

Between the land and the sea

**Considering social-ecological systems
for better coastal and ocean management**



*Ocean Policy Research Foundation Forum. Tokyo, 16 September 2009
Yves Henocque, IFREMER-OPRF Visiting Fellow*

NEWS FROM THE WORLD

October 2006

*The Stern Review, a detailed report on the economics of climate change, warns unabated
Global warming could cause damages worth
5 to 20% of global GDP*

September 2007

*Scientists report that Arctic sea ice has thinned by half
since 2001, with large areas of ice now only one meter
thick as the ocean and atmosphere continue to warm*

Worldwatch Institute, 2008

September 2009

*Climate change makes shipping's long-sought Northeast
Passage real: two German ships completing the transit*

International Herald Tribune/The Asahi Shimbun 12-13/09/09

SATOYAMA



A « cultural landscape »

where people feel they
are part of nature

But is it a story about the relationship between
man and nature or rather about human beings'
interrelations about nature ?

Our planet as a system

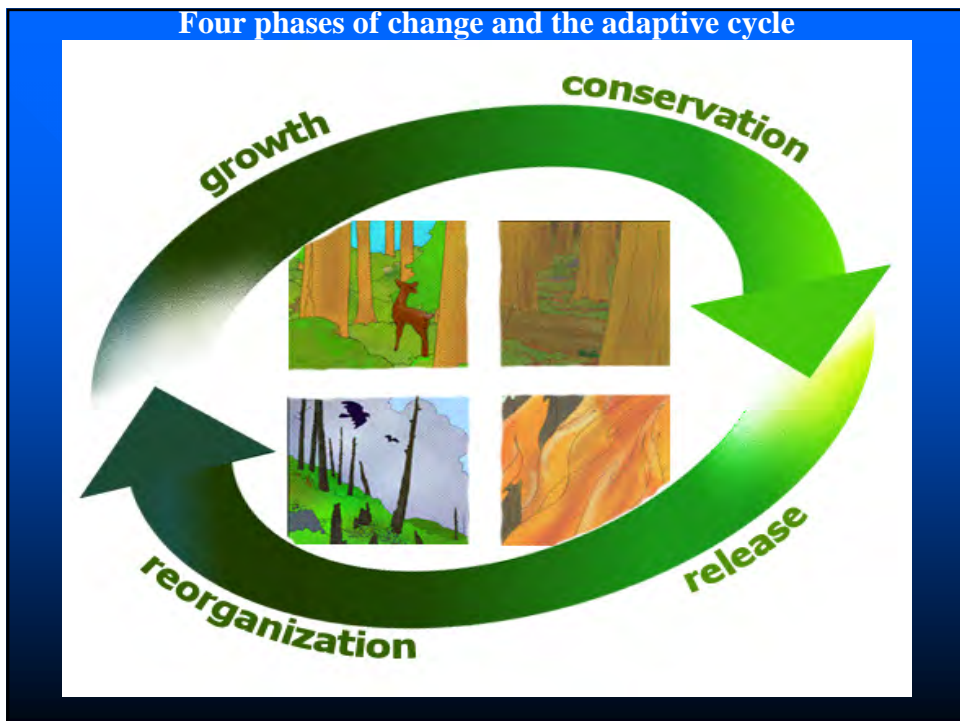
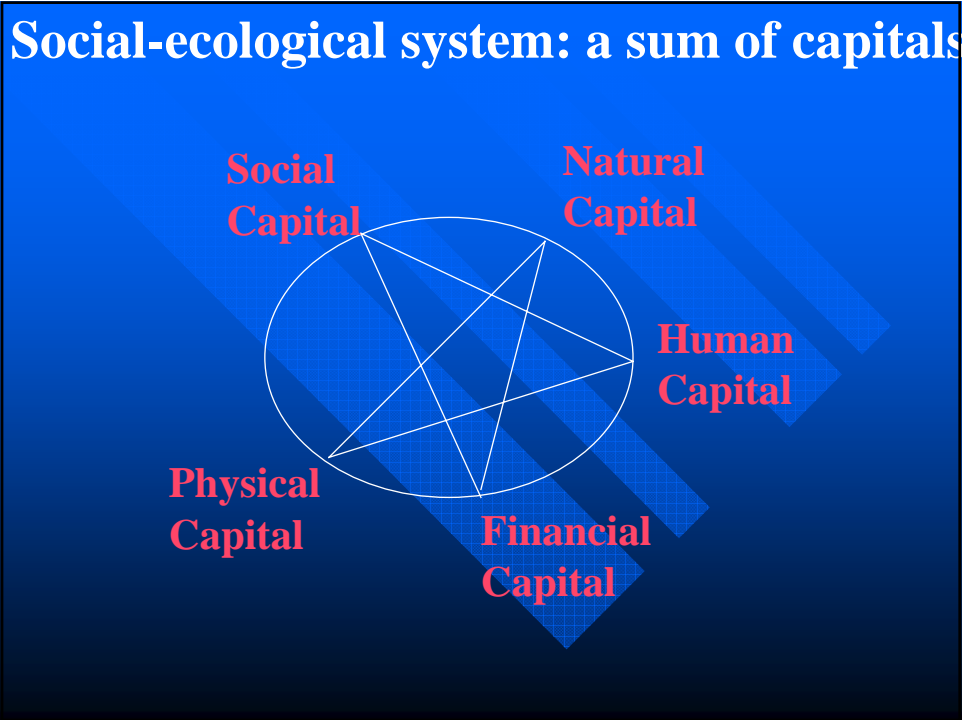
Set of connected components that comprise a unified object: Earth

Ecosystem

A dynamic complex of plants, animals,
microbes and physical environmental
features that interact with one another

Social-Ecological system

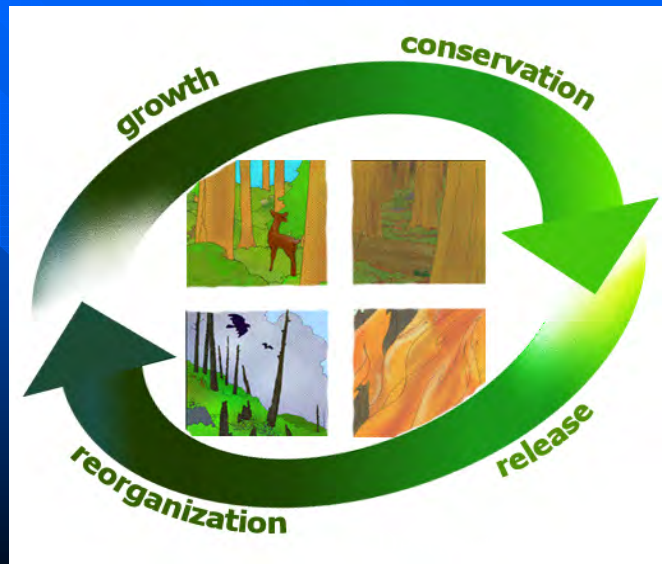
An integrated system of ecosystems and
human society with reciprocal feedback
and interdependence —→ *Satoyama ?*



How far the system is able to absorb shocks ?

RESILIENCE

May not necessarily
return to the
INITIAL STATE
after disturbances



RESILIENCE

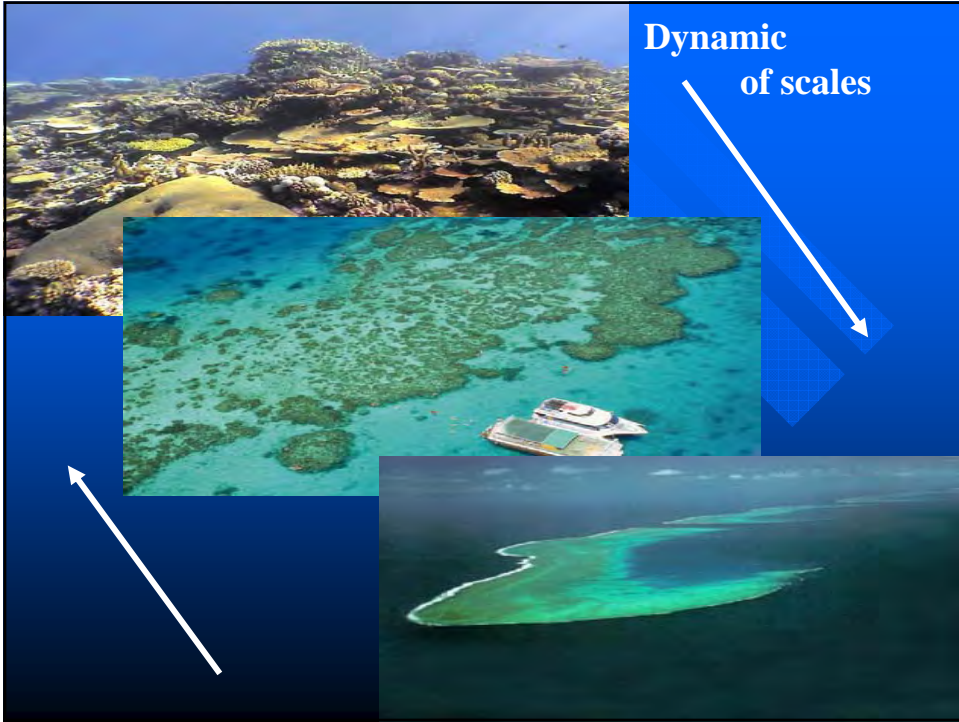
A CONCEPT THAT GOES WITH:

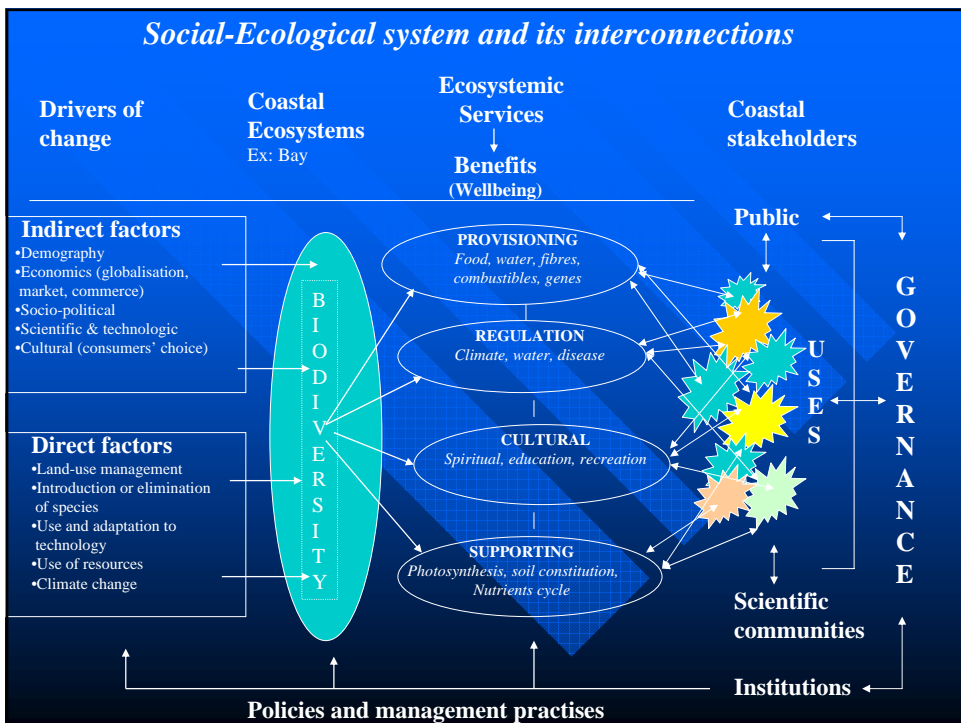
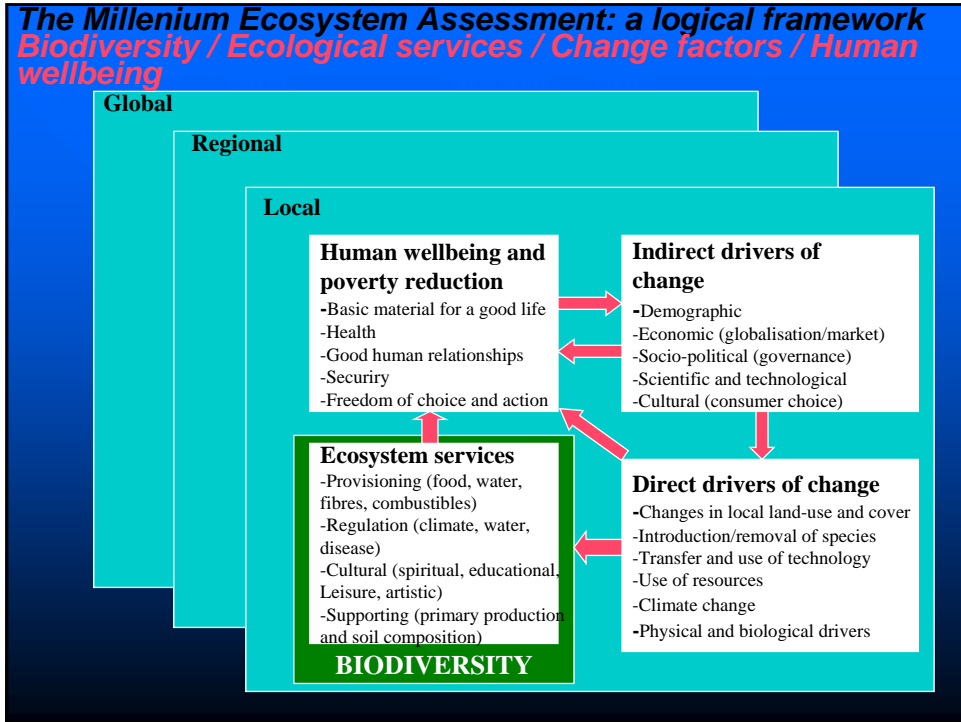
NON-LINEARITY

UNSTABLE STATES

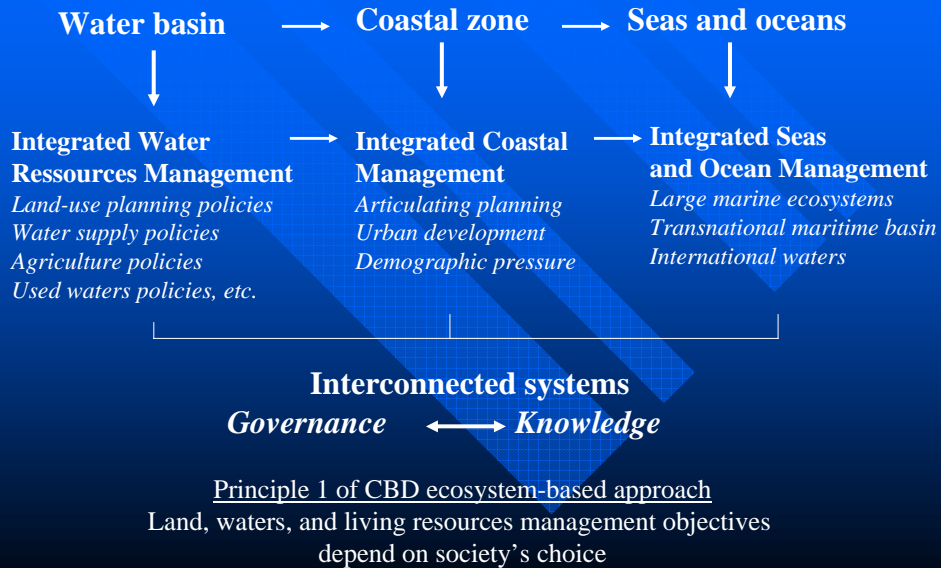
THRESHOLDS







APPLYING THE SOCIO-ECOSYSTEMIC APPROACH FROM RIVER TO COAST AND OCEAN



THE GREAT BARRIER REEF OUTLOOK REPORT 2009 AS A CASE STUDY

A national and international icon (1981: World Heritage list)

The largest coral reef ecosystem in the world (10% of total)

Spanning a length of 2,300 km along the East Coast of Queensland

Extending 70 to 250 km from the coast

Great Barrier Marine Park (1975 Act) extends over 344,400 km²

Complemented by the Great Barrier Reef COAST Marine Park

A multiple use marine park supporting more than 50,000 jobs

8 ASSESSMENTS REQUIRED BY THE ACT

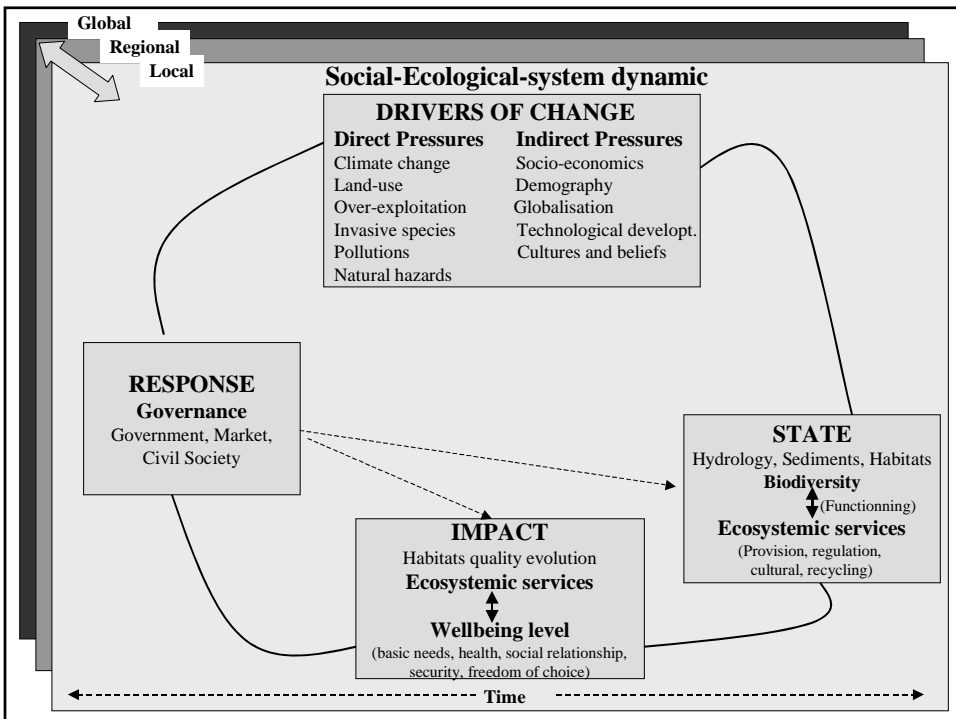
Values of the Great Barrier Reef

Biodiversity
Ecosystem health
Commercial and non-commercial use

Pressures and current responses

Factors influencing the reef's values
Existing protection and management
Ecosystem resilience
Risks to the reef

Long-term outlook for the social-ecological system



ASSESSMENT OF BIODIVERSITY

Habitats and species: « GOOD »

...But!

Knowledge is patchy

Few key habitats and species have been monitored
coral reefs, seabirds, seagrass, dugong, marine turtle

Few long-term monitoring programs

Baseline is different for each group studied

What do we know about long-term biodiversity trends?

European analysis of freshwater biodiversity
(165 catchments covering 7 million km²)

Nb. Of disappearing fishes depends on the scale:

- a few species disappear at the continental scale
- up to 50% of former native species went extinct at catchment scale
- more than 70% at the sub-catchment scale
- proportion of non-native species as high as 50%

**No major loss in total species richness but a
fundamental change in the community structure**



« Reshuffling » of biodiversity

ASSESSMENT OF ECOSYSTEM HEALTH

-Physical and chemical processes

A combination of factors: increased sedimentation
inputs of nutrients and pesticides
sea temperatures increasing
increasing ocean acidity

-Ecological processes

Decline in herbivory (indicator: dugong), predation on reef (indicator: sharks), in particle feeding (indicator: sea cucumber)
Populations of herbivorous fish healthy / algal blooms and introduced species are increasing

But nothing is known about trends in many key ecological processes such as microbial processes, primary production, symbiosis, competition and connectivity

ASSESSMENT OF COMMERCIAL AND NON-COMMERCIAL USE

Great Barrier Reef industries: \$ 5.4 billion (2007)

Marine tourism, fishing, recreational use,

Defence training

Central to the culture of « Traditional owners » caring for their land and « sea country ».

—————> **Benefits of use: Very good**
Impacts of use: Low impact

But the future cumulative effects of all use and the ecosystem-level impacts are poorly understood

ASSESSMENT OF FACTORS INFLUENCING THE REEF'S VALUES

Much of what will happen to the Great Barrier Reef in the future will be determined by factors external to it and even Australia



- **Climate change**
- **Catchment runoff (38 major catchments)**
- **Coastal development (Population increase)**

ASSESSMENT OF EXISTING PROTECTION AND MANAGEMENT

Understanding of context.....Very good
Planning.....Good
Financial staffing and info. inputs.....Poor
Management systems and processes...Very good
Delivery of outputs.....Good

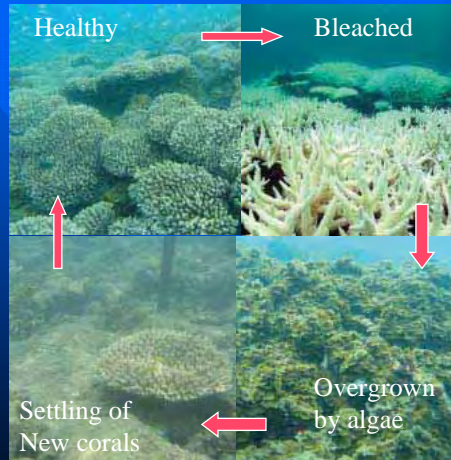


What about the outcomes ?

ASSESSMENT OF ECOSYSTEM RESILIENCE

Capacity to recover from disturbance or withstand ongoing pressures

Not about a single ideal ecological state, but an ever-changing system of disturbance and discovery



Great Barrier Reef Outlook Report 2009 – In Brief

ASSESSMENT OF ECOSYSTEM RESILIENCE

Recovery after disturbance: « Good »

For coral reefs, lagoon floor, coral trout,
humpback whales

Very slow in the case of loggerhead turtles

Or not evident in the case of dugongs

**But increasing frequency and extent of threats
are likely to reduce the resilience of species and
habitats**

LONG TERM OUTLOOK of a social-ecological system like the Great Barrier Reef

The main drivers of change:

- **Climate change**
- **Catchment runoff** (sediments, nutrients, pesticides)
- **Coastal development** (human population increase)
- **Fishing** (illegal fishing and poaching)



Reduce the resilience of the whole system

LONG TERM OUTLOOK

In spite of impressive management measures, the overall achievement of outcomes is poor because

The main drivers of change originate beyond the Scale of the Great Barrier Reef Region and the ability to address cumulative impacts Remains weak

**Outlook for the Great Barrier Reef ecosystem:
POOR**

Best response: further building the resilience of the system

**If change in the world's climate become too severe
catastrophic damage to the ecosystem
may not be averted**

At least.....

**Given the strong management of the Great Barrier
reef, it is likely that the ecosystem will survive
better than most other reef ecosystems around
the world !...**

SOCIAL-ECOLOGICAL SYSTEM APPROACH

**A SCIENTIFIC APPROACH OF SYSTEMIC NATURE
THAT CARES FOR INTERACTIONS, COMPLEXITY
AND UNCERTAINTY**



**AN ADAPTIVE KIND OF MANAGEMENT THAT LEARNS
BY DOING ABOUT INTERACTIONS BETWEEN SOCIAL
AND ECOLOGICAL DYNAMICS**

***BESIDES KNOWLEDGE, IT IS MAINLY ABOUT
HUMAN VALUES AND
CHANGES IN BEHAVIOUR***

SCIENCE OF RESILIENCE / SUSTAINABILITY

*Interdisciplinary
approach*



*Adaptive
management*

**The shaping of a new contract between
science and society
for a Global « Cool » New Deal**

**Where there will be a shift of emphasis
from the importance of « knowing » to
the centrality of « learning »**

This should be a multi-scale effort!

Calling simultaneously for:

**New forms of transnational
government networks (G20)**

New forms of national governance

New forms of local governance

