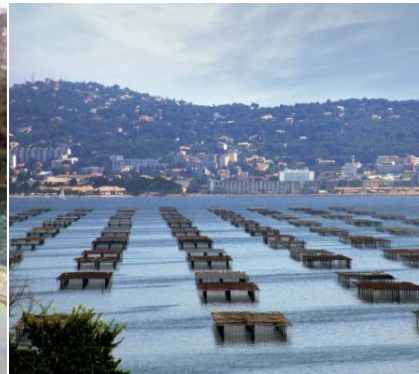
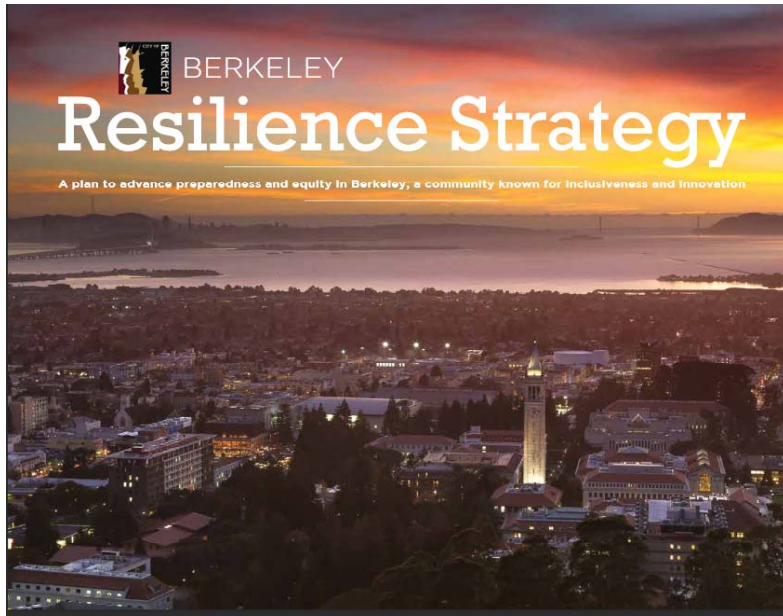


## Plurality of “systems” in working out resilience of social-ecological systems

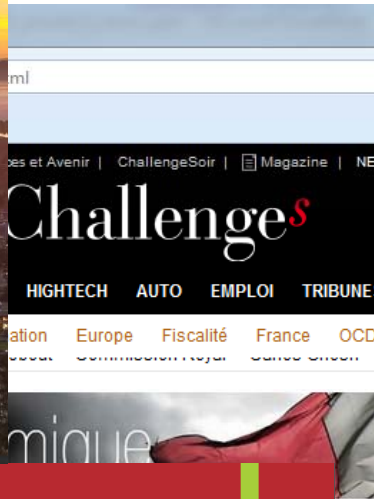
Olivier Barreteau, Director UMR G-EAU







# Systems



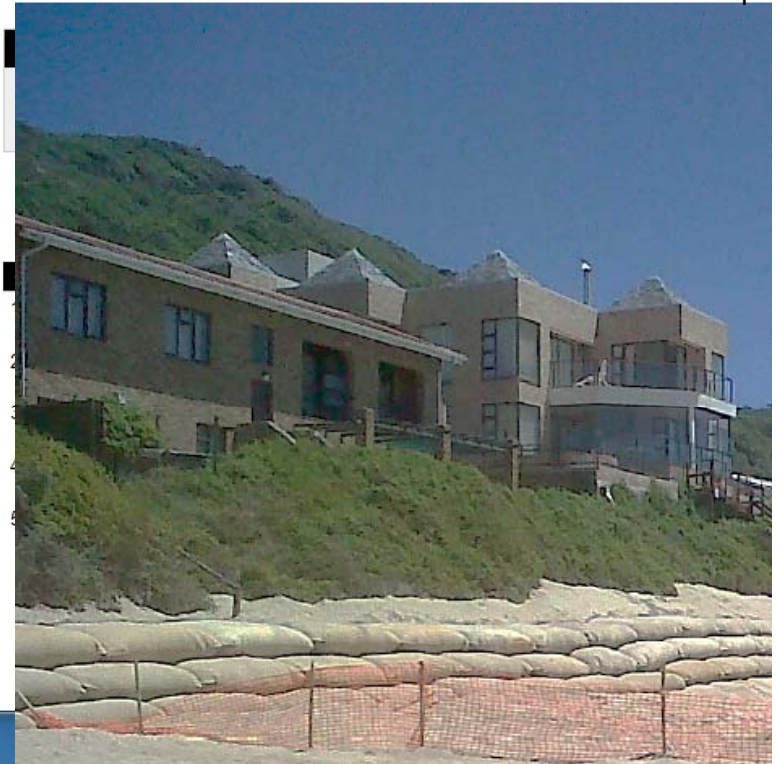
da

ase of vulnerability  
nats, regional IPCC



Buffelsbaai

© A. Crisp







Issues of mal-  
adaptation popping up



# « Resilience of what to what » (Carpenter et al. 2001)

- Need definitions to become operational

Ecosystems 2001 4: 765-782  
DOI: 10.1007/s10021-001-0045-9

**ECOSYSTEMS**  
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MINIREVIEW

– Capacity to handle disturbances,  
From Metaphor to Measurement:  
and stay in a given state  
Resilience of What to What?

– Need to specify scales, stakes...

Steve Carpenter,<sup>1\*</sup> Brian Walker,<sup>2</sup> J. Marty Anderies,<sup>2</sup> and Nick Abel<sup>2</sup>

– Existing operational definitions  
are system specific

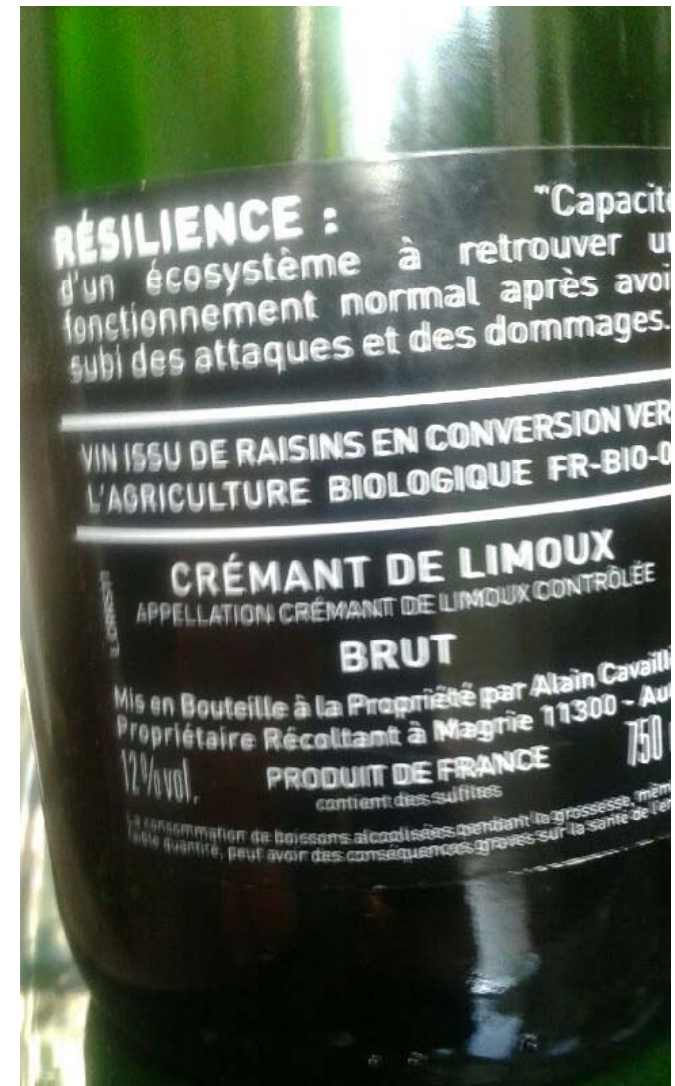
<sup>1</sup>Center for Limnology, 680 North Park Street, University of Wisconsin, Madison, Wisconsin 53706, USA; and <sup>2</sup>CSIRO Sustainable Ecosystems, GPO Box 284, Canberra, ACT, 2615 Australia

## ABSTRACT

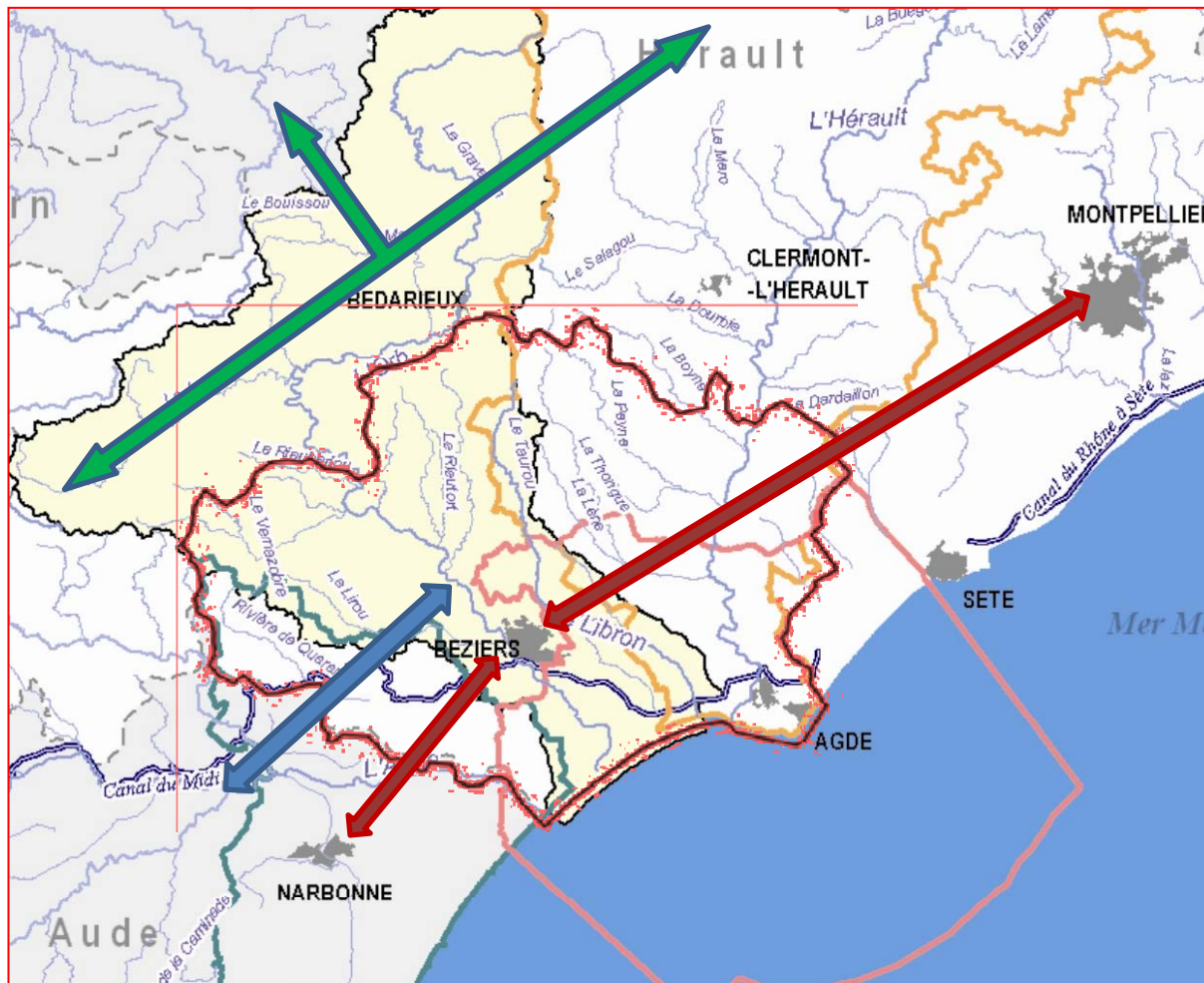
Resilience is the magnitude of disturbance that can be tolerated before a socioecological system (SES) moves to a different region of state space controlled by a different set of processes. Resilience has multiple levels of meaning as a metaphor related to sustainability, as a property of dynamic models, and as a measurable quantity that can be assessed in field studies of SES. The operational indicators of resilience have however received little attention in the literature. To assess a system's resilience, one must specify which system configuration and which disturbances are of interest. This paper compares resilience properties for two contrasting SES, lake districts and rangelands, with respect to the following three general features: (a) The ability of an SES to stay in the domain of attraction is related to slowly changing variables, or slowly changing disturbance regimes, which control the boundaries of the domain of attraction or the frequency of events that could push the system across the boundaries.

Examples are soil phosphorus content in lake districts woody vegetation cover in rangelands, and property rights systems that affect land use in both lake districts and rangelands. (b) The ability of an SES to self-organize is related to the extent to which disturbances are endogenous rather than forced by external drivers. Self-organization is enhanced by coevolved ecosystem components and the presence of social networks that facilitate innovative problem solving. (c) The adaptive capacity of an SES is related to the existence of mechanisms for the evolution of novelty or learning. Examples include biodiversity at multiple scales and the existence of institutions that facilitate experimentation, discovery, and innovation.

**Key words:** resilience; resistance; stability; persistence; socioecological system (SES); lake districts; rangelands; sustainability; self-organization; adaptive capacity; adaptive cycle.

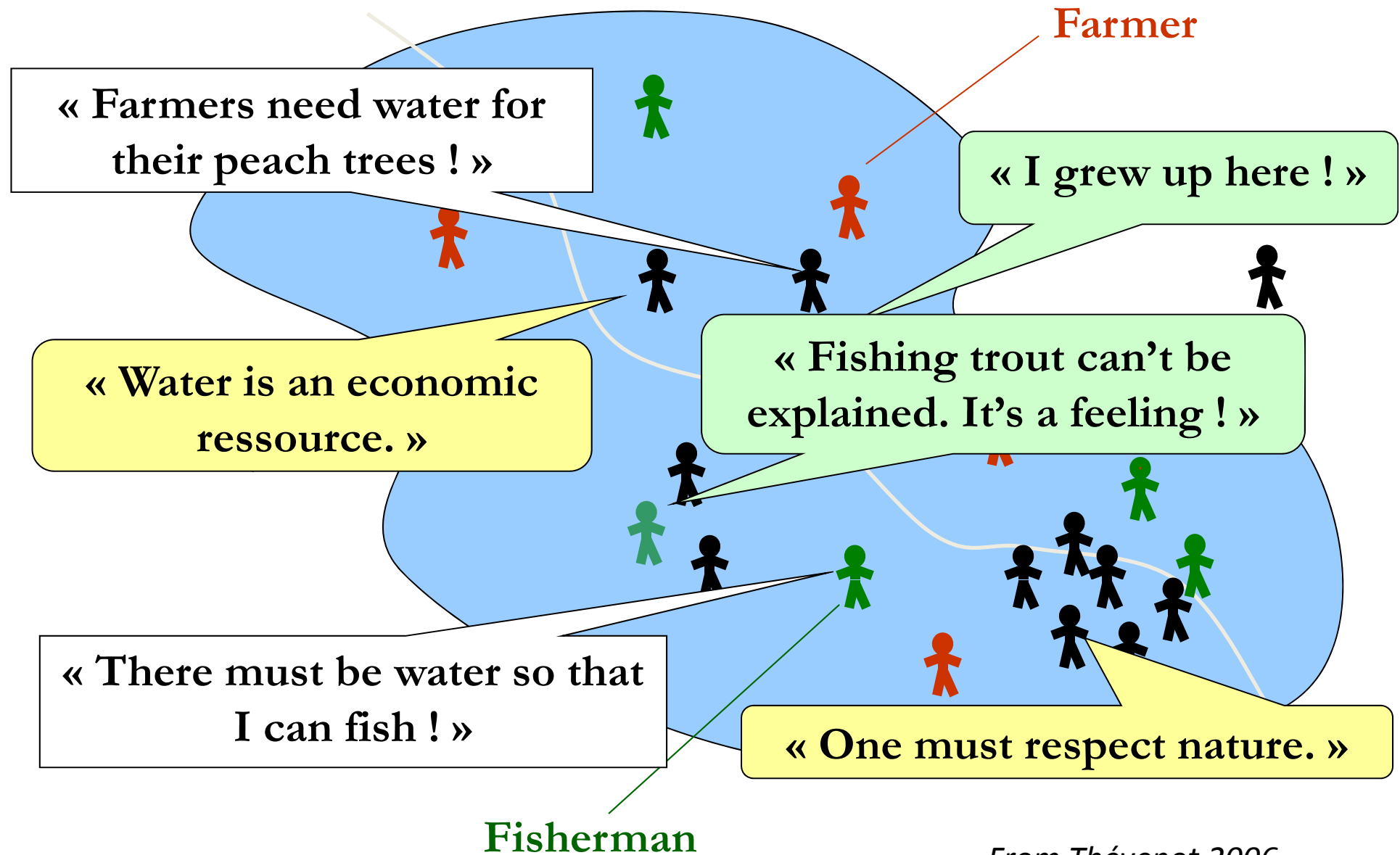


# Example with water: social hydrological systems



- Confusion in policy arenas
- Systems are essentially open
- Multiple sources of confusion

# A pragmatic view of socio-Hydrosystem (A. Richard)



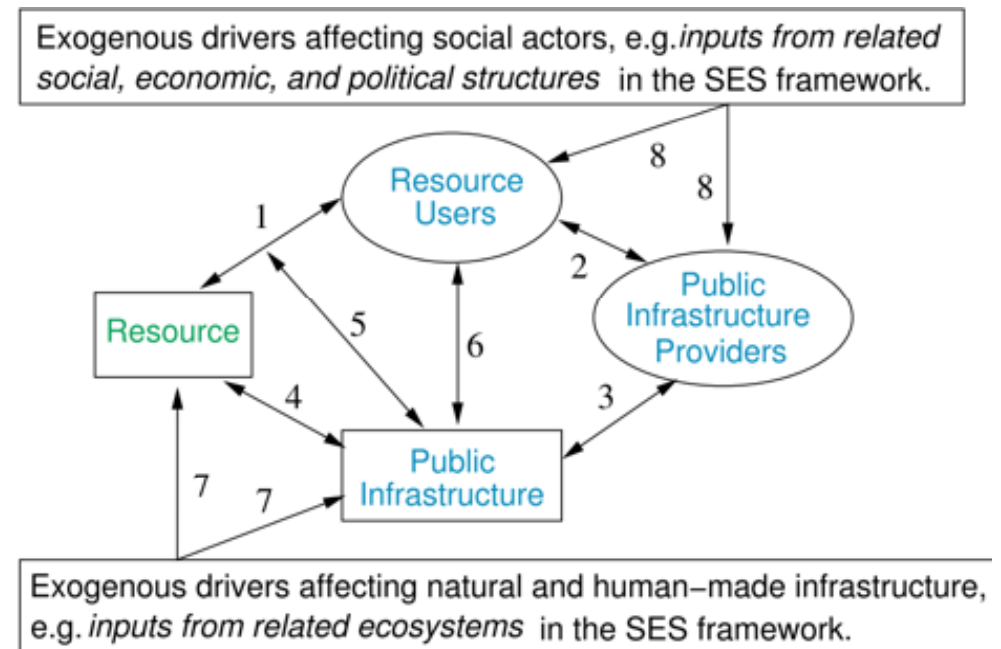
*From Thévenot 2006*

➔ Integrating this diversity of viewpoints in collective choices with an equal legitimacy

# Consequences for NRM governance and adaptation

- No unique (social-ecological) system
- Actions performed generate changes beyond their goal
- Need to explore the interactions at system's borders
- Robustness as an analytical tool

Anderies et al. 2004

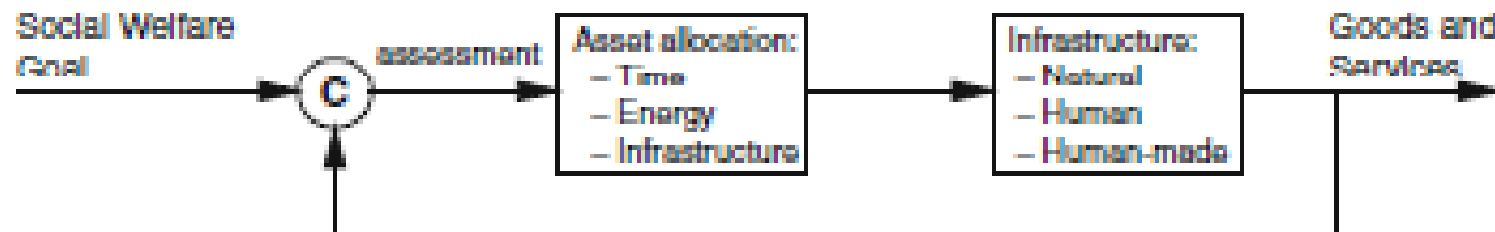


# Transfer of robustness

- *By transfer of vulnerability/robustness, we mean a change for other agents or stakes in their robustness while increasing one's own robustness for a given stake*
- Plurality of view points: spatial and time scales, stakes  
=> Interaction between feedback loops

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## B Feedback Control Loop for General SES

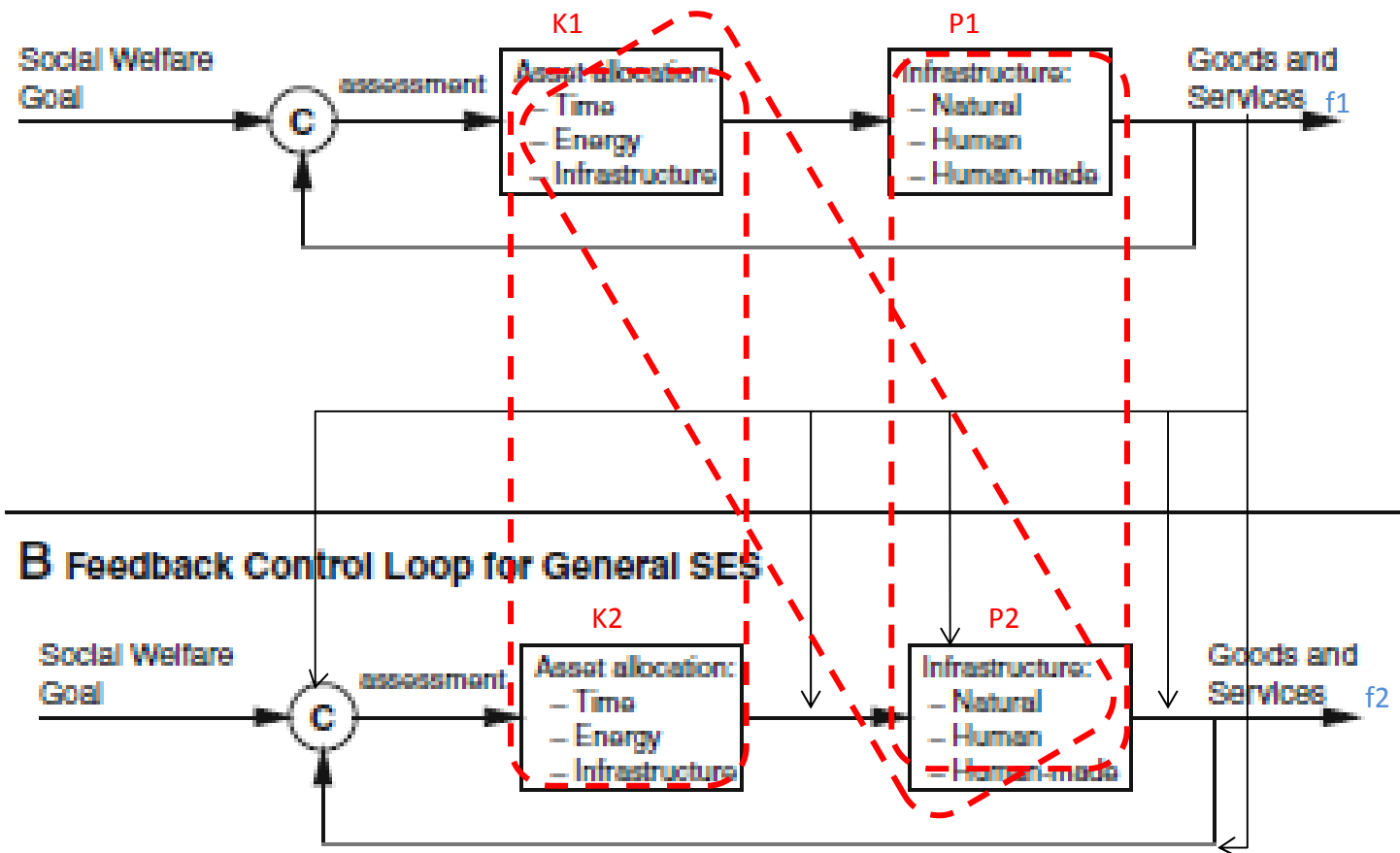


From Anderies 2015



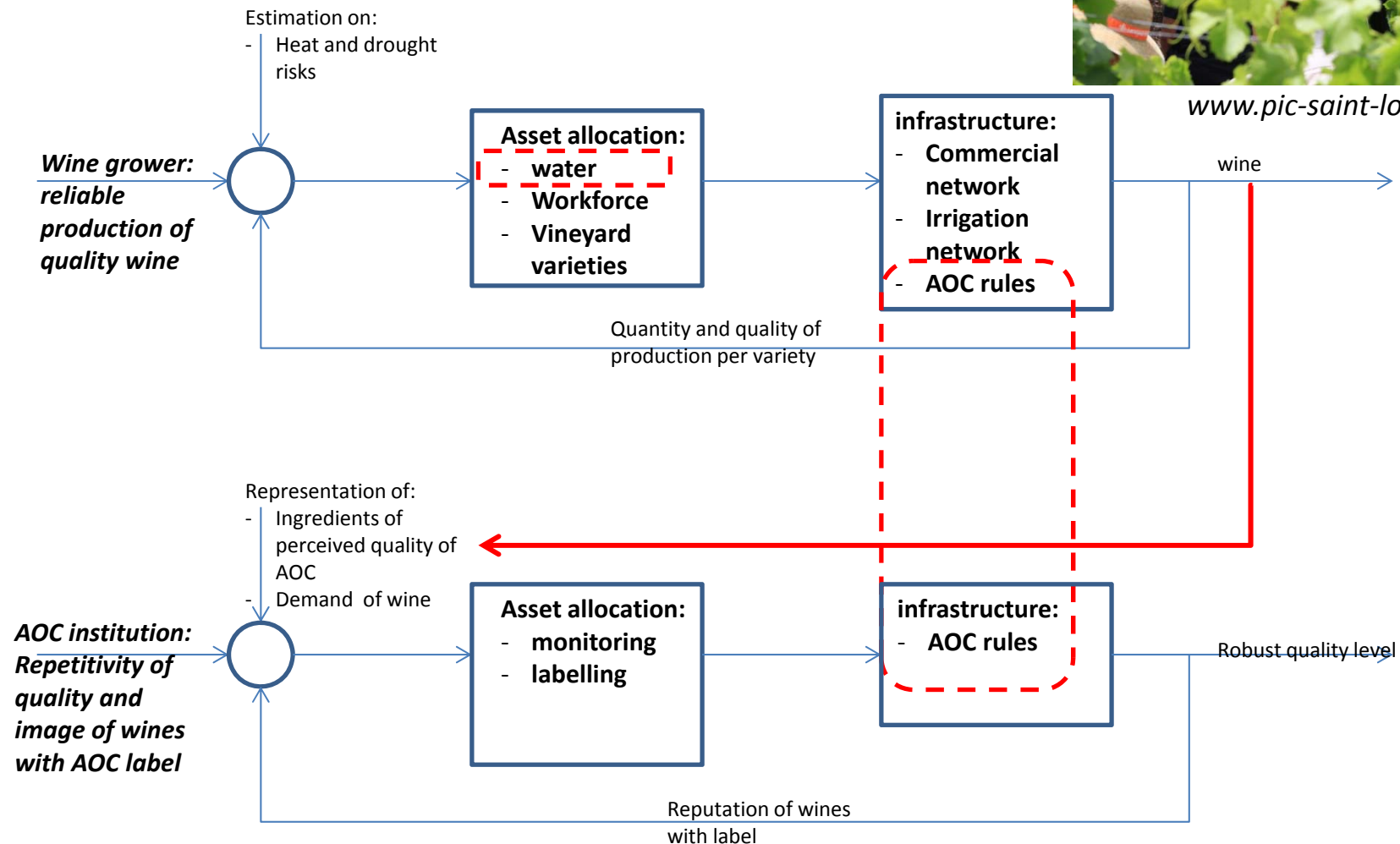
# Transfer of robustness

## B Feedback Control Loop for General SES



- Metaphor to analyse cases towards a typology of transfers

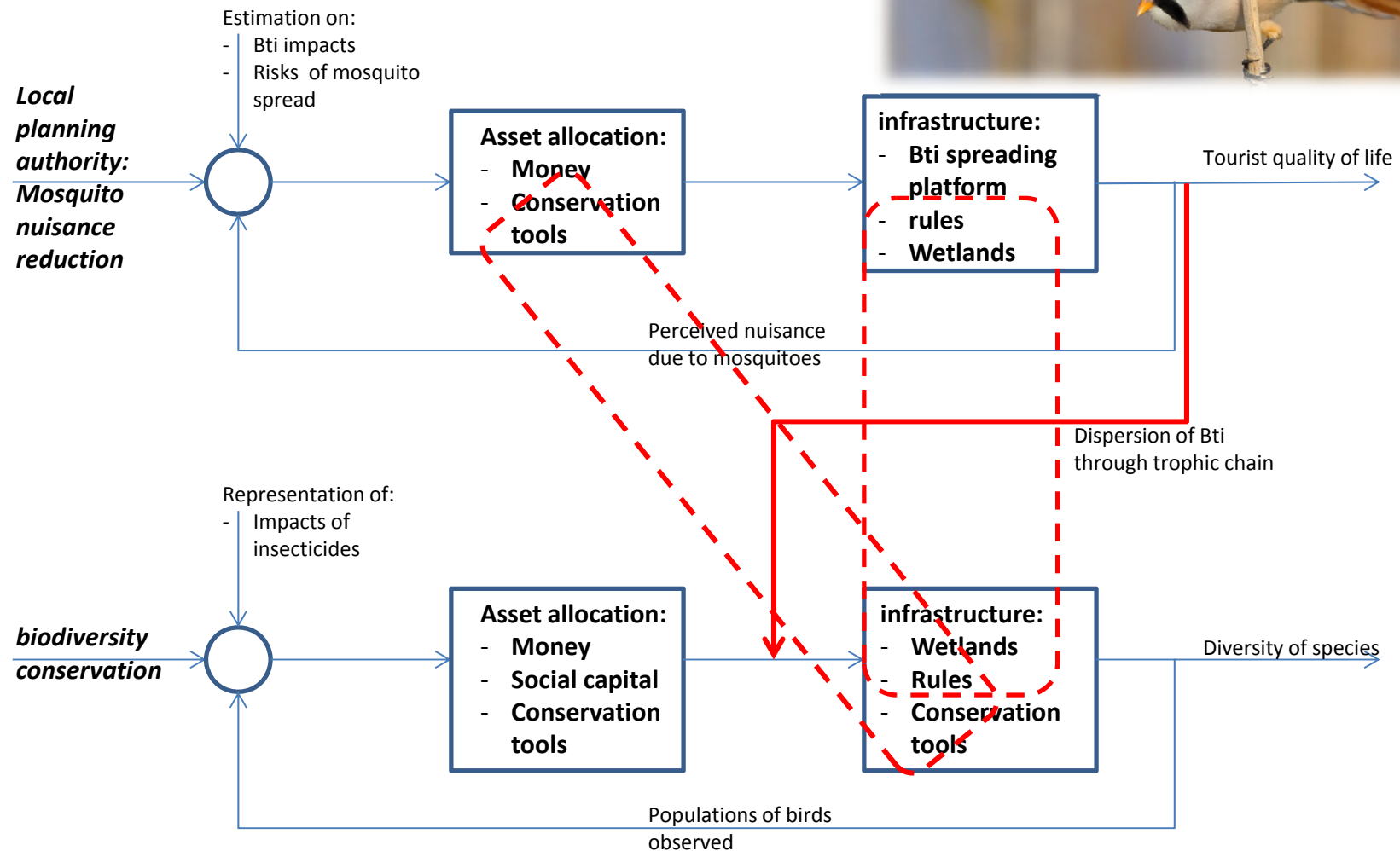
# Drought adaptation VS Protected Designation of Origin



Institutional locked in; possible trade off with water sharing  
(Based on Dedieu 2015)



# Mosquito control VS biodiversity conservation



# In practice: facilitate communication

- Heritage approach
  - Discuss on future
- Participatory settings
  - Identify and agree on interdependences
  - Capacity for joint exploration





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- Belmont Forum (incl. NERC, NSF, NRF, ANR)
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