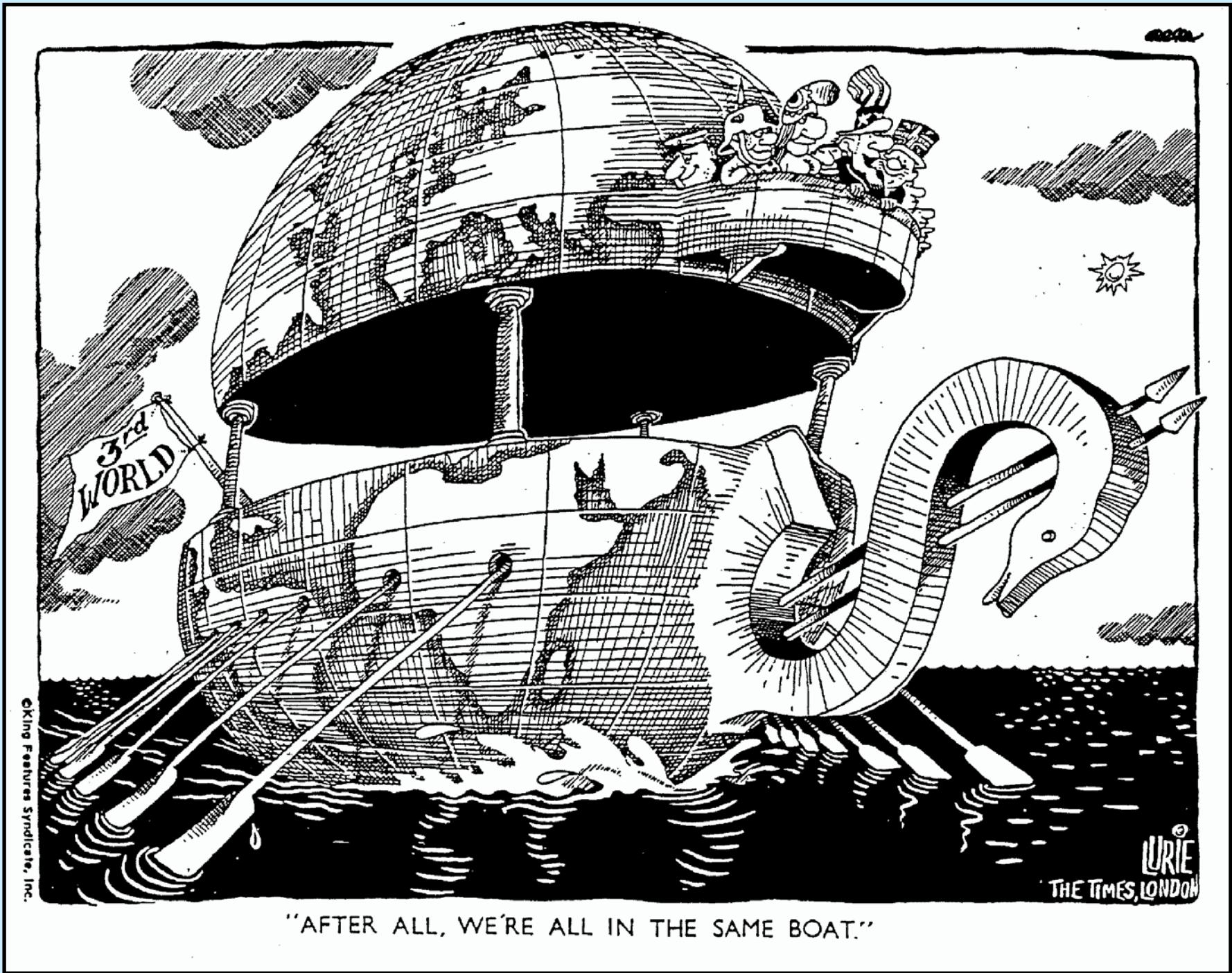
### INDUSTRIAL OUTPUT

### POPULATION

### FOOD/PERSON



**F**amily planning produces an average family size of two children per couple starting in 1995. World population eventually stabilizes at under 8 billion. Without the need to plow capital into food production and pollution control, money goes to pollution-prevention technologies. Within a century the nonrenewable resources used per unit of industrial output plunge by 80%, and pollution falls by 90%. The world sustains, at least until the year 2100, an annual per capita consumer goods output comparable to that of Western Europe in 1990



"AFTER ALL, WE'RE ALL IN THE SAME BOAT."

# Panarchy

*UNDERSTANDING  
TRANSFORMATIONS  
IN HUMAN AND  
NATURAL SYSTEMS*



*EDITED BY*

*Lance H. Gunderson*

*C. S. Holling*



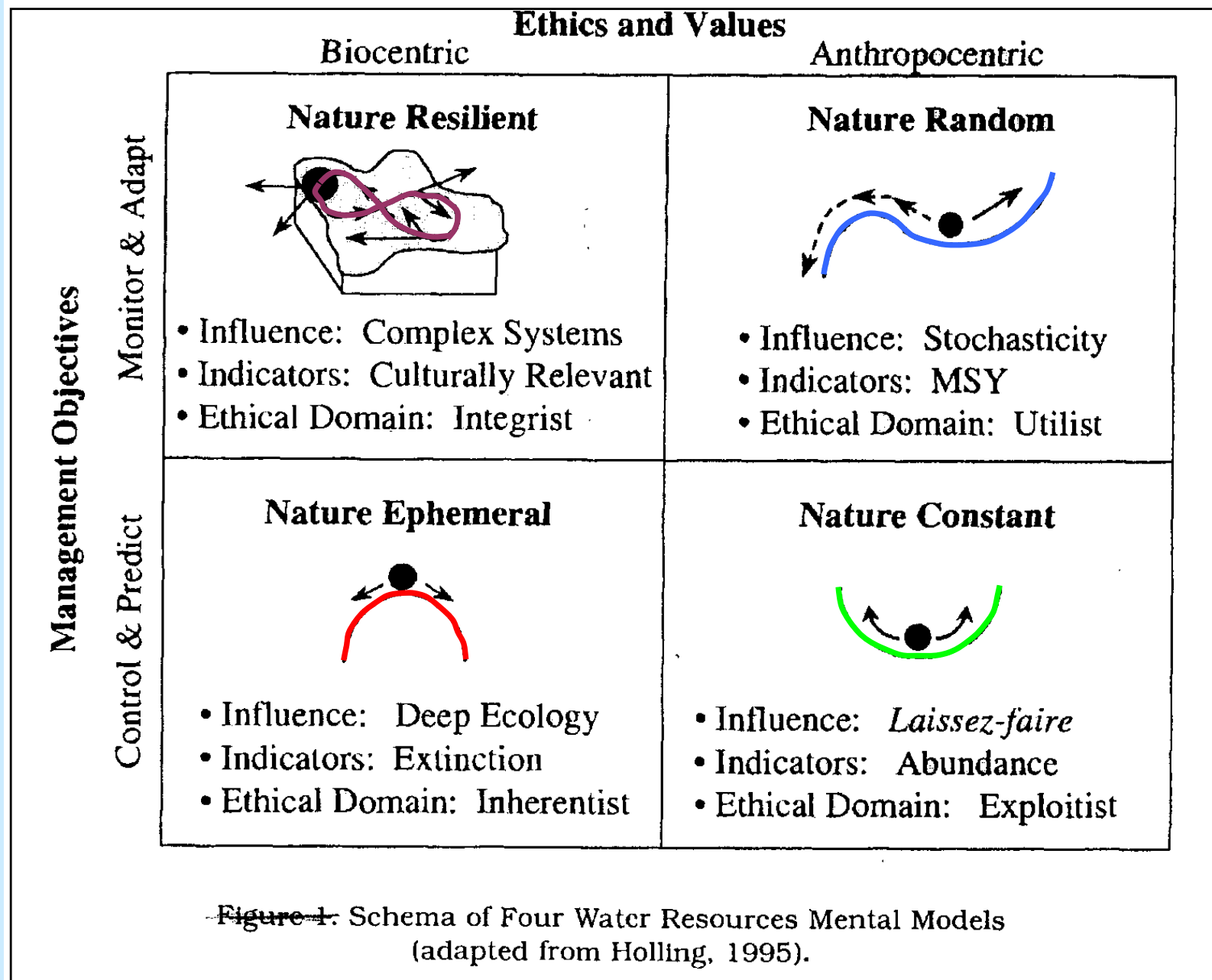
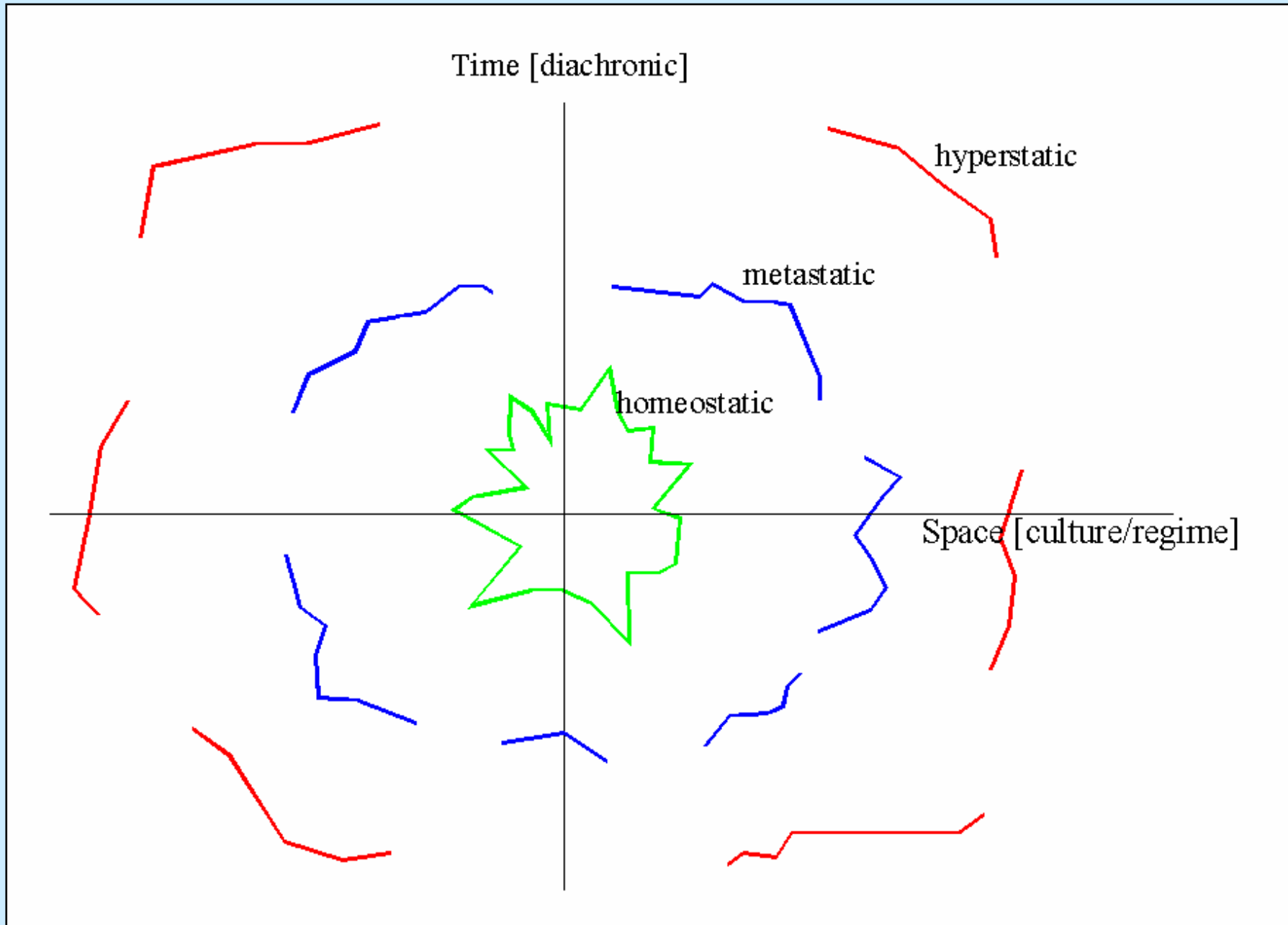


Figure 1. Schema of Four Water Resources Mental Models (adapted from Holling, 1995).

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# UNDERLYING TRANSFORMATIONS

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## **VOLATILITY**

- TURBULENCE AND UNCERTAINTY

## **VULNERABILITY**

- INTERDEPENDENCIES AND RISK

## **VIGILANCE**

- ENVIRONMENTAL SCANNING AND PREPAREDNESS

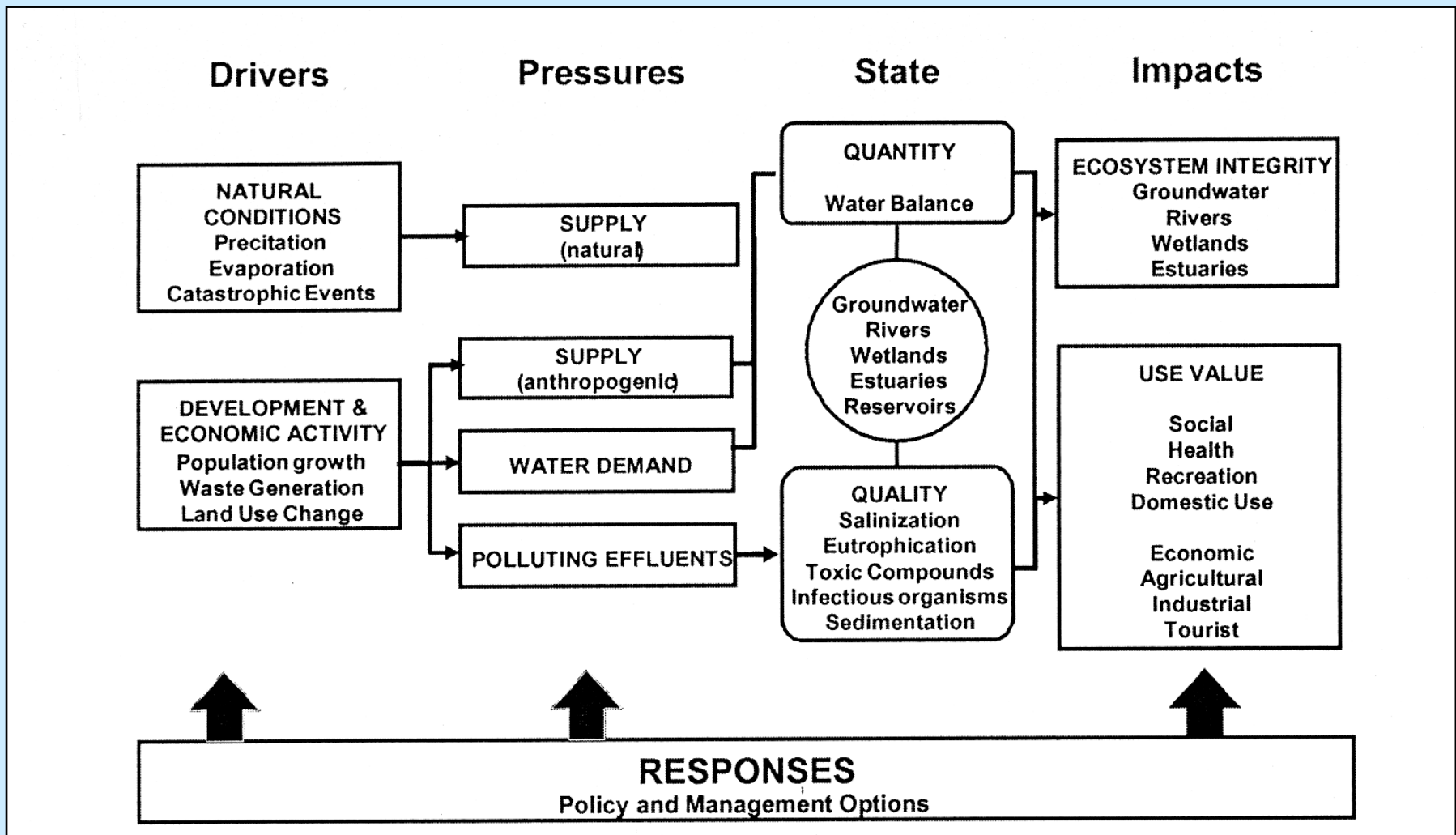
# VULNERABILITY

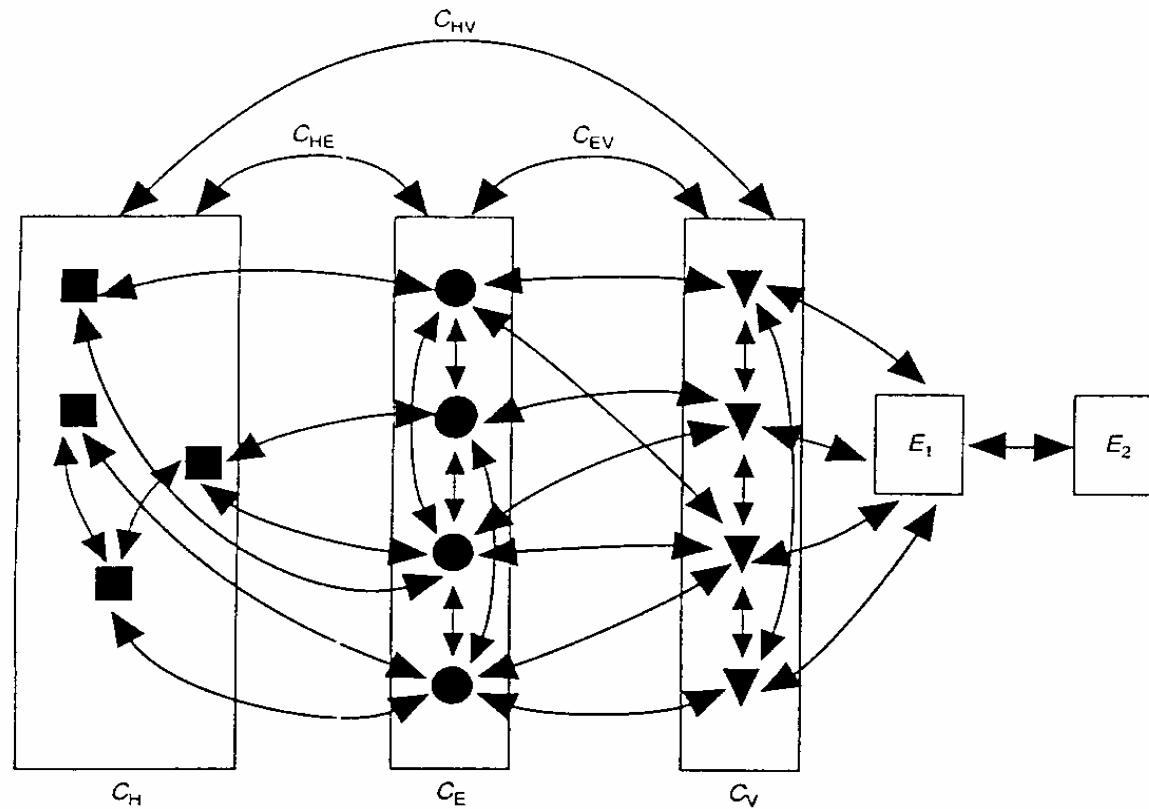
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- [a] Fragile Physical Environment
  - = environmental degradation
  - = lack of ecosystem resilience
  - = history of extreme hydrological events
- [b] Fragile Economy
  - = economic inequalities/disparities
  - = inadequate funding
- [c] Lack of Local Institutions
  - = lack of social resilience
  - = poor social protection
  - = marginalization
  - = capacity for recuperability
- [d] Lack of Preparedness
  - = inadequate warning systems
  - = lack of training
  - = lack of community mobilization

# Sociogeographic Vulnerability

- Vulnerability cannot be differentiated into different causes
- Similar constellations of institutions and regimes will have diverse effects at the local level
- Existing vulnerability assessments are inadequate to deal with multi-scale, long-term processes of adaptation and resilience
- Integrated assessment and policy are essential including emphasis on a sustainable development agenda





Feedbacks

- $C_H$  Feedback among human activity (■)
- $C_E$  Feedback among environmental changes (●)
- $C_V$  Feedback among ECARs (▼)
- $C_{HE}$  Feedback among human activities and environmental changes
- $C_{EV}$  Feedback among environmental changes and ECARs
- $C_{HV}$  Feedback among human activities and ECARs

State of the environment

- $E_1$  State of the present environment
- $E_2$  State of the environment at time 2

*Summary of causality and feedback operating to produce cumulative effects (CEs). Black arrowheads indicate direction of inductive reasoning and gray arrowheads show the direction of deductive reasoning.*



## ***The EEA Typology of Indicators***

Indicators can be classified into 4 simple groups which address the following questions:

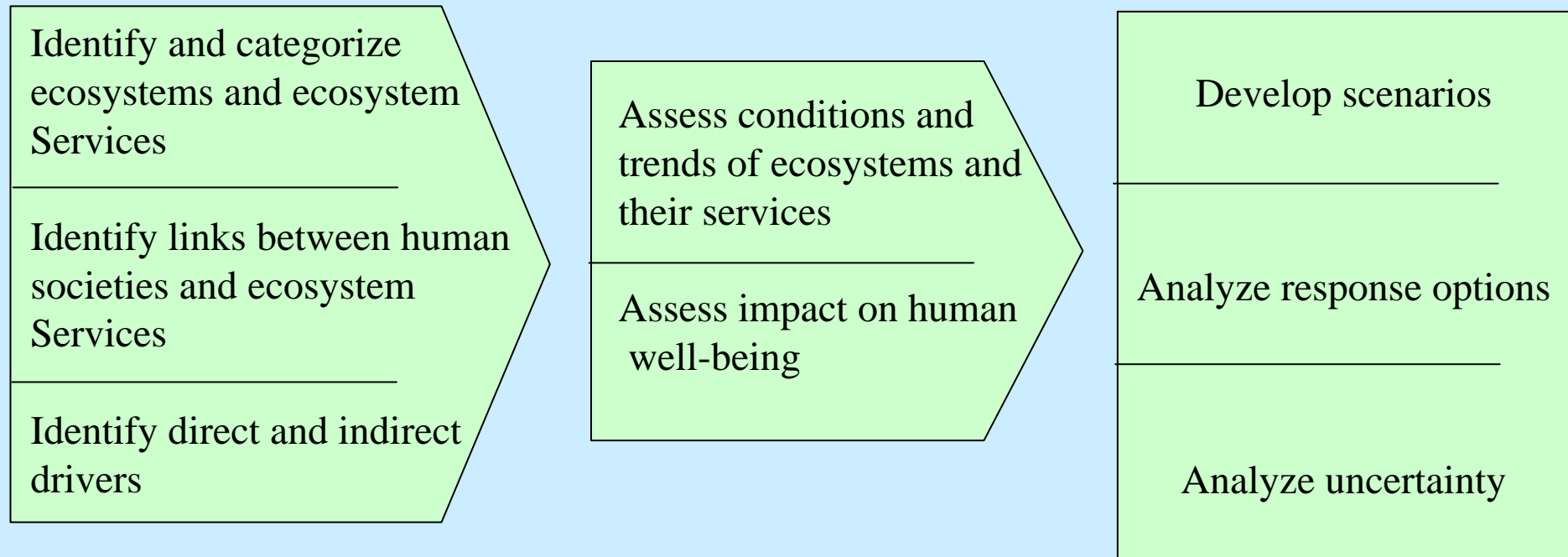
- 'What is happening to the environment and to humans?' (Type A or Descriptive Indicators)
- 'Does it matter?' (Type B or Performance indicators)
- 'Are we improving?' (Type C or Efficiency indicators)
- 'Are we on the whole better off?' (Type D or Total Welfare indicators)

# Complementary Goals for Ecosystem Indicators

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- Policy Relevance
- Technical Credibility
- Political Legitimacy

# The Analytical Approach of the Millennium Ecosystem Assessment



## Ecosystem Services

### Provisioning Services

*Products obtained from ecosystems*

- Food
- Fresh water
- Fuelwood
- Fiber
- Biochemicals
- Genetic resources

### Regulating Services

*Benefits obtained from regulation of ecosystem processes*

- Climate regulation
- Disease regulation
- Water regulation
- Water purification

### Cultural Services

*Nonmaterial benefits obtained from ecosystems*

- Spiritual and religious
- Recreation and ecotourism
- Aesthetic
- Inspirational
- Educational
- Sense of place
- Cultural heritage

### SUPPORTING SERVICES

*Services necessary for the production of all other ecosystem services*

- Soil formation
- Nutrient cycling
- Primary production

## Determinants and Constituents of Well-being

### Security

- Ability to live in an environmentally clean and safe shelter
- Ability to reduce vulnerability to ecological shocks and stress

### Basic Material for a Good Life

- Ability to access resources to earn income and gain a livelihood

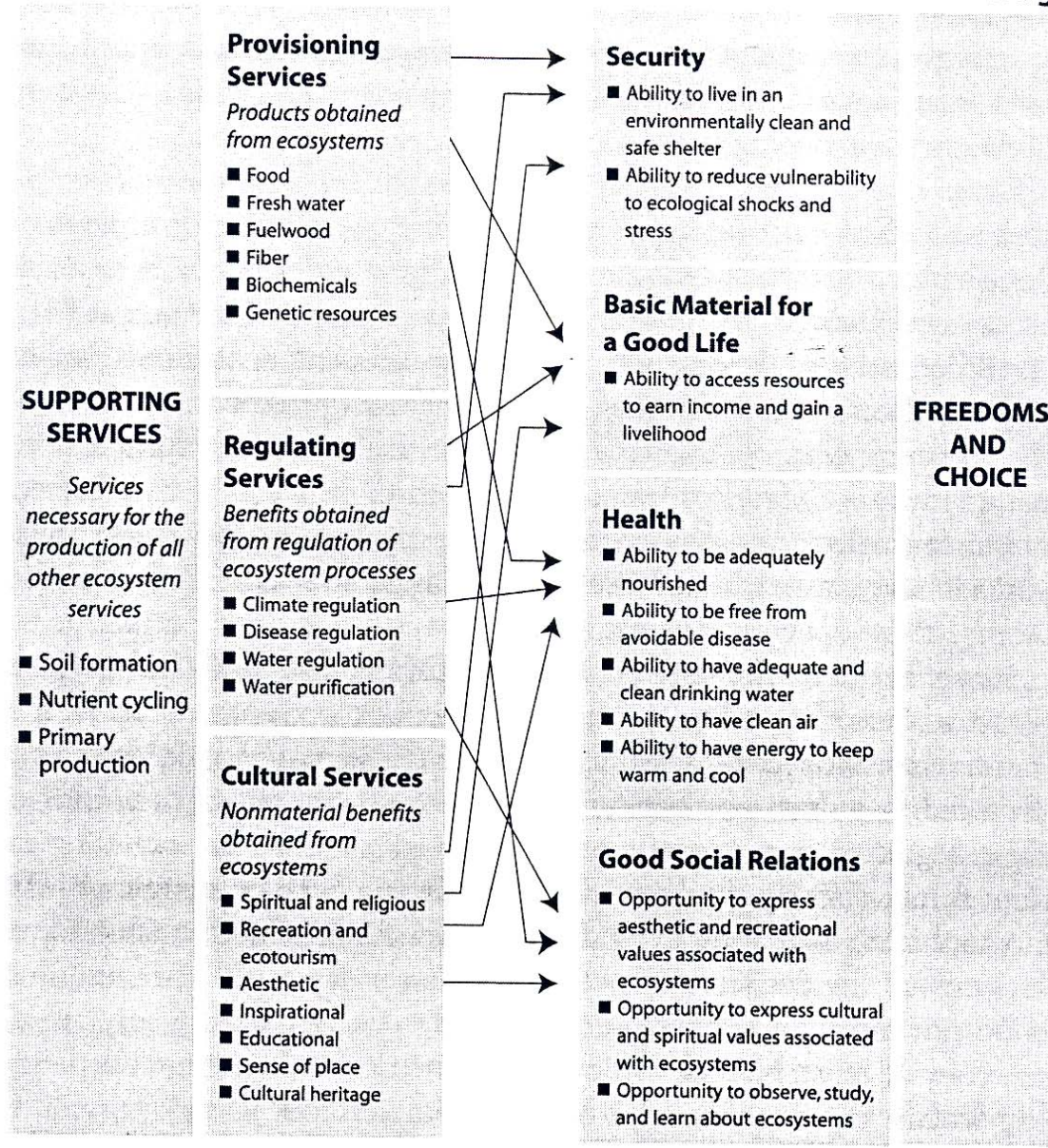
### Health

- Ability to be adequately nourished
- Ability to be free from avoidable disease
- Ability to have adequate and clean drinking water
- Ability to have clean air
- Ability to have energy to keep warm and cool

### Good Social Relations

- Opportunity to express aesthetic and recreational values associated with ecosystems
- Opportunity to express cultural and spiritual values associated with ecosystems
- Opportunity to observe, study, and learn about ecosystems

### FREEDOMS AND CHOICE



# Towards a Strategy of “Vigilance”

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- **Flexible responses**, i.e., operational and strategic flexibility
- **Proactive commitment**, in terms of environmental scanning and through an emphasis on risk rather than crisis management
- **River basin focus** and robust transnational “regimes”
- **Combinations of global approaches** and national plans
- **Ecosystemic emphasis** and environmental interdependencies
- **Integrated, comprehensive management**, capacity building and organizational mobilization.

**The Ultimate Paradigm**

Either a

Democracy of Restraints

or a

Tyranny of Constraints

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# 50 Reasons Not To Change

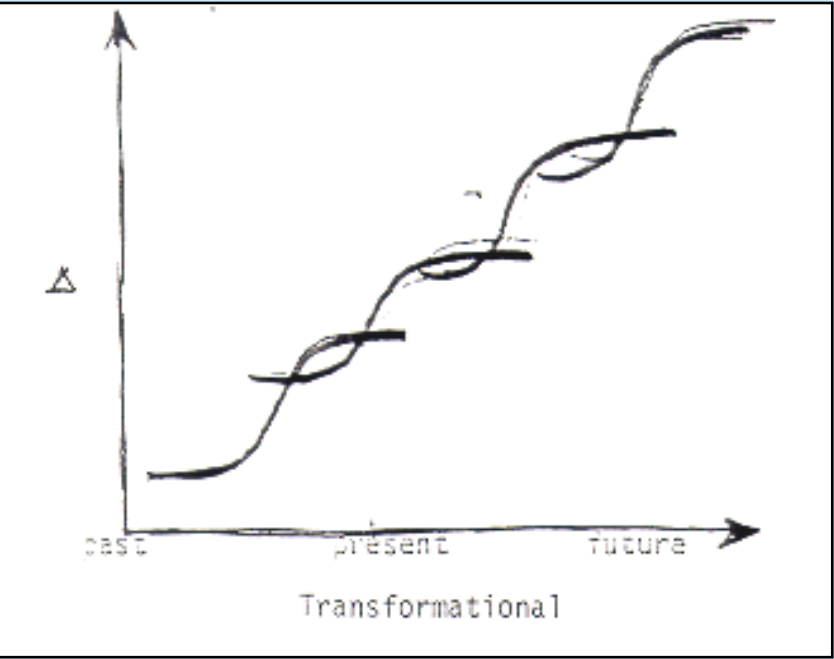
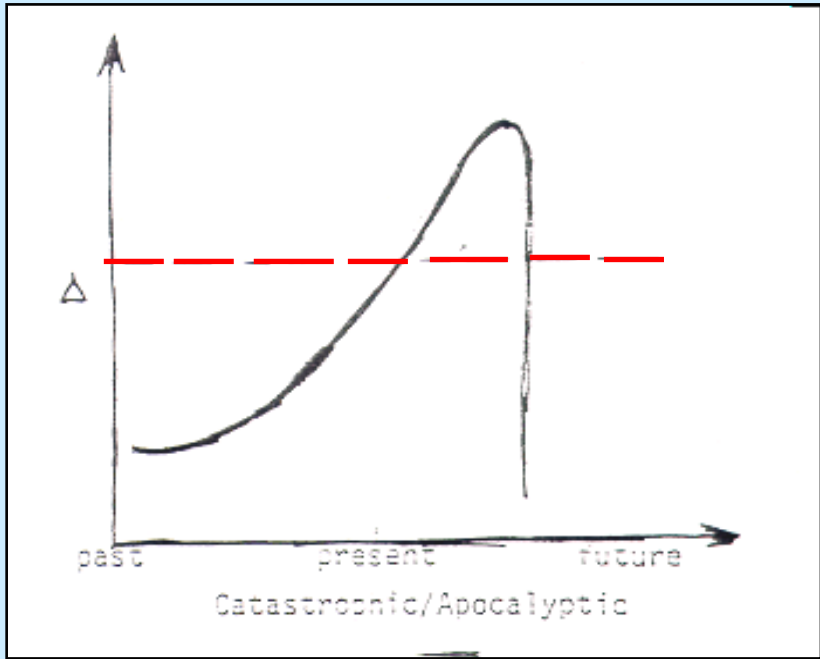
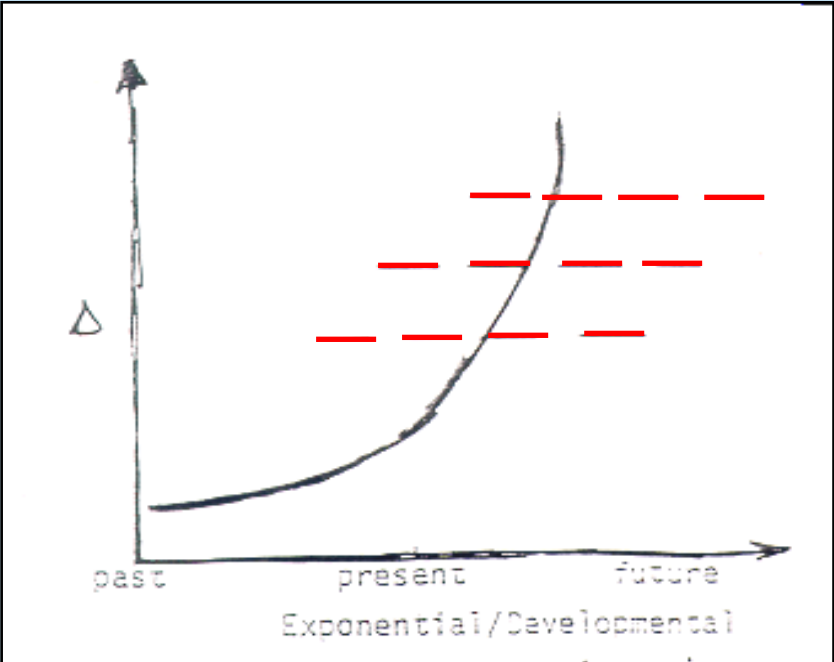
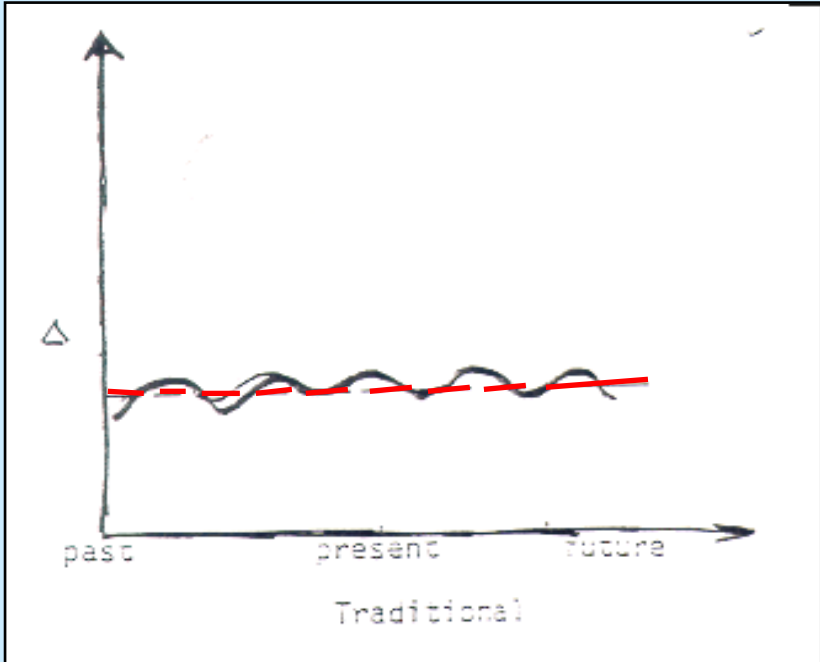


**Stop.**  
**Look inward.**  
**Listen.**  
**To yourself.**  
**To others.**

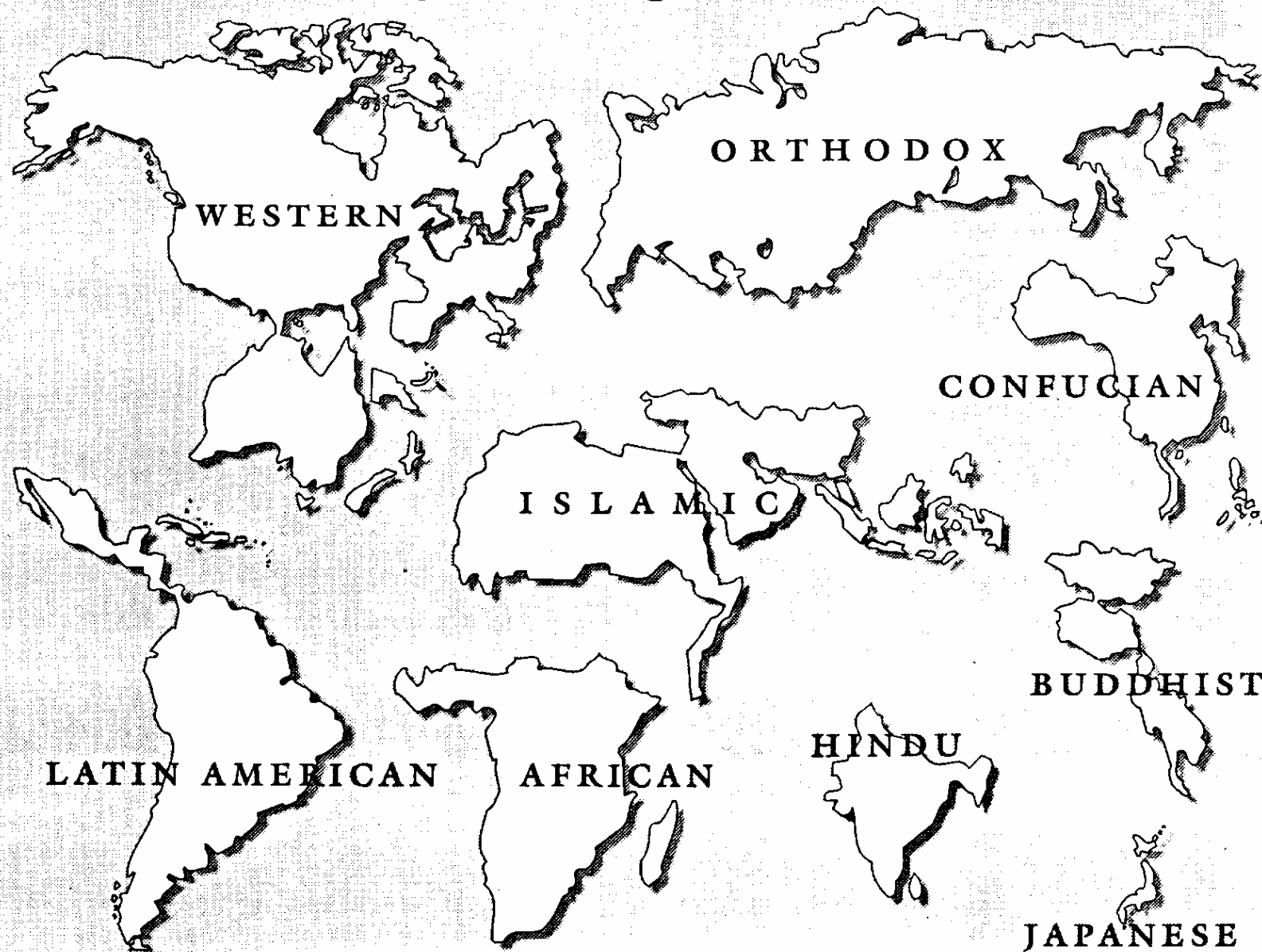


“The future is not result of choices among alternative paths offered by the present, but a place that is created --- created first in mind and will, created next in activity. The future is not some place we are going to, but one we are creating. The paths to it are not found but made, and this activity of making them changes both the maker and the destination.”

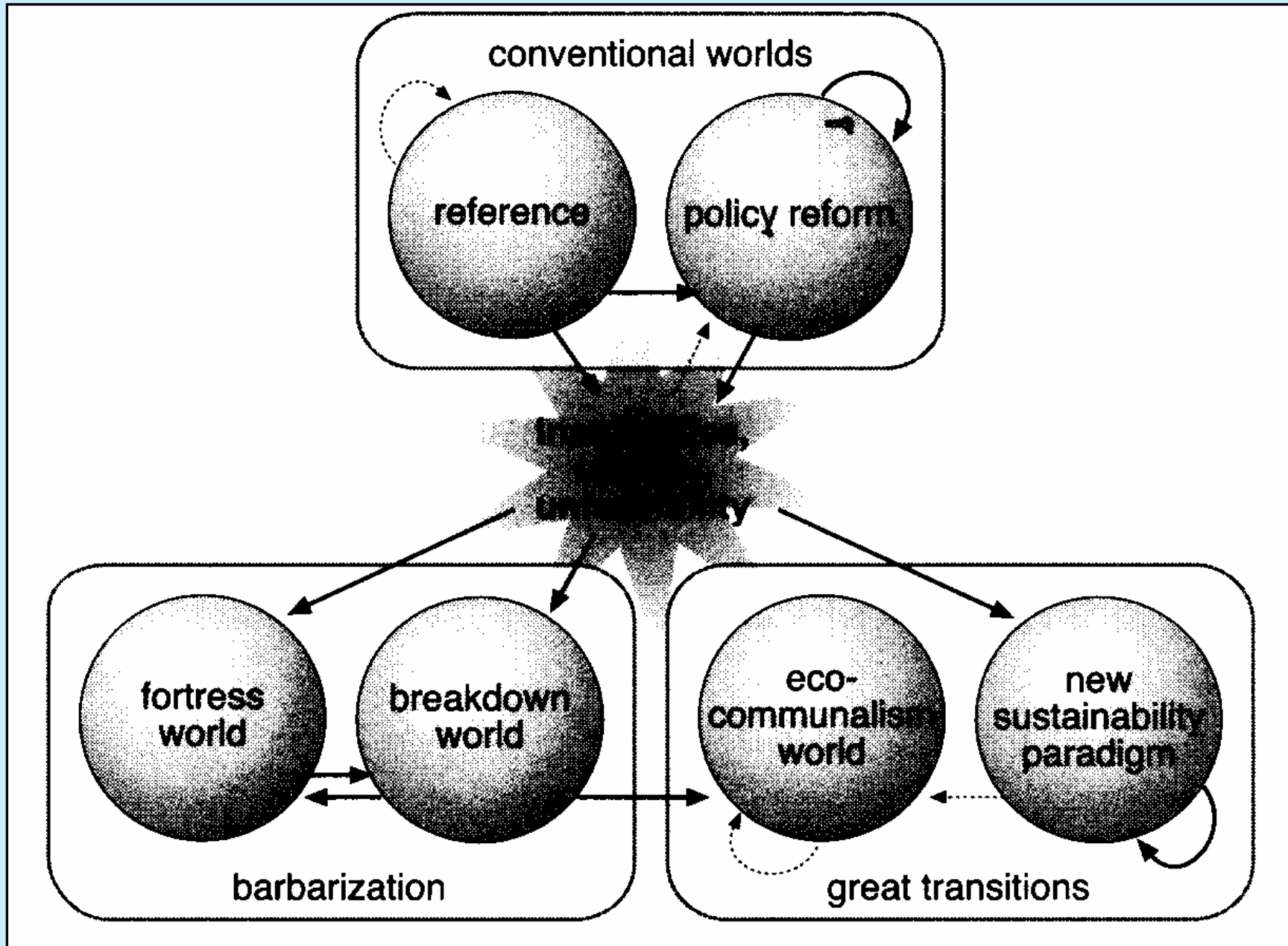
John Schaar



## The world according to Huntington



Source: Adapted by *The Economist* from "The Clash of Civilisations and the Remaking of World Order" by Samuel Huntington



Source: Gunderson and Holling, 2002

# Emerging Operational Principles

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- **Envisioning**

Share the dream, share the goals

- **Empowerment**

Joint decision making, power sharing

- **Enactment**

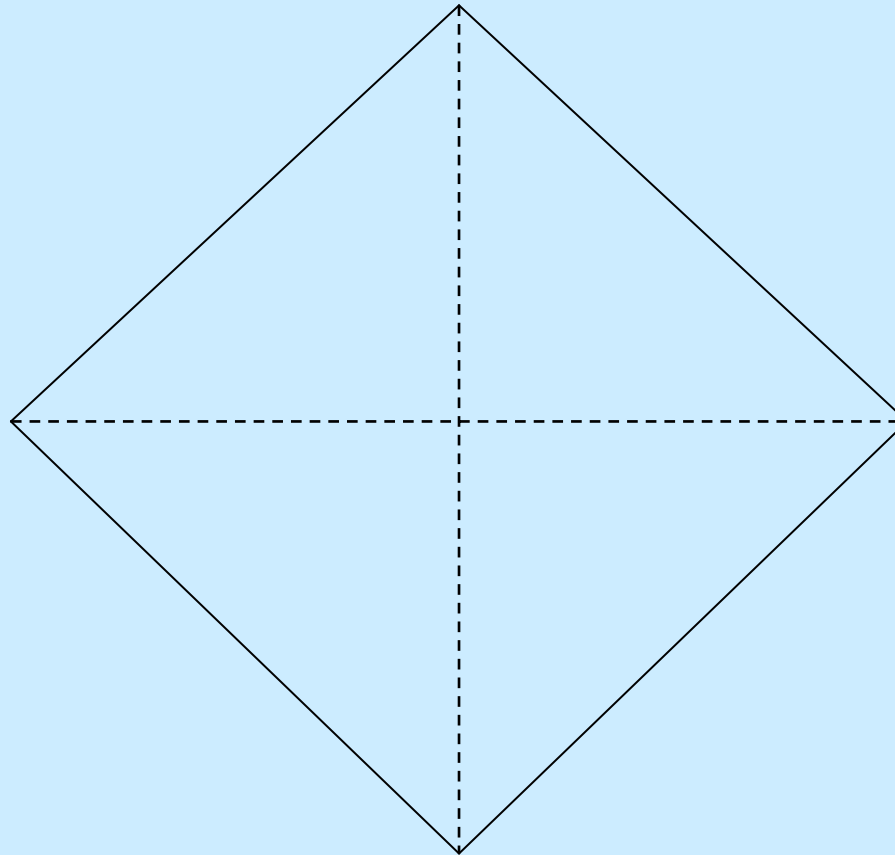
Implementation, civic engagement

**POLITICIANS**  
[elected representatives  
policy generators]

**PROFESSIONALS**  
[knowledge generators  
researchers  
data & information]

**PRACTITIONERS**  
[implementors  
administrators]

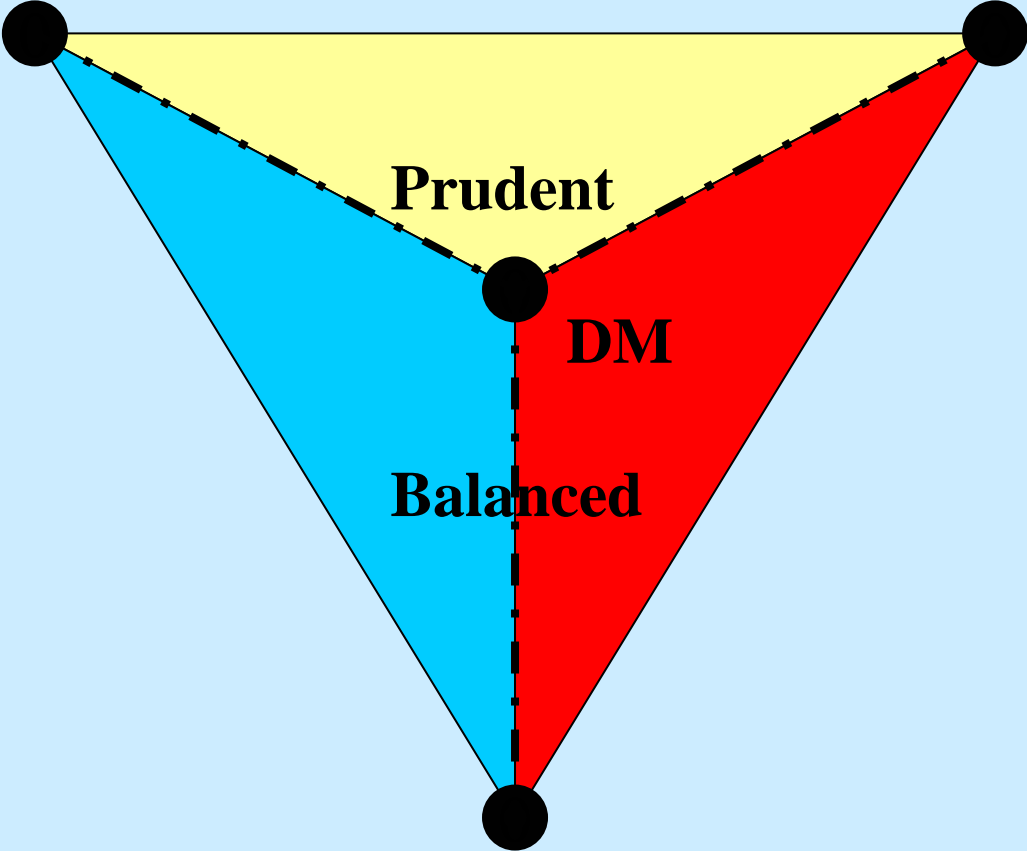
**PUBLIC**  
[recipients]



**THE ON-GOING CHALLENGE OF RELATING:**

Legal Mandates

Professional Standards



Public Desires

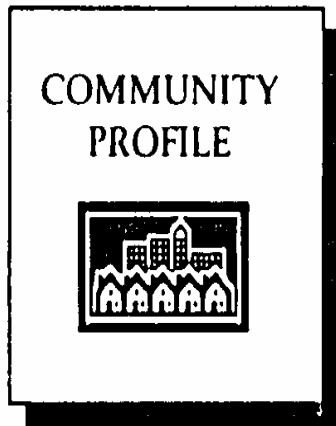
# The Politics of Transformation

- Building Data / DSS
- Expanding Knowledge / Judgement
- Creating Institutions / Capacity Building
  - Mobilize Resources
    - Articulate Values



1.

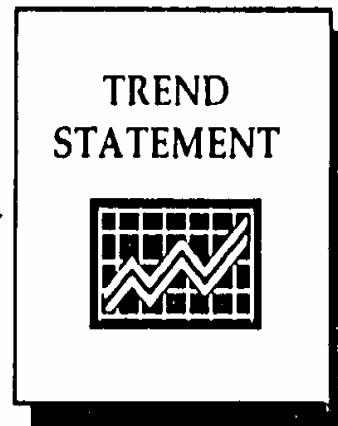
*Where are we now?*



- Descriptive Information
- Community Values

2.

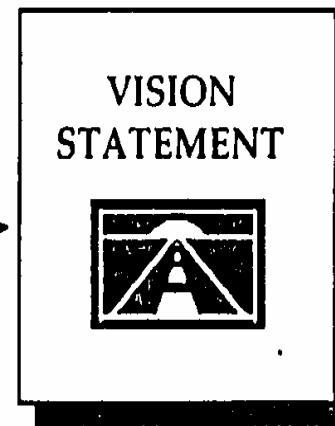
*Where are we going?*



- Trend Information
- Probable/Possible Scenarios

3.

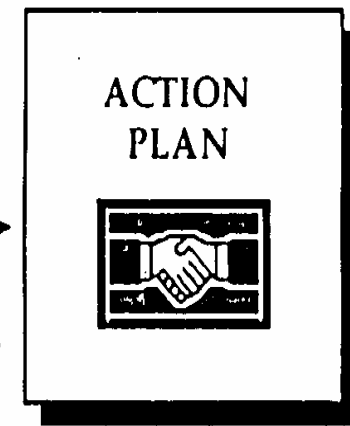
*Where do we want to be?*



- Preferred Scenario
- Community Vision

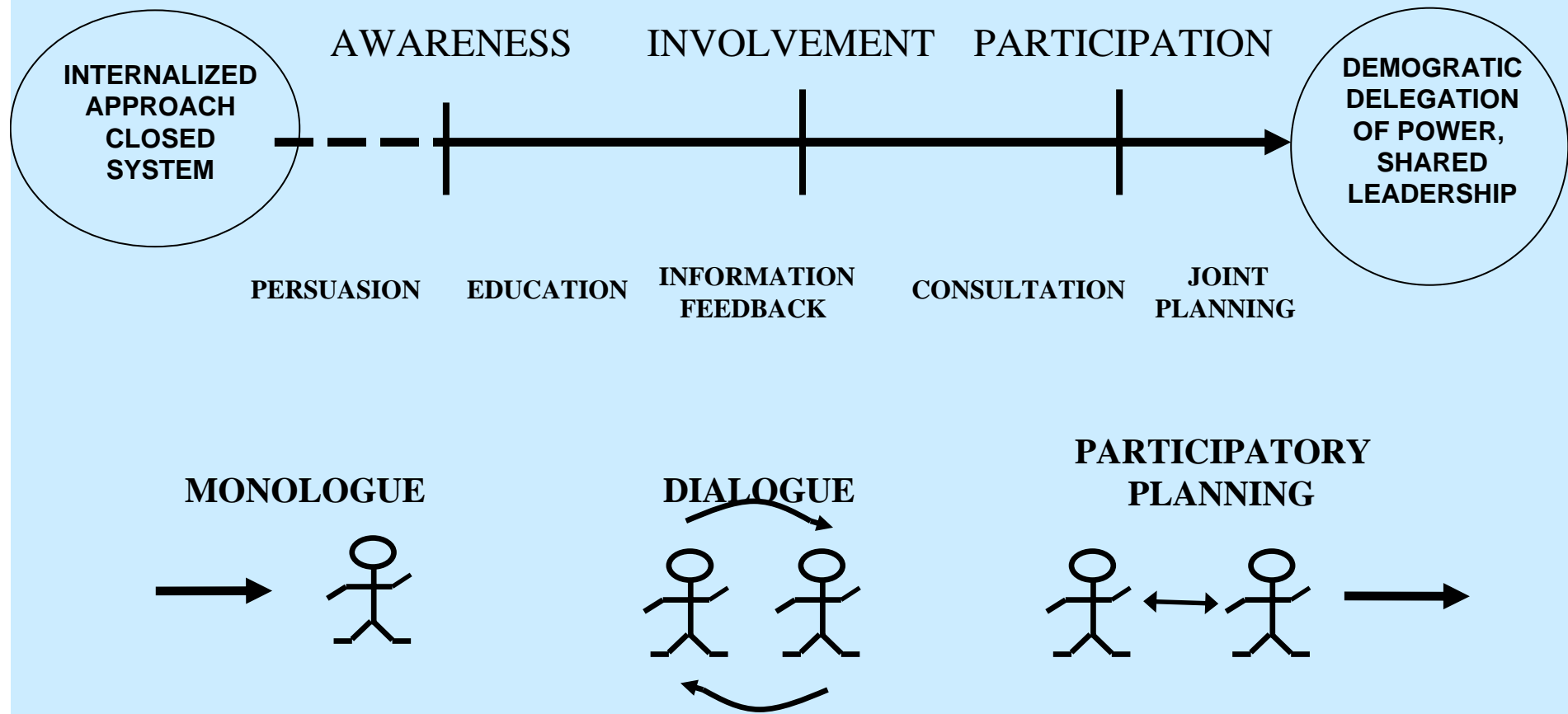
4.

*How do we get there?*



- Goals, Strategies & Actions
- Action Agendas & Priorities

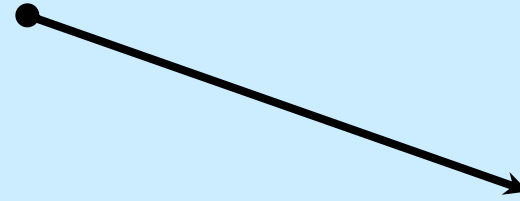
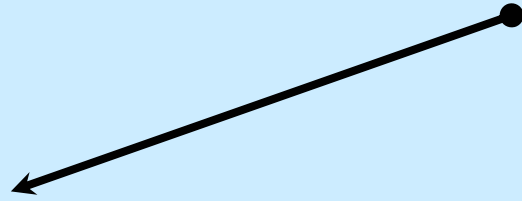
# THE RANGE OF PUBLIC ENGAGEMENT





*"At last! After all the debates and polls, it's back to real politics!"*

# WHY IS IT SO DIFFICULT TO “MAKE IT HAPPEN?”



## THE FORCES OF HISTORY & EXPERIENCE

1. THE INERTIA OF HABIT
2. THE INERTIA OF HISTORY
3. THE INERTIA OF EQUILIBRIUM

## FUNDAMENTAL CONFLICTS

- A. COGNITIVE CONFLICTS
- B. STAKEHOLDER CONFLICTS
- C. IDEOLOGICAL CONFLICTS