



What on Earth is Resilience?

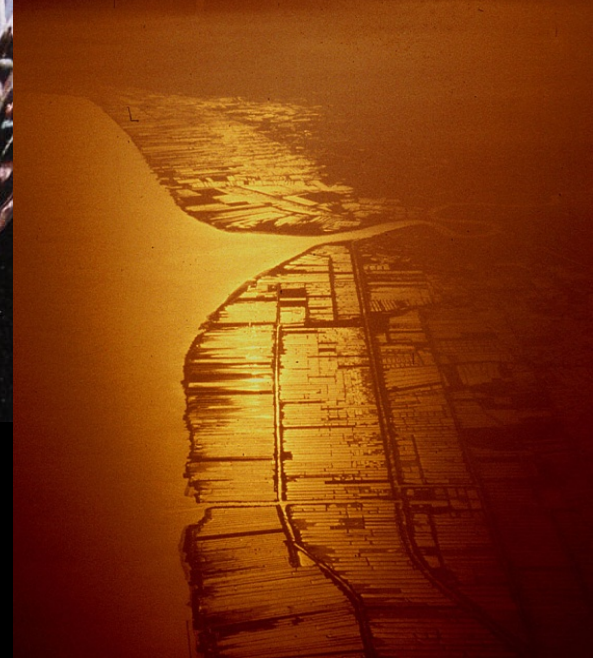
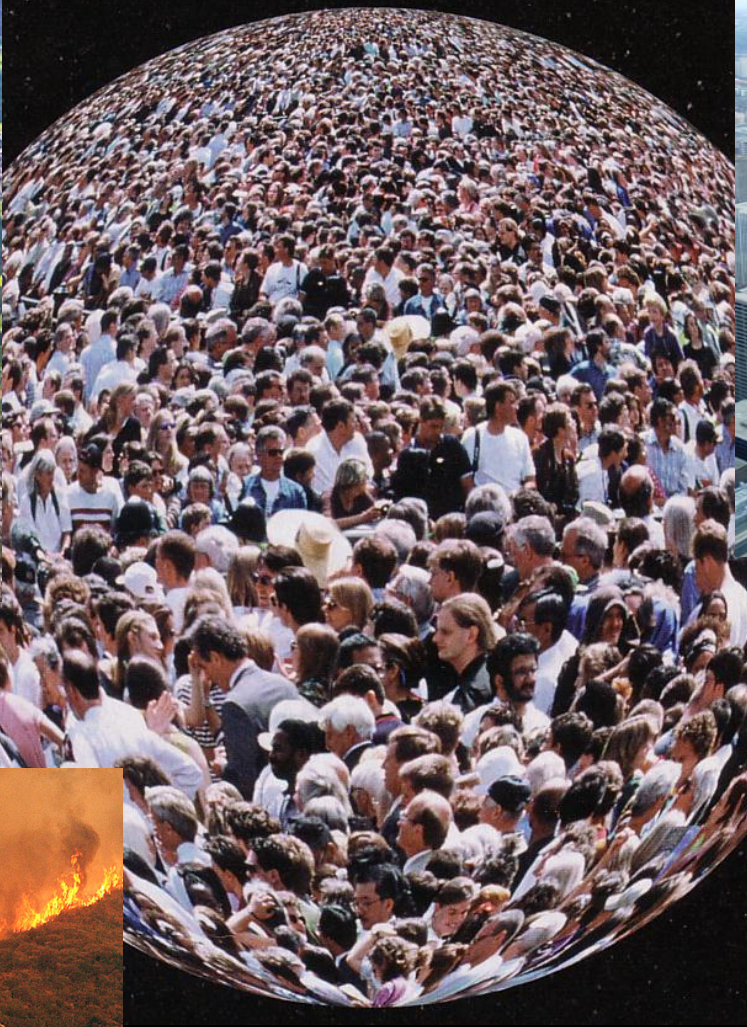
Law for Social-Ecological Resilience

Carl Folke,
Stockholm Resilience Centre, Stockholm University
Beijer Institute of Ecological Economics, Royal
Swedish Academy of Sciences

Capturing Essential Feedbacks

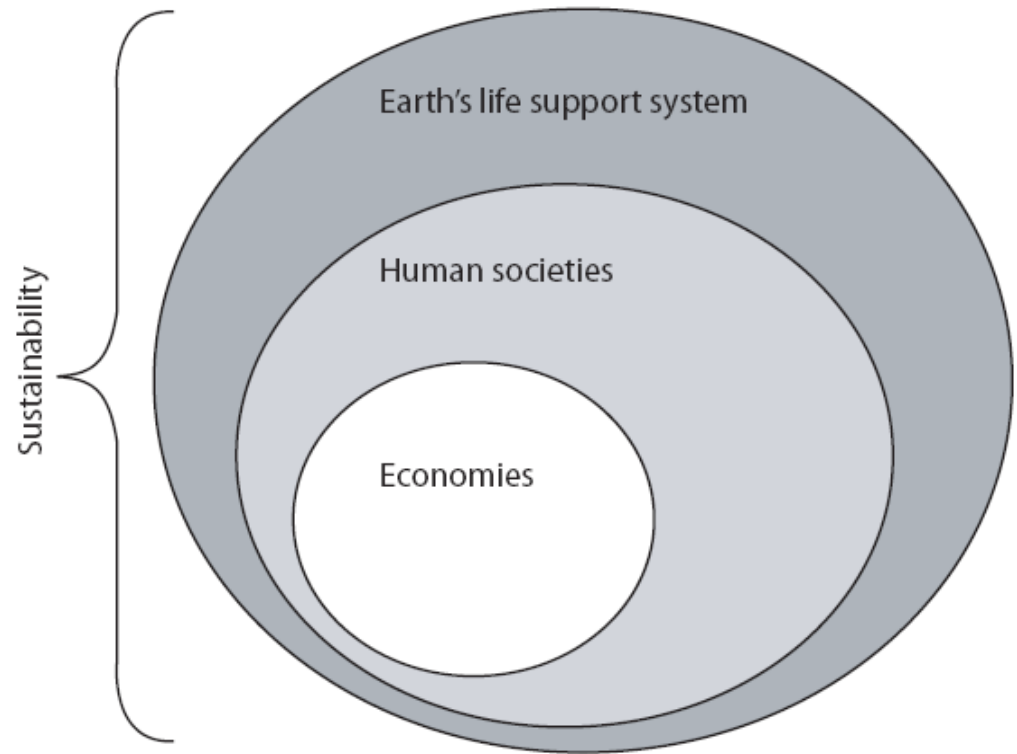
- In social-ecological systems
- In relation to tipping points, thresholds
- Across levels and scales
- In multilevel and adaptive governance
- For transformations towards sustainability

A biosphere shaped by humanity



Perspective

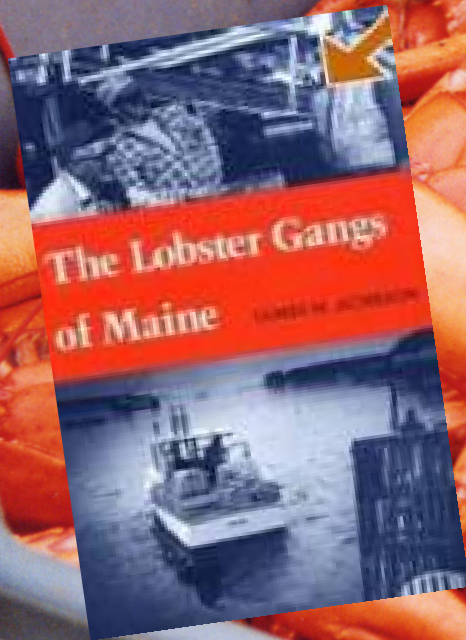
- Integrated economies and societies
- The living resource base as the foundation for the integration
- Strengthening the ability of people to enhance Earth's life support capacity for societal development and human wellbeing





Common Pool Resource Stewardship and Climate Change

Seafood management in Maine, USA a success story



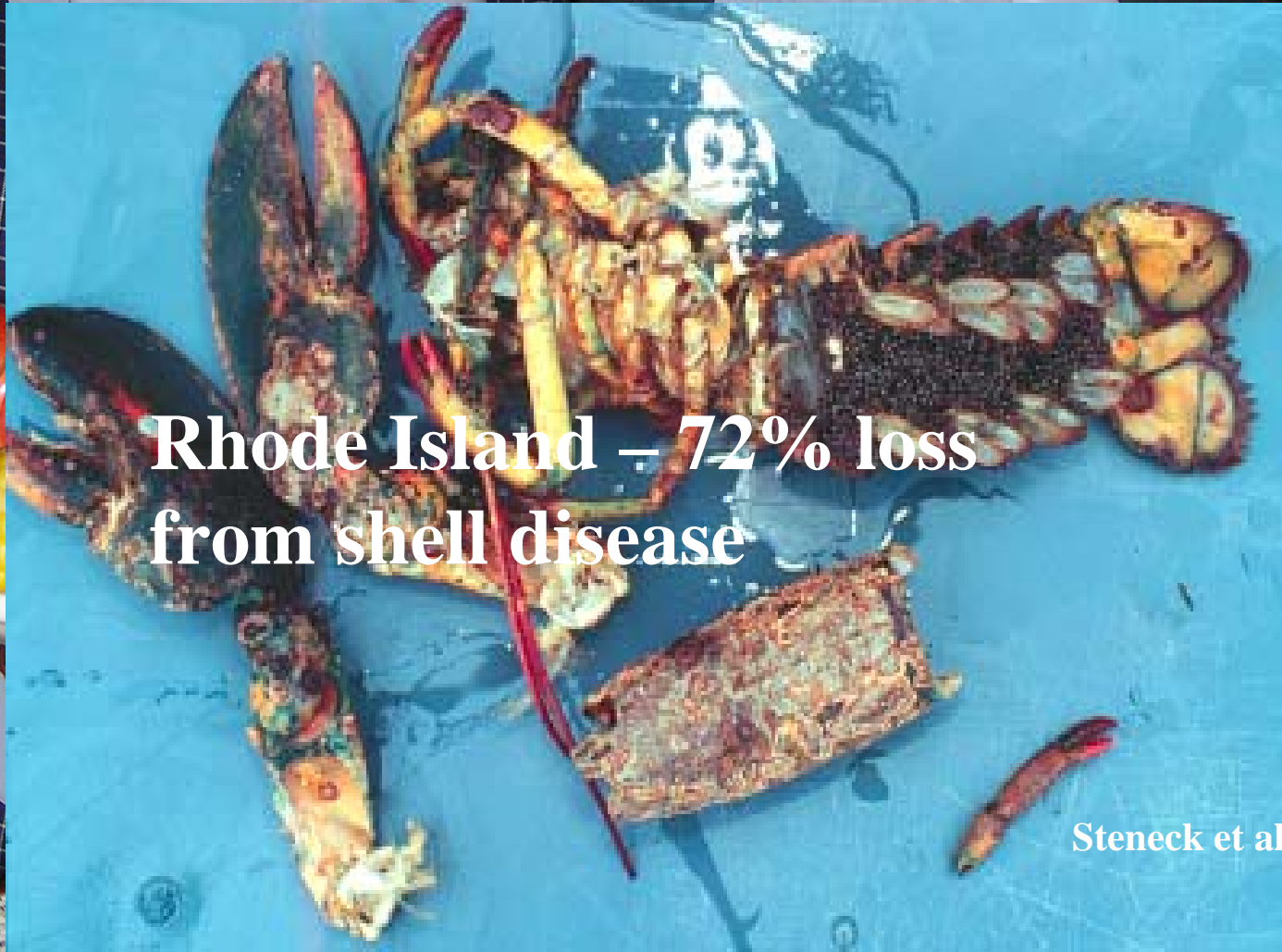
Stockholm Resilience Centre
Research for Governance of Social-Ecological Systems



A centre with:



Lobster aquaculture and juicy dinners..... a gilded trap?



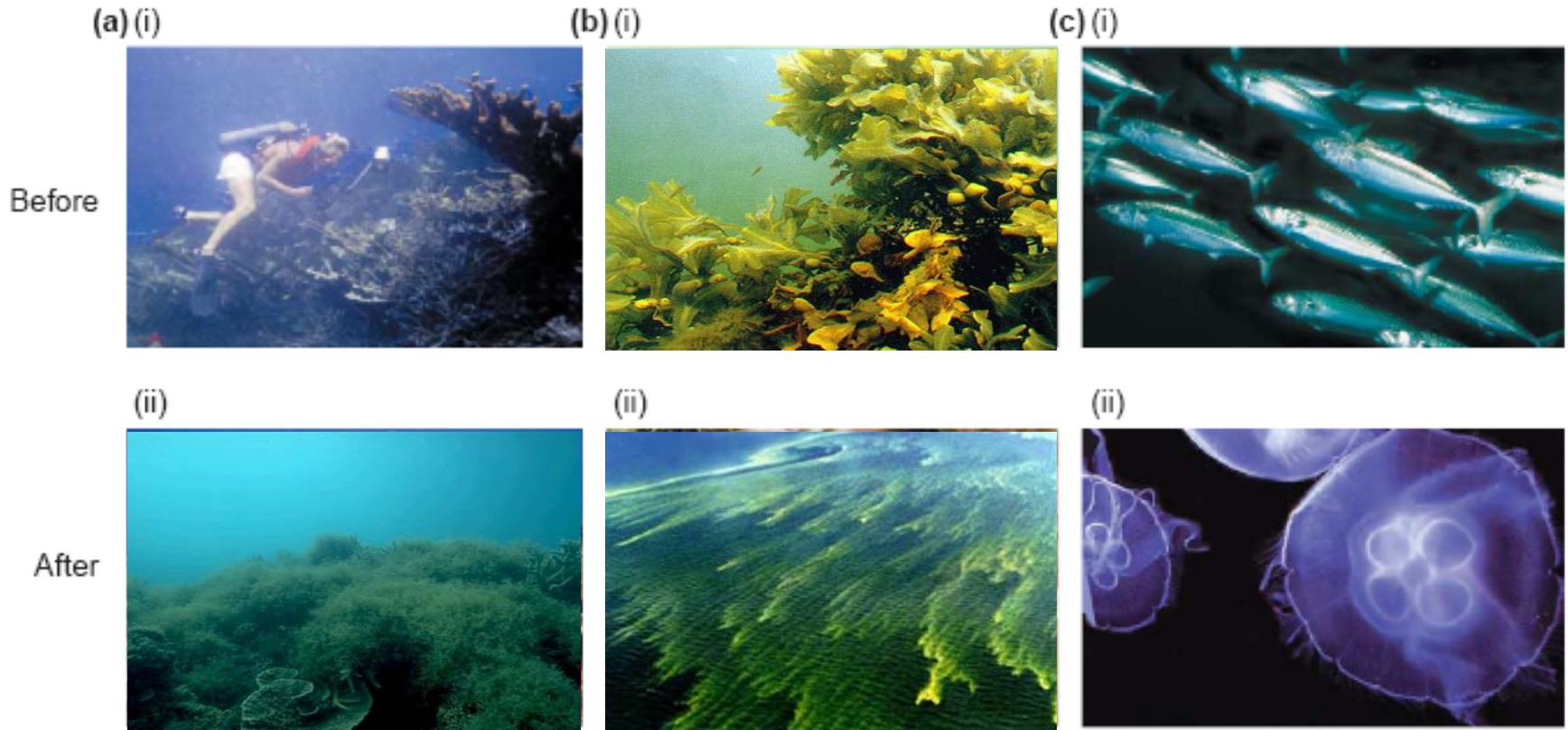
**Rhode Island – 72% loss
from shell disease**

Steneck et al. in review

Tipping points – critical transitions



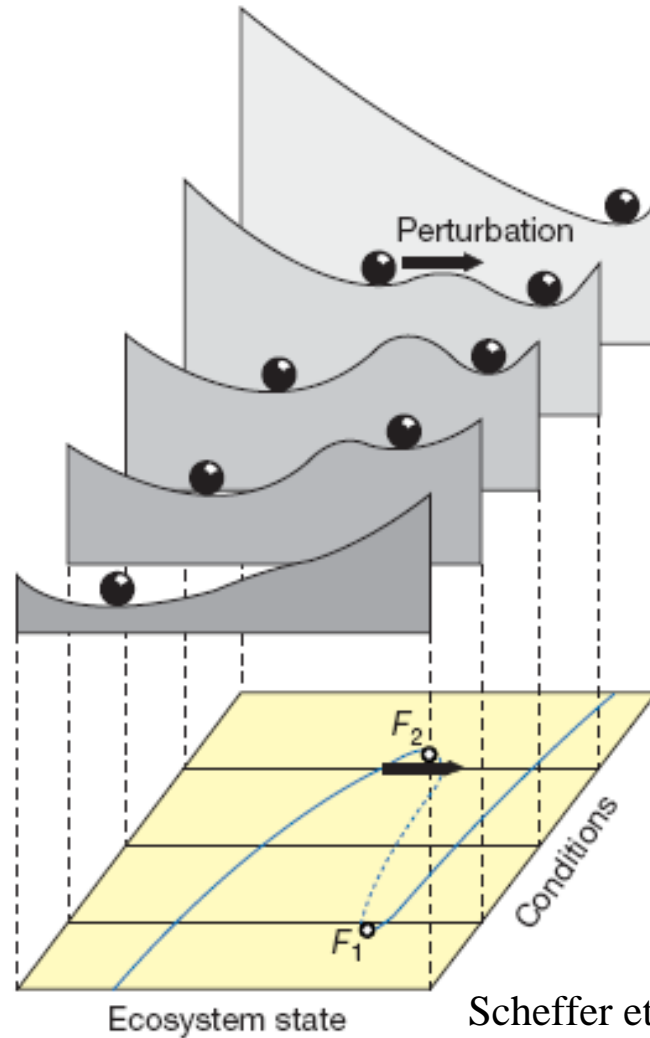
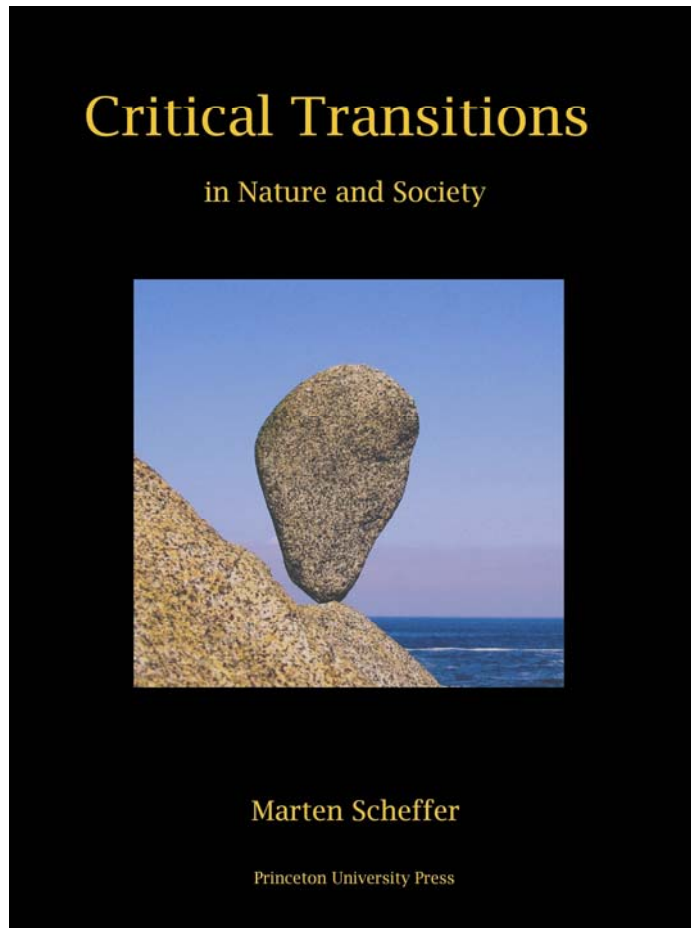
Marine shifts



losses of ecosystem services

Hughes et al. 2005. TREE

Critical transitions and regime shifts



Scheffer et al. 2001. Nature



Type of Misfit	Definition of Mechanism
Spatial	Governance does not match the spatial scales of social-ecological processes
Temporal	Governance does not match the temporal scales of social-ecological processes
Threshold behavior	Governance does not recognize, or is unable to avoid, abrupt shifts in social-ecological systems
Cascading effects	Governance is unable to buffer, or amplifies cascading effects between domains

Cascading effects

El Niño, Borneo and global markets





Stockholm Resilience Centre
Research for Governance of Social-Ecological Systems



A centre with:



Turning El Niño from creator to destroyer

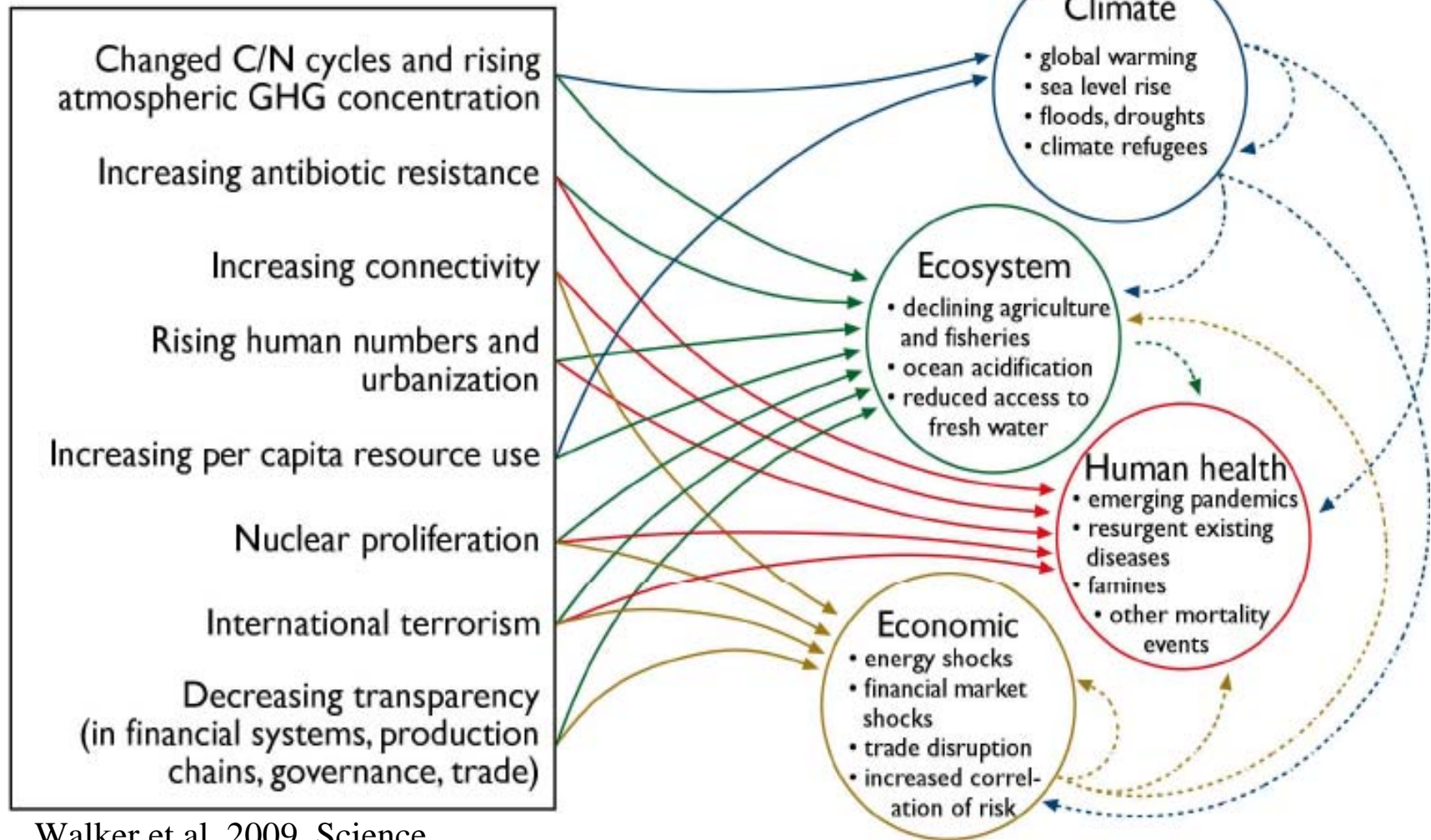


1997 fires - 13–40% of the
mean annual global carbon
emissions from fossil fuels

e.g. Curran et al. 200. Science
Page et al. 2002. Nature

Global drivers (exogenous and endogenous)

Unwanted outcomes



Walker et al. 2009. Science

Collaborative, global institutions for social-ecological resilience – is it at all possible?

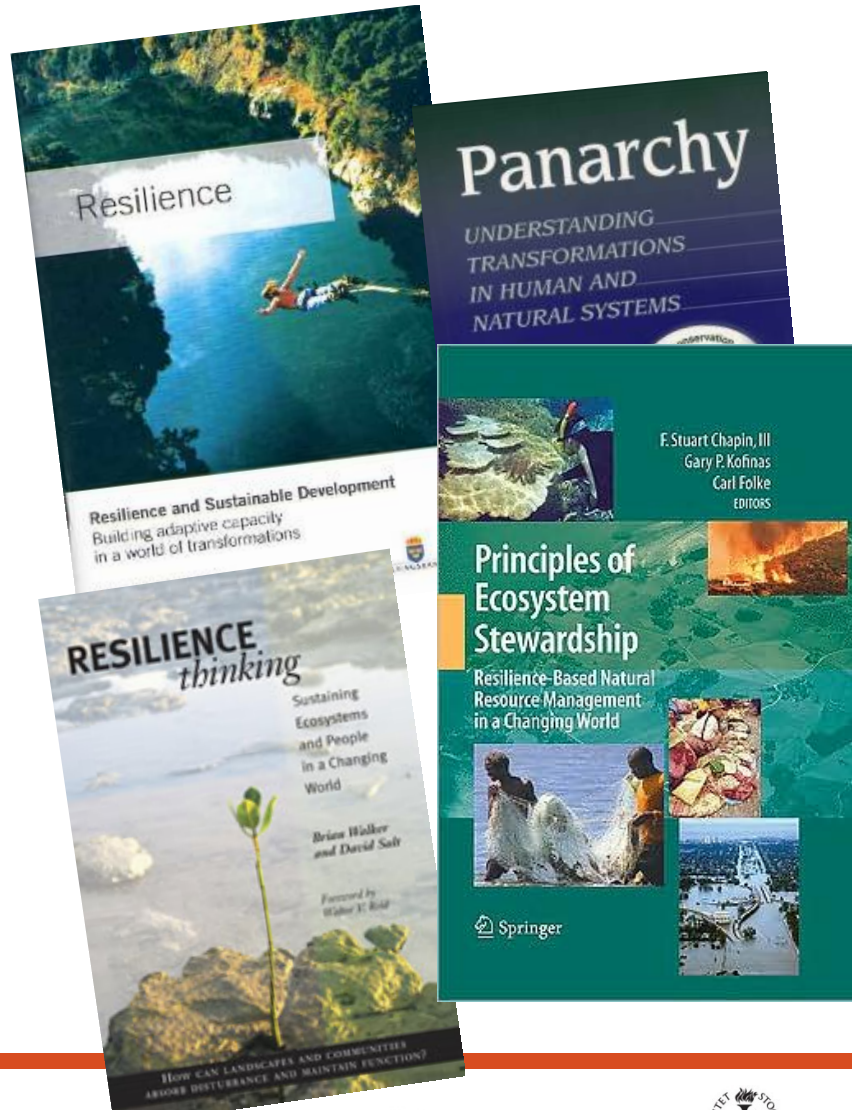
Illegal, unreported and unregulated (IUU) overfishing in the Southern Ocean

- Mobilization and action through an international platform putting pressure on nations and providing enforcement measures
- The CCAMLR Convention (Commission for the Conservation of Antarctic Marine Living Resources)

Österblom et al. 2010. PLoS ONE

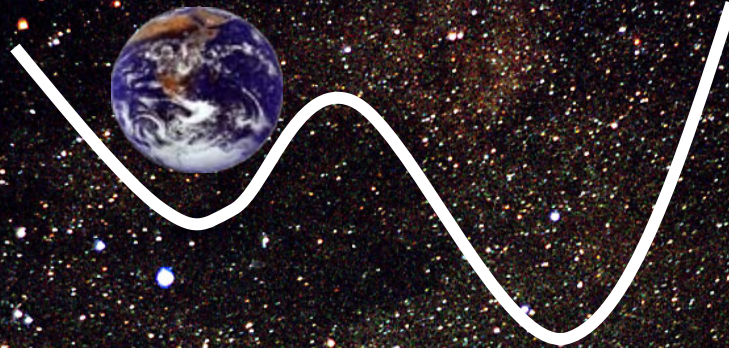


Three features of social-ecological resilience



1. **PERSISTENCE** in the face of change, buffer capacity, withstand shocks
2. **ADAPTABILITY** the capacity of people in a social-ecological system to manage resilience e.g. through collective action
3. **TRANSFORMABILITY** the capacity of people in a social-ecological system to create a new system when ecological, political, social or economic conditions make the existing system untenable

The Resilience of the Earth System



Stockholm Resilience Centre
Research for Governance of Social-Ecological Systems

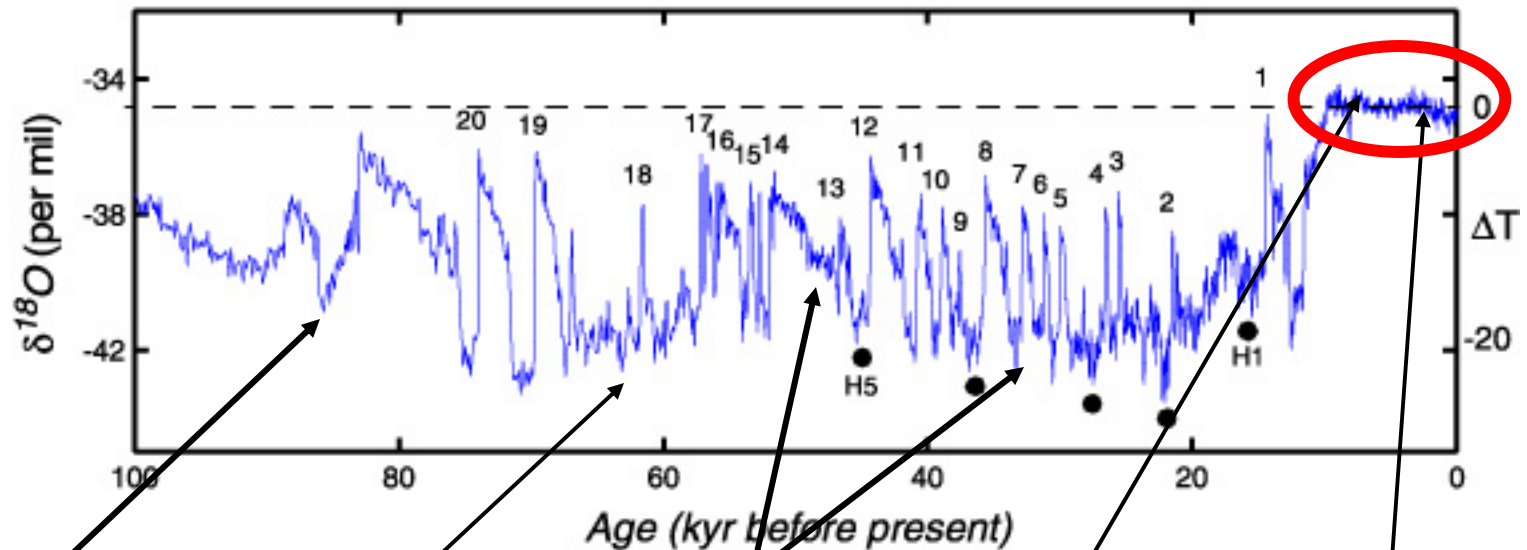


Stockholm
University

A centre with:



Last Glacial-Interglacial Cycle



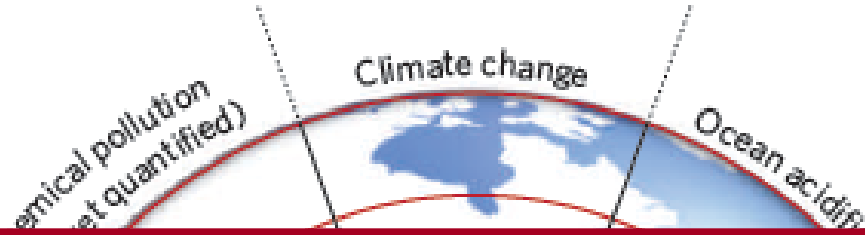
First migration of
fully modern humans
out of Africa

Aborigines
arrive in
Australia

Migrations of
fully modern humans
from South Asia
to Europe

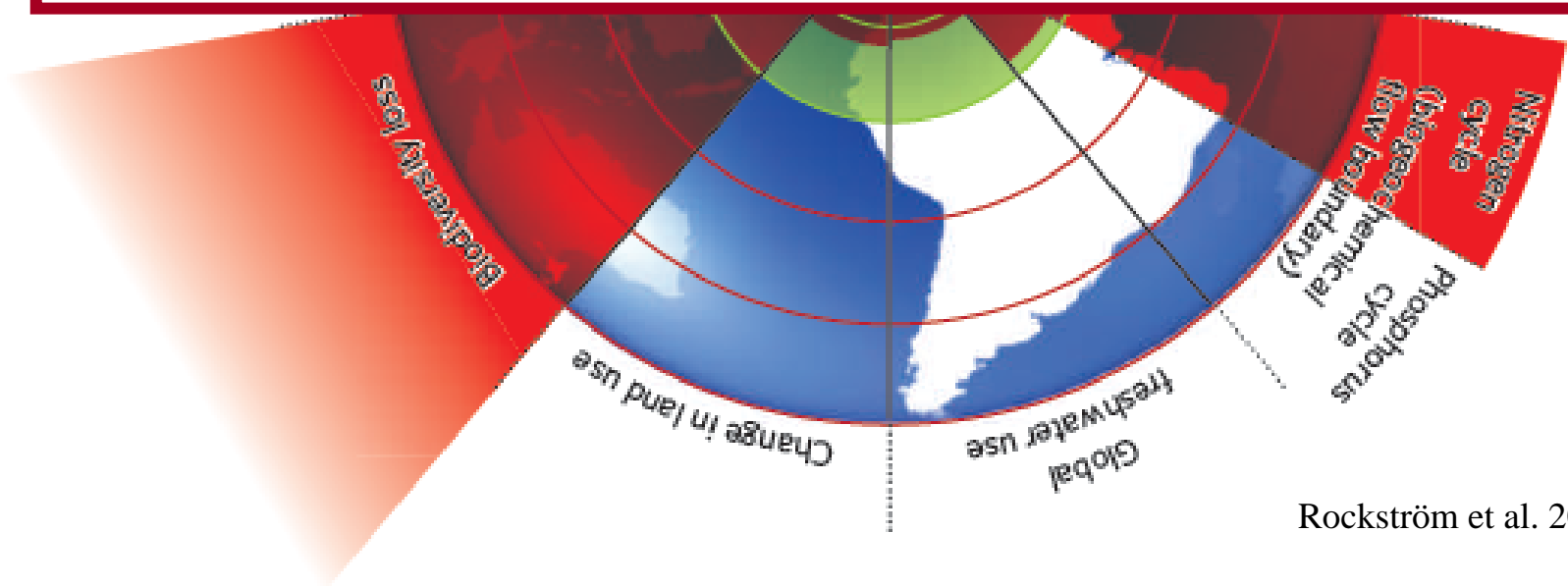
Beginning
of agriculture

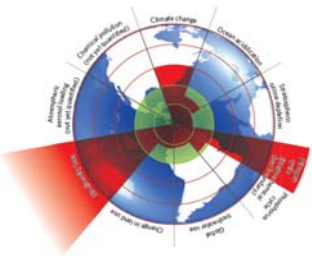
Great European
civilisations:
Greek, Roman



A SAFE OPERATING SPACE FOR HUMANITY

to stay away from global tipping points

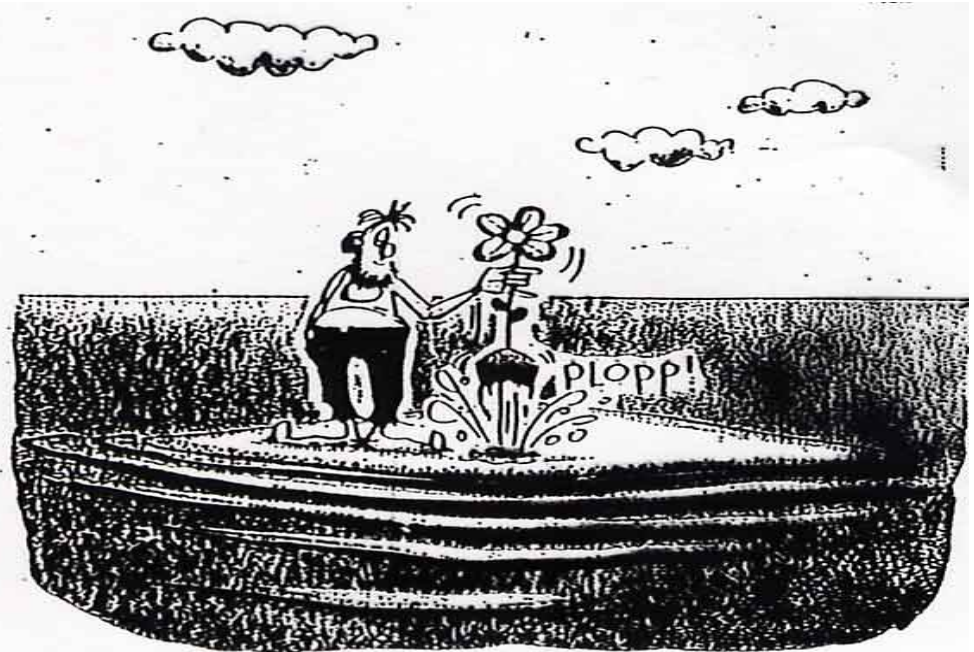
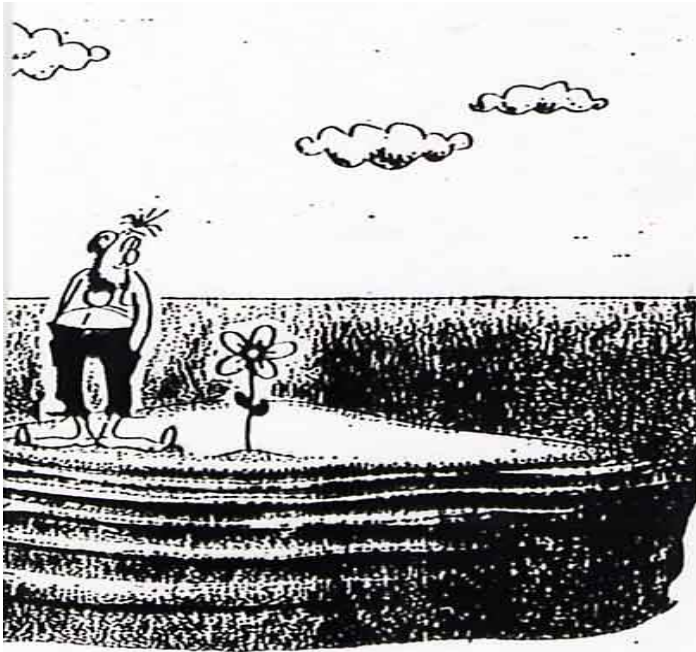




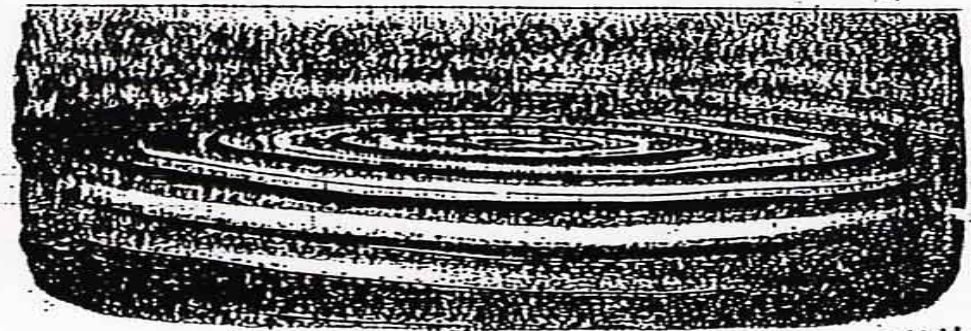
Global governance challenges of planetary boundaries

- the capacity of international institutions to deal with individual planetary boundaries, as well as interactions between them;
- the challenges posed by institutional interactions and inter-linkages;
- the role of international organizations in dealing with planetary boundaries interactions;
- the role of global governance in framing social-ecological innovations

Galaz et al. in review



**Lack of SES resilience –
expect surprise**



Stockholm Resilience Centre
Research for Governance of Social-Ecological Systems



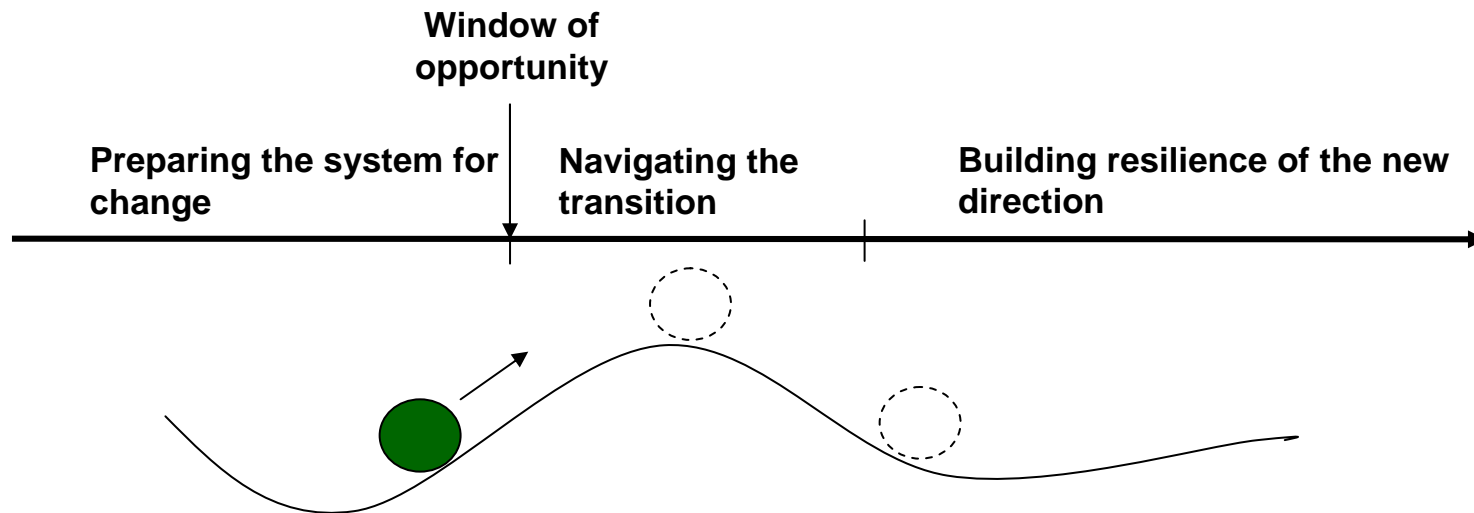
A centre with:



SES transformations and law?

- Prepared and navigated transformations of social-ecological systems for shifting towards more flexible, adaptive forms of management and governance
- Focus on transformations that increase our capacity to learn from, respond to, and manage environmental feedback in social-ecological systems
- Includes redirecting governance into restoring, sustaining, and developing the capacity of social-ecological systems to generate essential ecosystem services in the context of the planetary boundaries

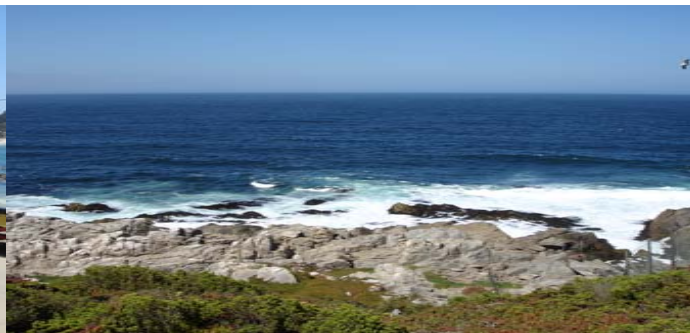
Transformation of SES



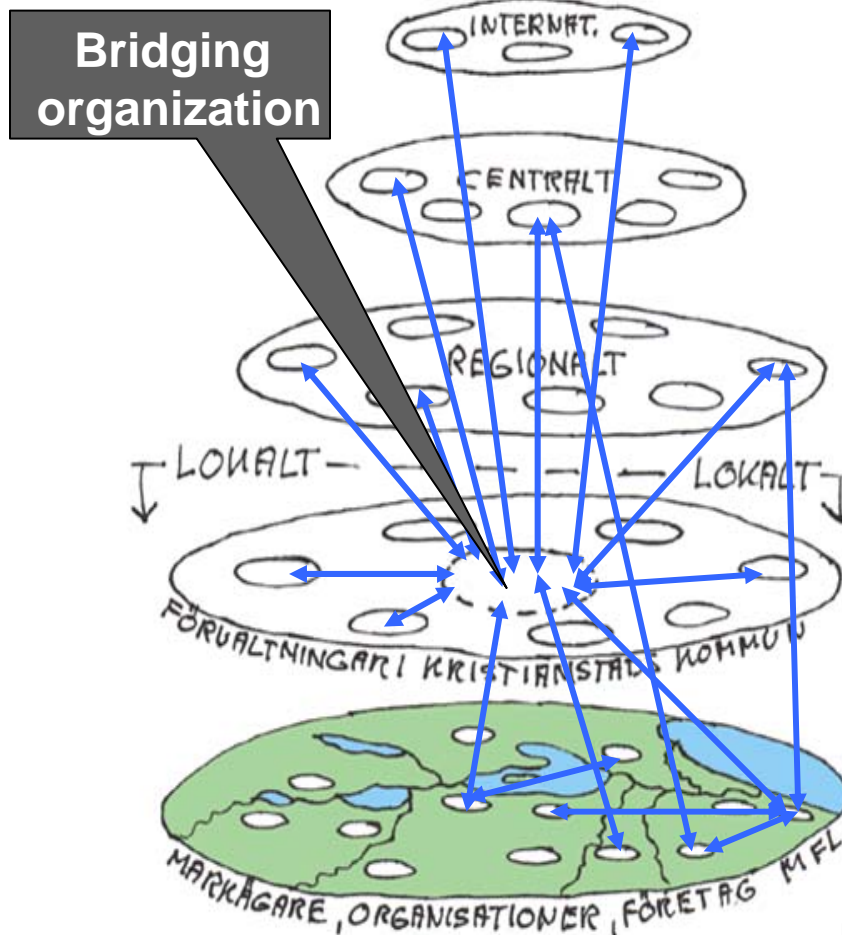
Critical elements in the Chile transformation

- A shift to a democracy, following 17 years of a dictatorship, provided a window of opportunity and new paths for policy innovation and ecosystem management
- Social processes, including experimenting, co-learning and communication about ecosystem dynamics between fishers and scientists, and strong social networks provided critical elements for the governance transformation
- Enabled fishers to reorganize and influence new national fishery legislation that introduced maritime zoning, regulated mobility of the fleets, allocated exclusive territorial users rights for fisheries and introduced a differential individual transferable quota for harvested species

Gelcich et al 2010. PNAS



Bridging organizations



- Performing essential functions in crafting effective responses to change in social-ecological systems
- Linking groups, networks and organizations across levels, creating the right links, at the right time, around the right issues
- Accessing and combining multiple sources of knowledge and interests
- Enhancing vertical and horizontal integration and social learning

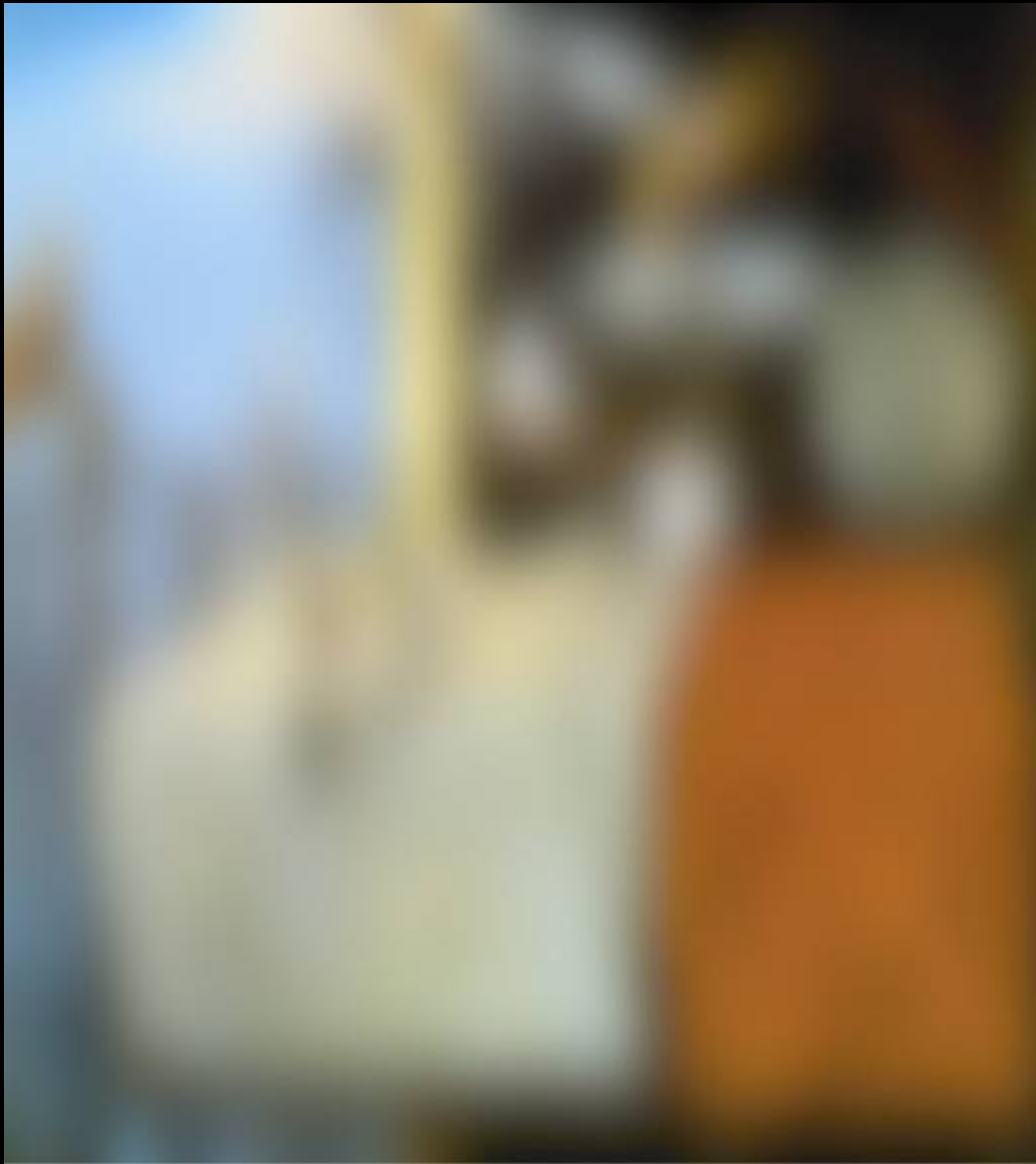
Folke et al. 2005, Hahn et al. 2006, Olsson et al. 2007

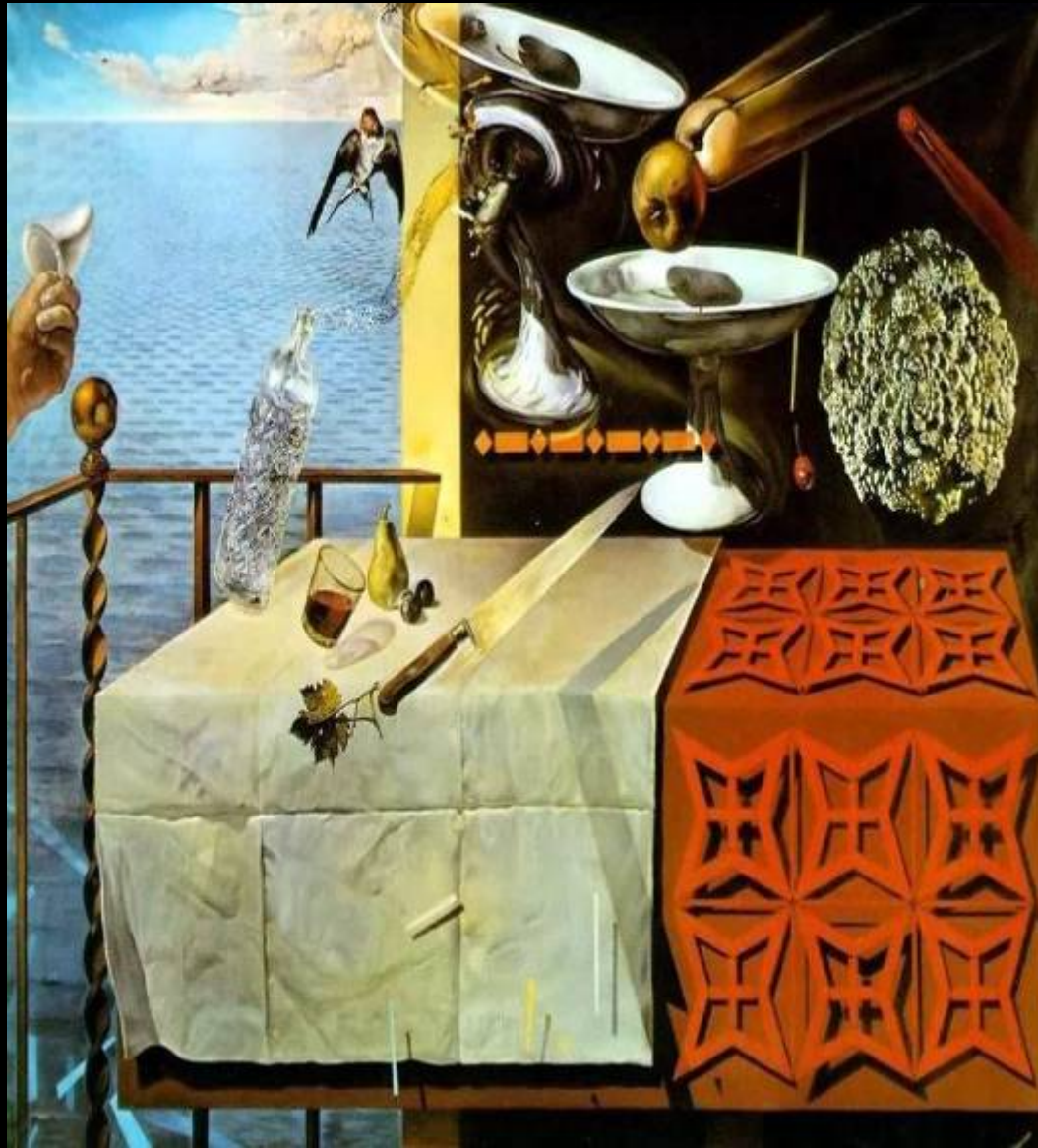


- Collective action and multilevel governance may lead to traps and vulnerable SES if ecosystem resilience is not accounted for.
- Political crises, disconnected from environmental issues, may open up opportunities for transformational change of SES.
- Open access and unsustainable extraction affecting coastal resources may be curbed through international action









The Resilience Lens provides new, often surprising insights