Current views of social ecological systems: from sustainability to adaptive capacity

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Contents

- What are social-ecological systems?
- Why study them? The sustainability-resilience duality
- How to study them?
- Concluding remarks

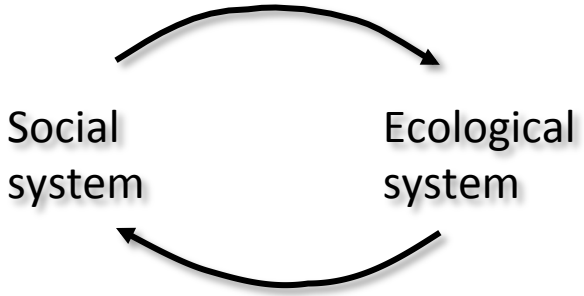
What are SES?

- Surprisingly, there are no detailed definitions of SES, it is a concept that people *take for granted*
- In general, SES are defined in terms like "… intertwined social-ecological systems … assumed to behave as ***complex adaptive systems***…" (Biggs, Shclutter and Schoon, 2015)
- Used first in 1988 in an epidemological article, next entry in 1999 by Elinor Orstrom
- Thousands of articles study SES without using the expression!
- Related to the concept of 'territoire' in geography but not equivalent

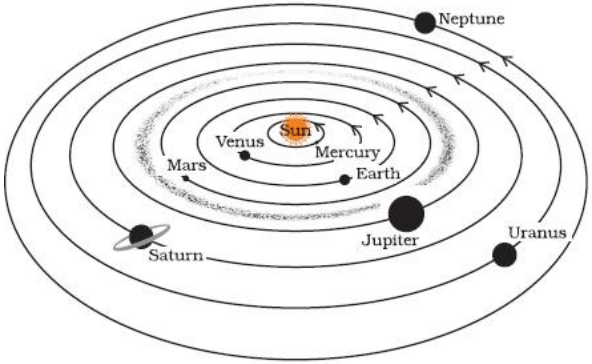
What are SES?

- An extension of the *ecosystem concept eg. C.S. Holling*

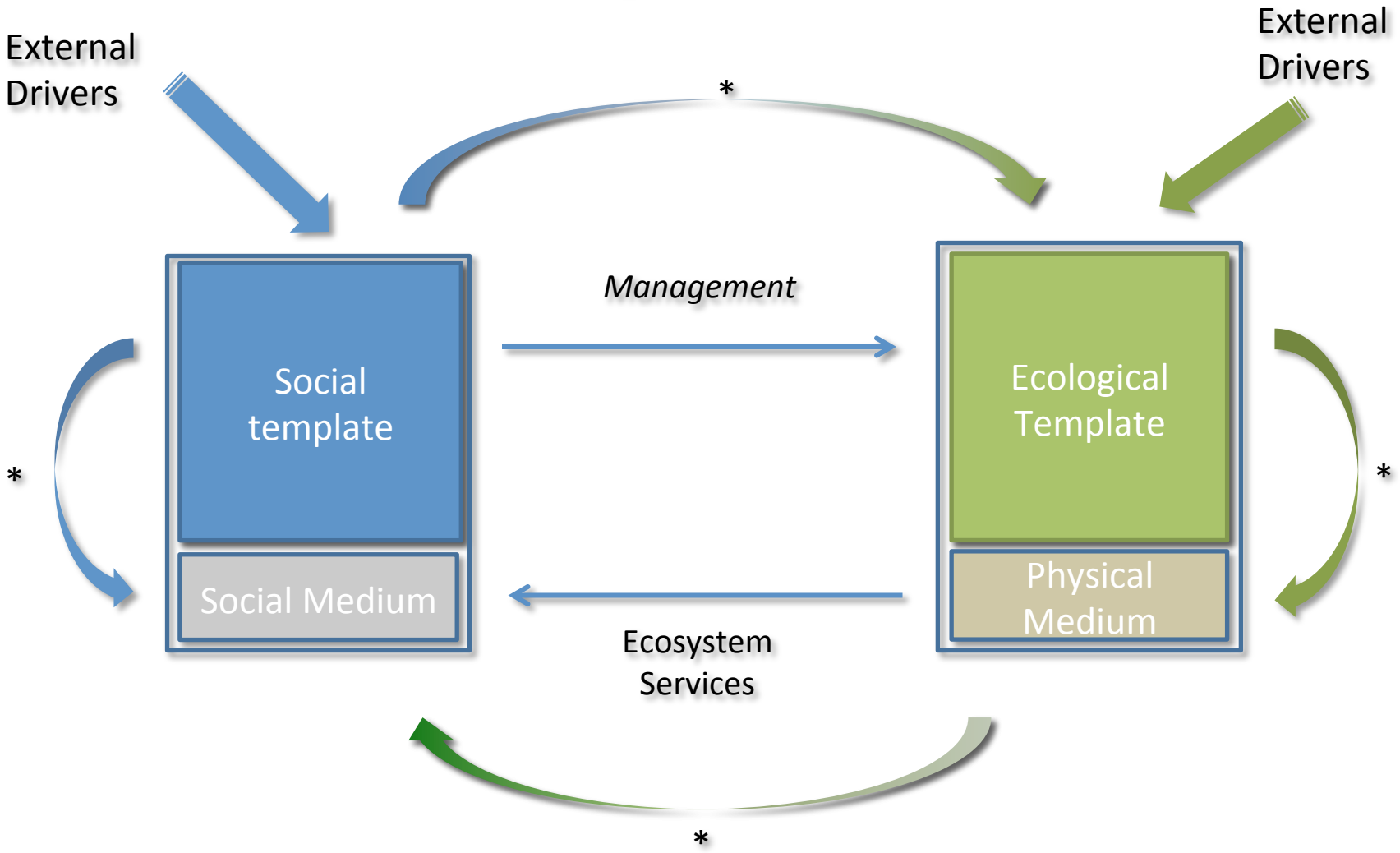
- The result of a '**co-evolution**' between *social* systems and *ecological* systems (e.g., *Journal of Ecological Economics*)



- Interacting systems, simply pertaining to a larger one (earth system, solar system, universe) and as **part of the evolutionary process of life** obeying the **laws of thermodynamics** (Physicists)

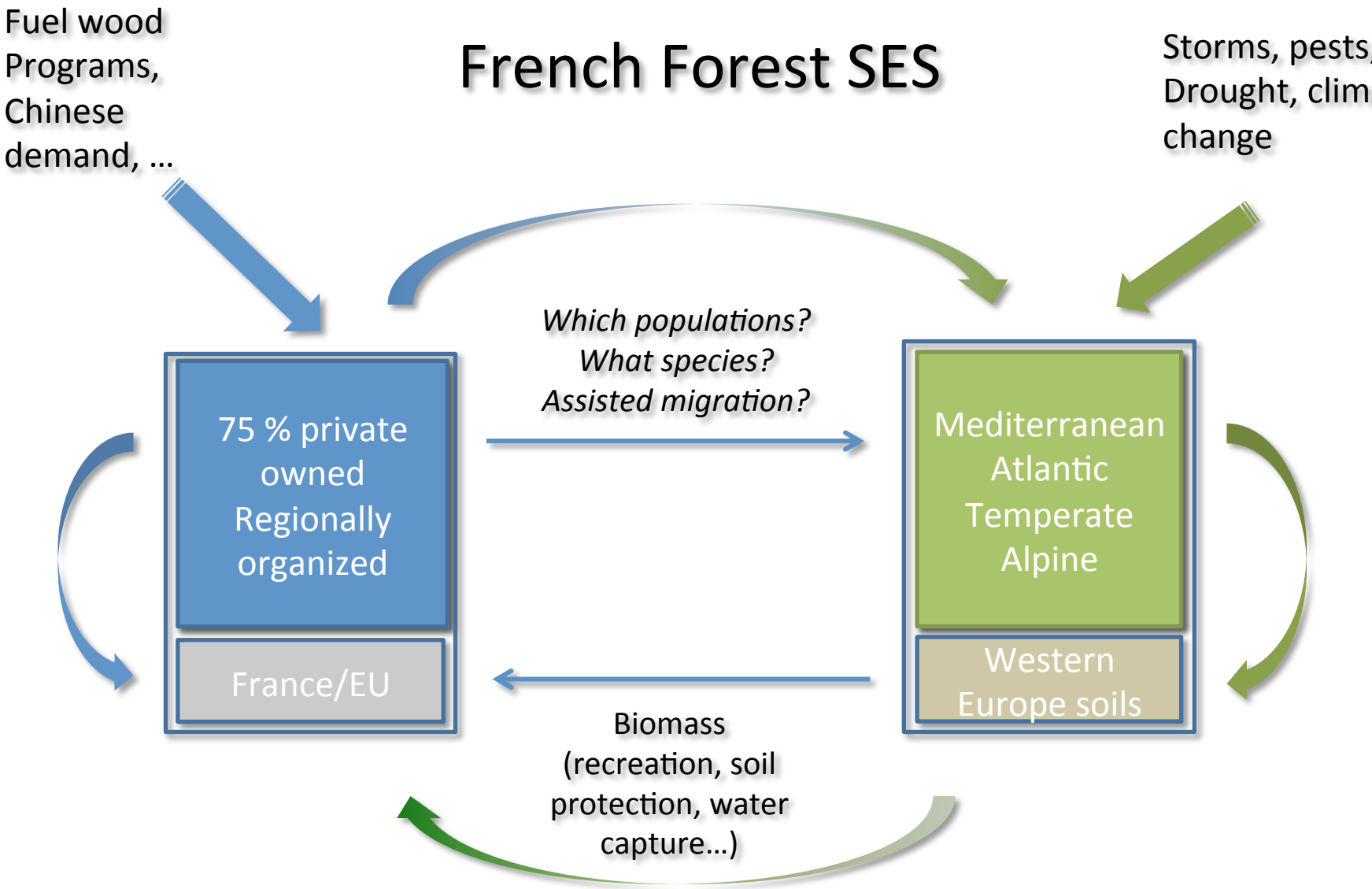


SES: The ecologist's view of nature



*Linear and non linear feedbacks

French Forest SES

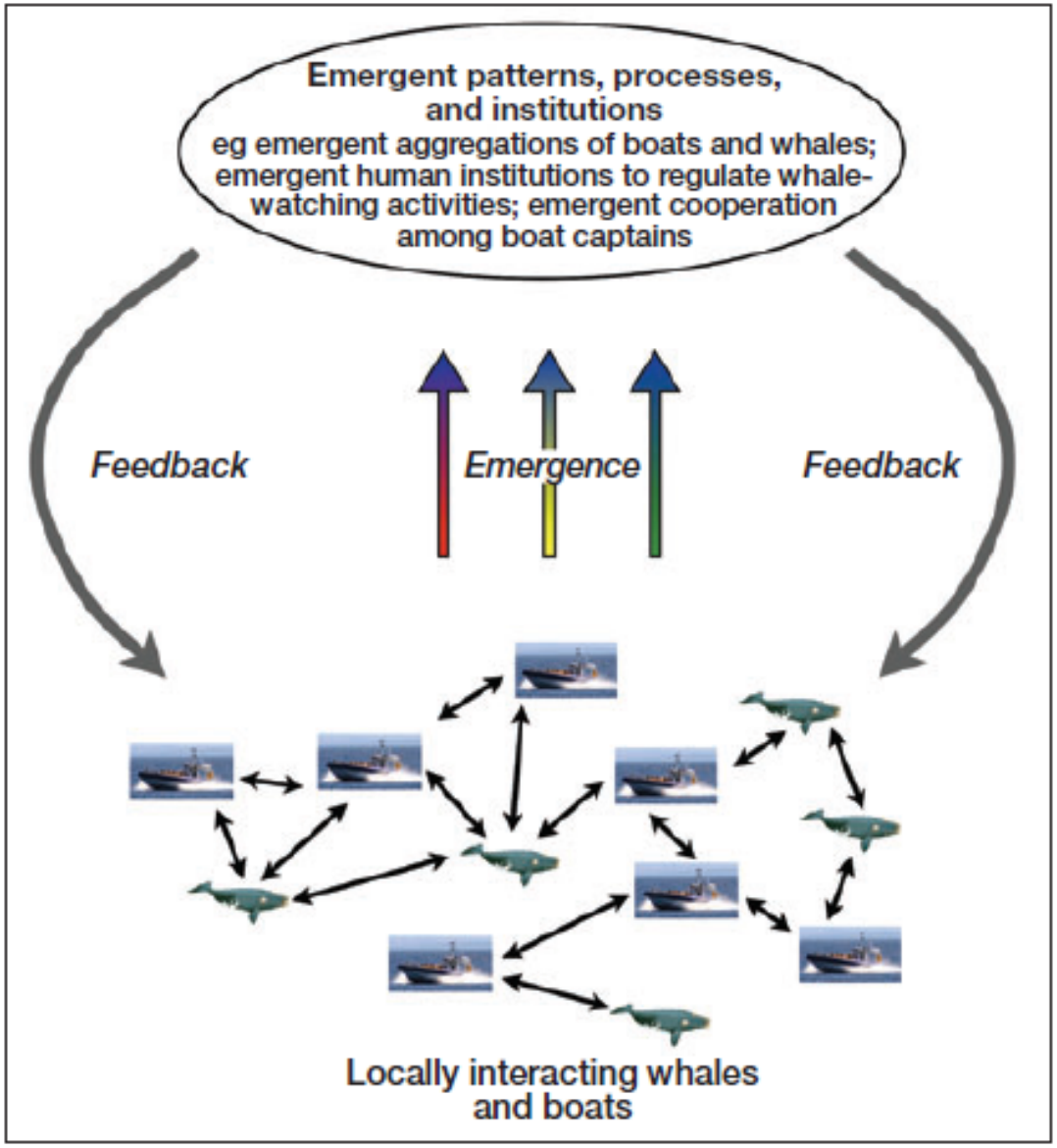


But… the SES concept has inherited problems because of its interdisciplinarity…

- The problem of *scale* from the fields of Ecology
  - It is difficult to set limits to a given SES
  - We study processes that are longer than human generations (Folke et al. 2007; Bergsten et al. 2014)
- The problem of *single repetition* of the social sciences
  - How much can we generalize?
  - Can we reconcile inductive and hypothetico-deductive research? (Moon & Blackman, 2014)

Addressing the scale problem in SES

You look at the level of *self-organization of humans* regarding the use of natural resources

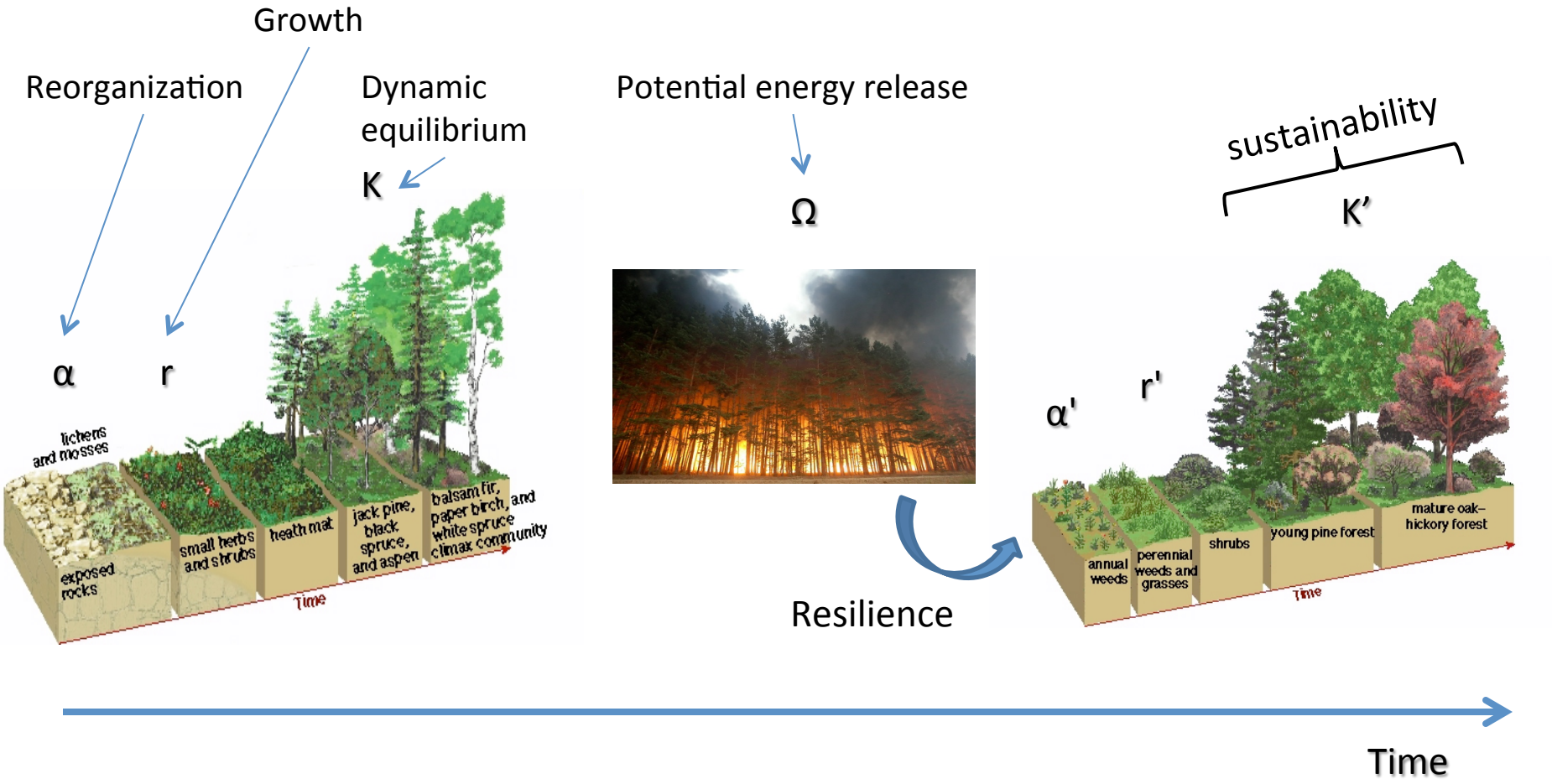


Future landscapes: managing within complexity

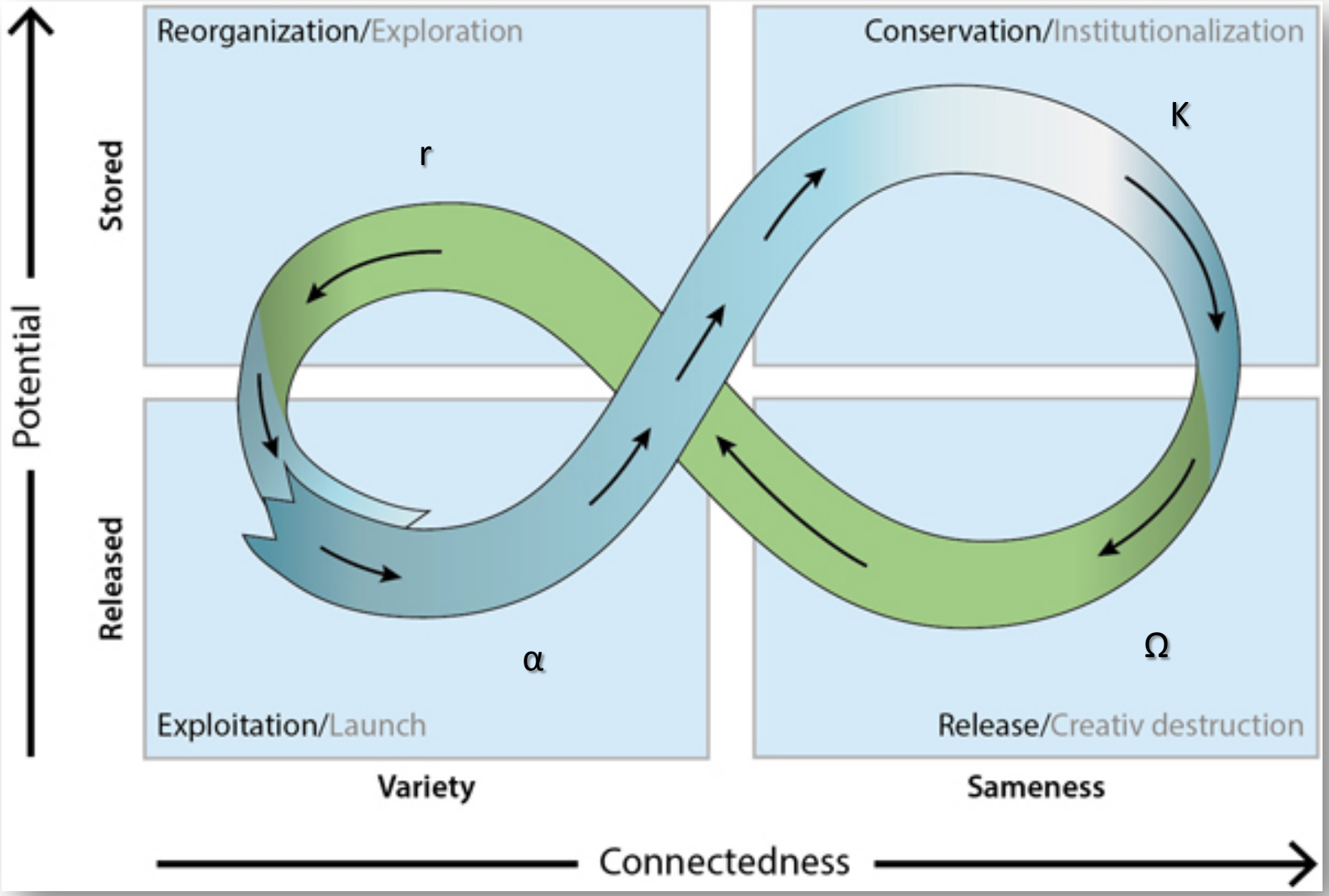
Lael Parrott[1*] and Wayne S Meyer[2]

Front Ecol Environ 2012; 10(7): 382–389,

What is the dynamics of SES? The ecological succession paradigm



The Metaphore of the Adaptive Cycle



Why study SES?

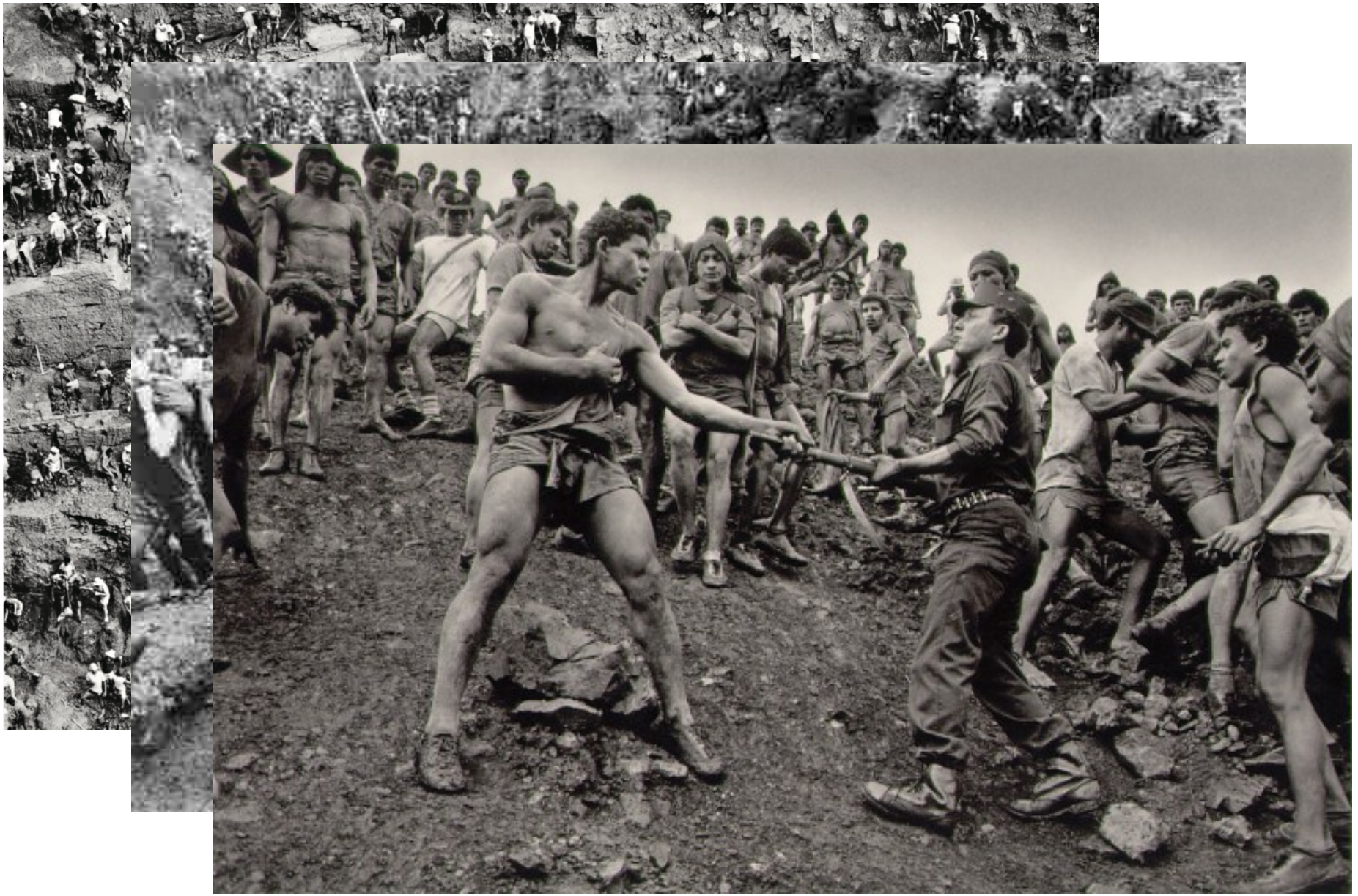
To implement sustainability?
To create resilience?

The Tragedy of the commons
(Hardin 1968, cited 27 317 times!)

"Cows on Selsley Common - geograph.org.uk - 192472" by Sharon Loxton.

Hardin expanded William Forster Lloyds (1794-1852) idea of common, unregulated use of resources

…Any free access resource will be eventually depleted if uncontrolled by governments or if it is not privatized…



The Mines of Serra Pelada, by Sebastiao Salgado, 1986

But people can organize to use ressources

Elinor Orstrom (1933 -2012)
2009 Nobel prize of economics

http://www.vikalpsangam.org/article/rice-from-dry-river/#.VgfS6n1hS2w

The sustainability/Resilience approach to SES

'*Sustainability*' has dominated the language, regulations and objectives for at least 40 years and has led to the approach of 'Sustainability science' (NSF & *PNAS*)

'*Resilience thinking*' has emerged since the late 1990's as a framework for tackling *resilience* problems (Resilience Alliance., eg. *Ecology and Society* journal.)

Sustainability science -> use ressources thoughtfully

What kind of a science is sustainability science?

Robert W. Kates[1]
Independent Scholar, Trenton, ME 04605

PNAS | December 6, 2011 | vol. 108 | no. 49 | 19449–19450

Resilience thinking –> promote adaptive capacity to perturbations

Perspective

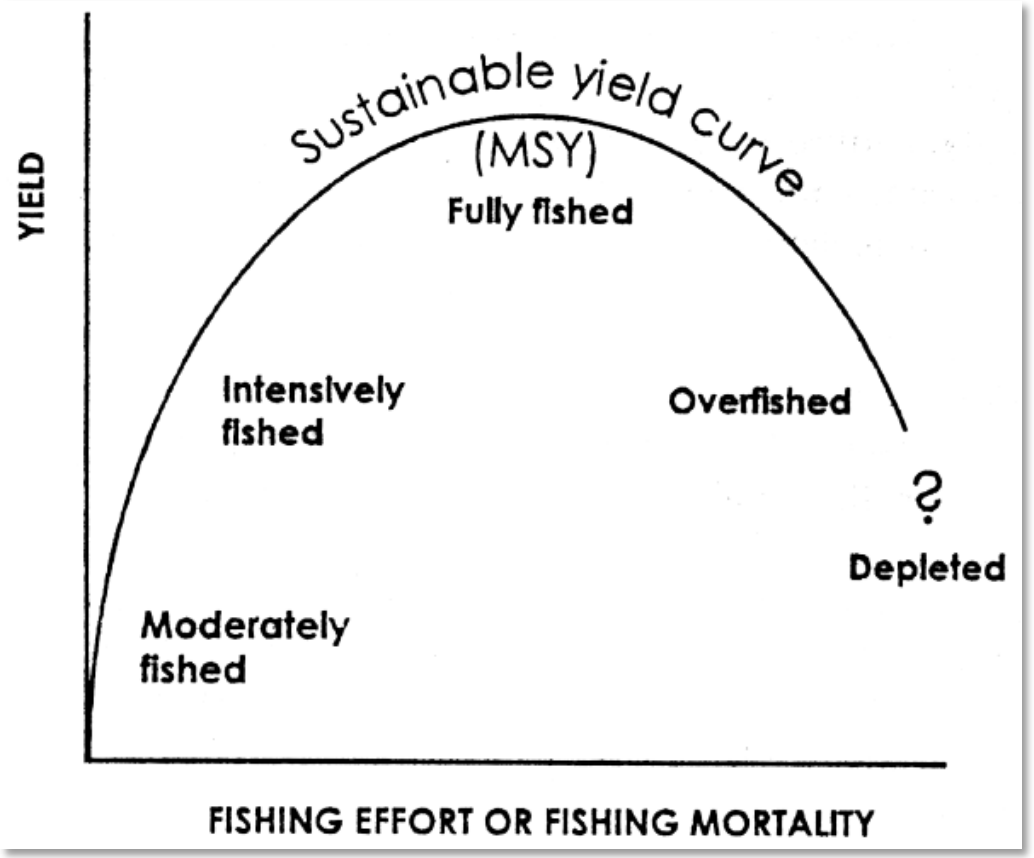
Resilience, Adaptability and Transformability in Social–ecological Systems

Brian Walker[1], *C. S. Holling*, *Stephen R. Carpenter*[2], and *Ann Kinzig*[3]

Ecology and Society 9(2): 5. 2004
http://www.ecologyandsociety.org/vol9/iss2/art5

Sustainability as optimization

• Most of the studies referring to sustainability are *optimization approaches* of a ressource use



http://www.fao.org/docrep/003/w1238e/W1238E02.htm

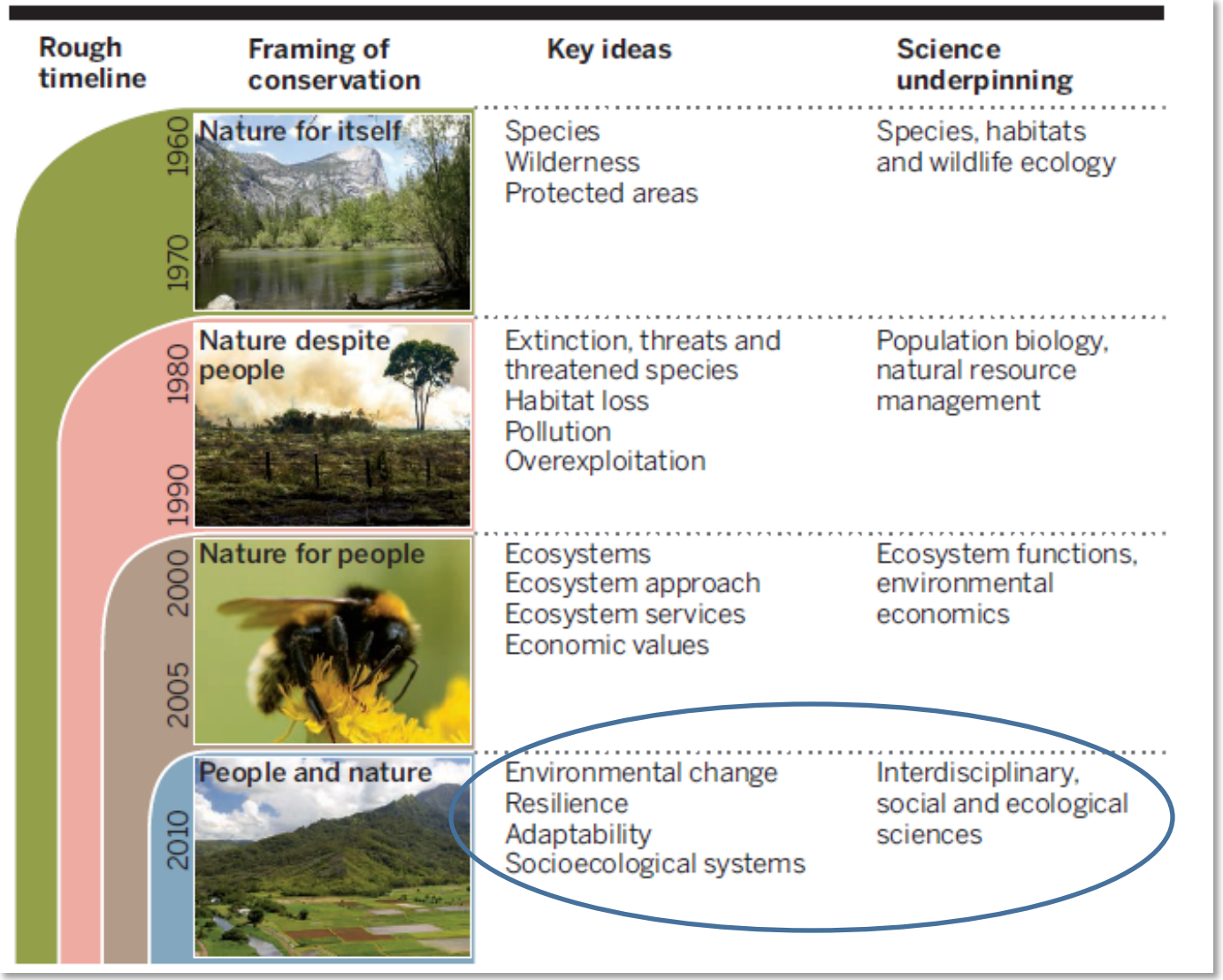
Sustainability as social and environmental justice

United Nation sustainability goals for 2030

	Sustainability Science approach[1]	*Resilience theory approach*[1]
Research agenda	Free	Bounded by the adaptive cycle methaphore
Scale	Population level	System level
Overall goal	To optimize specific processes	To maintain system dynamics
Attitude to society	Society **is flawed**	« neutral » (?)
Attitude to change	Change is **traumatic and mandatory**	Change is **normal** (but see next)
Attitude to status quo	see above	**Ambiguous** because of unresolved issues between *resilience* and *transformability* of SES
Strengths	Effectiveness	Global vision
Weaknesses	Technocratic view of the world	Global vision: *resilience of what to what*?

[1] Loosely adapted from Redman 2014

Convergence of research agendas with conservation science



ECOLOGY

Whose conservation?

Changes in the perception and goals of nature conservation require a solid scientific basis

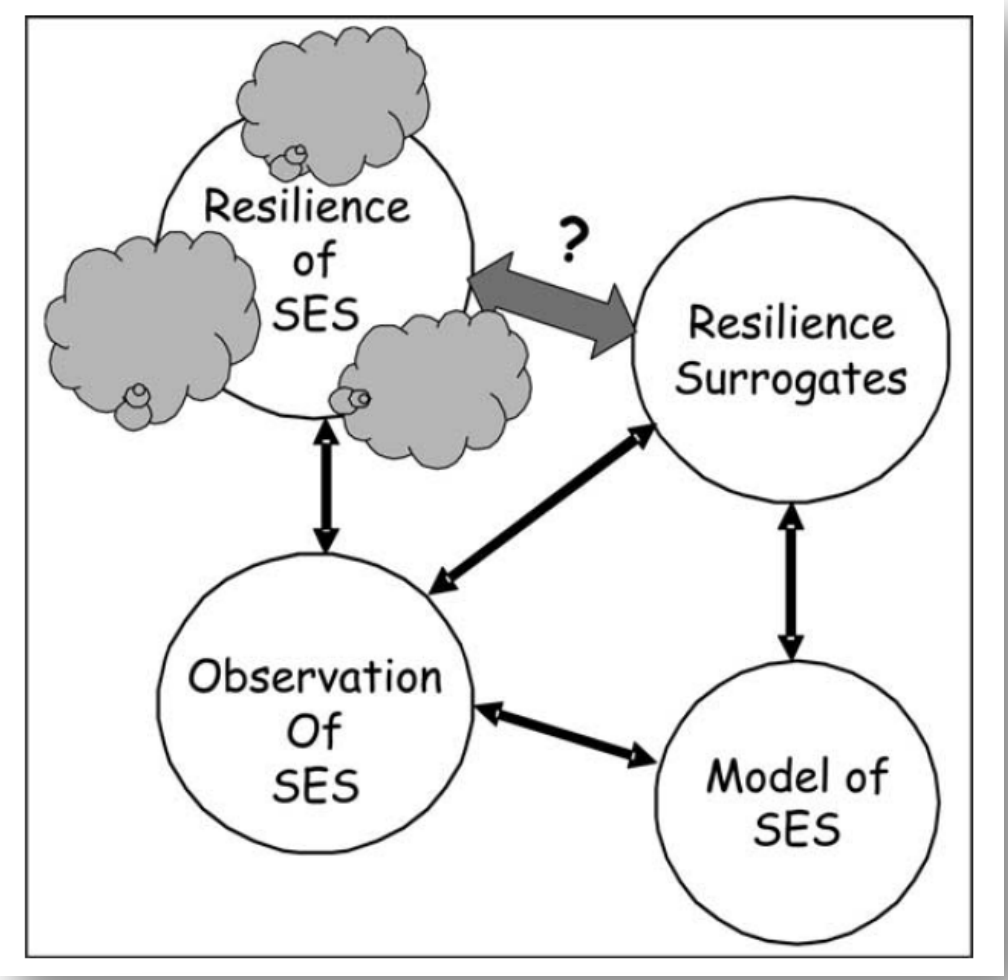
By **Georgina M. Mace**

How to study SES?

• Both sustainability science and resilience thinking are ***question-oriented*** disciplines

• Hence, it is ***the question*** that determines what kind of tools (both theoretical and practical) are needed

• In principle, all fields of knowledge should participate on ***equal grounds*** on SES studies i.e., **epistemological pluralism** (Miller et al. 2008)



Ecosystems (2005) 8: 941–944
DOI: 10.1007/s10021-005-0170-y

ECOSYSTEMS

SPECIAL FEATURE

Surrogates for Resilience of Social–Ecological Systems

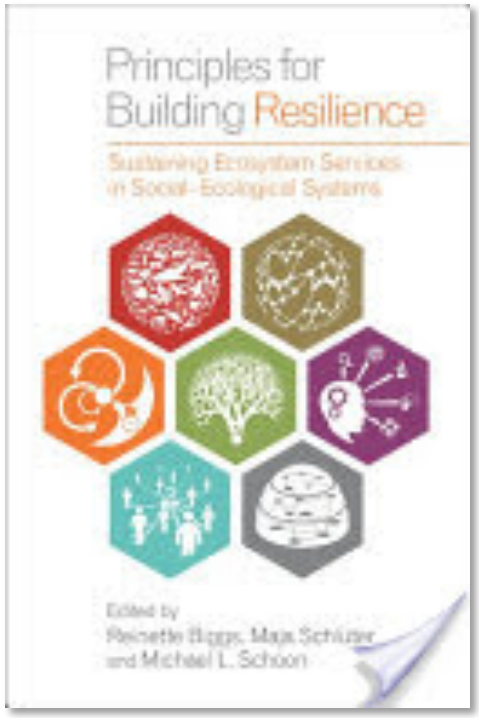
Stephen R. Carpenter,[1]* Frances Westley,[2] and Monica G. Turner[3]

Major *non-mutually* exclusive approaches

1. Stackeholder assessments (ecological anthropology,...)
2. Scenario building (broad sense)
3. Historical profiling (geography, ecological history)
4. Case study comparisons (comparative public policies)

Which surrogates (indicators) to look at?

- Diversity & redundancy
- Connectivity
- Learning capacity
- Participation in decision making
- Polycentric governance
- …
- Whatever you think is important!



The need for 'boundary concepts'

- Both sustainability/resilience problems require interdisciplinary approaches bound by *common concepts*.

- 'Boundary concepts' are *fuzzy enough* to be used by different disciplines but with *precise definitions within* disciplines.

- Frequently discussed 'boundary concepts' are the '**precautionary principle**', '**resilience**', '**ecosystem services**' and more recently, '**planetary boundaries**', among others

Our own approach (TESS)

Identify **a conflict over a ressource**, find a suitable interdisciplinary team and identify **boundary concepts**

Inmerse in the system to identify **autorganization levels** (networks, leaders, governance, etc) without *a prioiri* hypothesis

Identify **capitals** (i.e., potential energy) of the system that allow adaptation: natural, social, cultural (local knowledge), and economic.

Understand the **stocks** of capitals in the system and the relevant **traditions and/or policies** that regulate their **flow**

Construct **dynamic models**, either

a) Qualitatively
b) Quantitatively

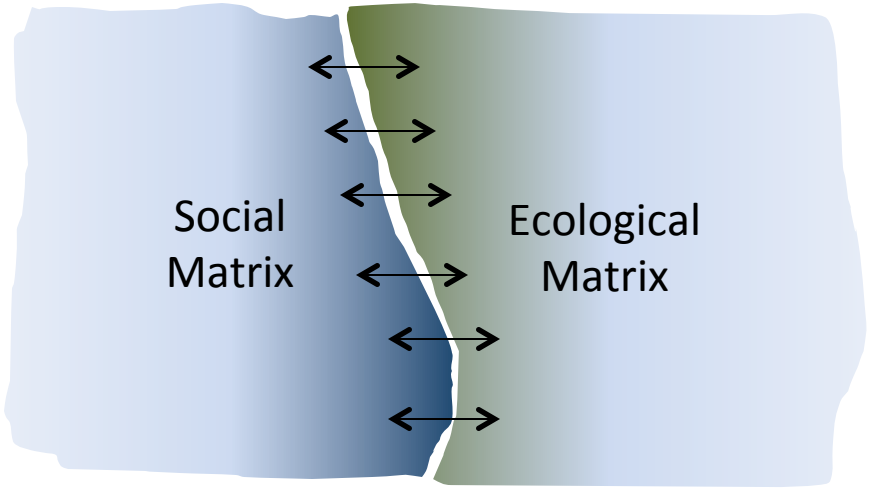
Use model results to
- explain **observed dynamics**
- construct **scenarios**

Return to the system with **new knowledge**; Compare with ***similar cases*** to extract lessons; continue **monitoring**

Concluding remarks I

What are social ecological systems?

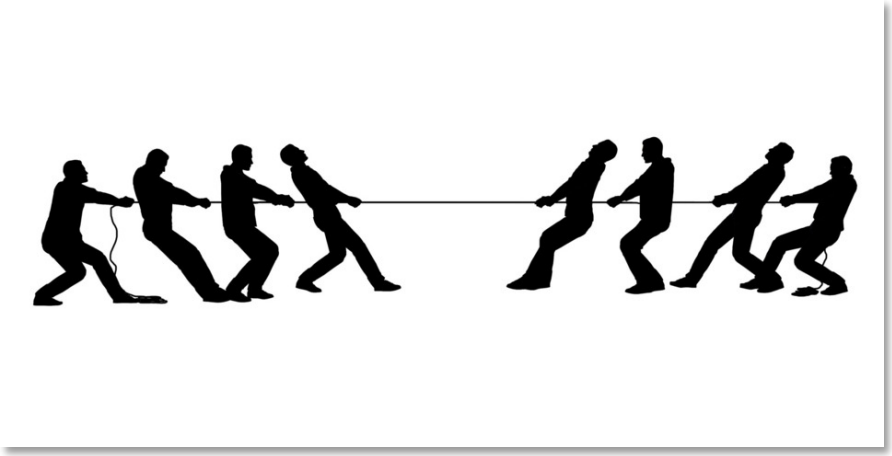
- Social ecological systems are *complex adaptive systems*, in which *feedbacks* between social and ecological components create social and ecological structures and dynamics that *would not exist otherwise* (my own definition)



Concluding remarks II

Why study social-ecological systems?

- The main reason to study SES is that **conflicts** exist regarding the use of natural resources
- because society is asking for **long term solutions** to different environmental/biodiversity crises



Concluding remarks III

How to study social-ecological systems?

- There is no single answer to the question: it depends on the problem!
- In general, we all study SES through the identification of *surrogates* of their abstract properties
- Strong dependency on metaphores, analogies and interdisciplinarity

Highlights

- The SES concept is the ecologist's view of nature
- Conflicts around ecosystem use are still the main motivation to study SES
- The use and development of 'boundary concepts' is needed for interdisciplinary integration

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