Agro-ecosystems as ecological funds: a condition for innovative design?

Elsa Berthet, Blanche Segrestin, Benoit Weil

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Introduction

- Increasing challenges in environmental issues: new distributed but “common” objects
  - Ex.: smart cities, sustainable agricultural systems…

- Strong design challenges:
  - Stakeholders with diverging interests
  - Multifunctional and multidimensional objects
  - High uncertainty and unknown

⇒ A need for methods and tools to better qualify the objects of design and initiate their collective design process

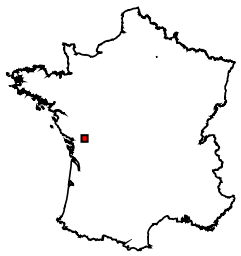
- Agro-ecosystems: emblematic of these design challenges
- However, in the literature, their design is a blind spot
  - Economy:
    - Damages on ecosystems = externalities
    - Ecosystems = stocks of natural capital
  - Ecology:
    - Ecosystems are given (modeling approaches)
    - Human activities disrupt their functioning
  - Agronomy:
    - Ecosystems = “context” of agricultural production
    - Avoiding hazards through “artificialization”

Costanza & Daly 1992

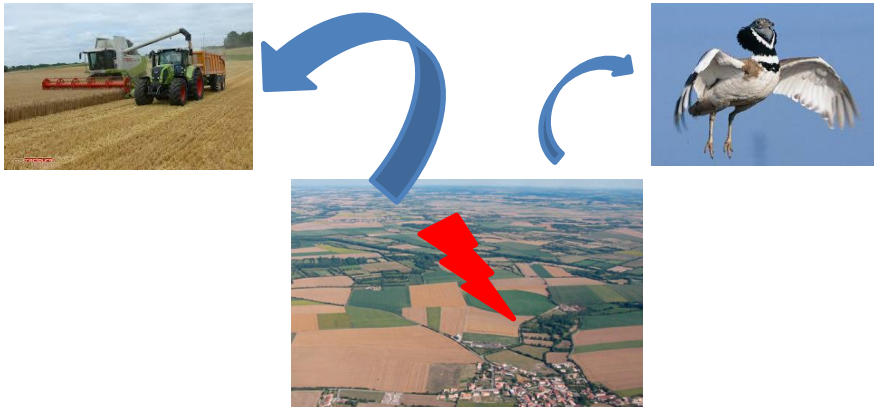
Blandin 2009

Meynard & Girardin 1991

Toward a model for agro-ecosystem design
… building on an empirical case



- Case study in the West of France
- Intensive cereal plain
- Biodiversity and water quality degradation



- Initial situation: a conflict about « known » values

Initial approach

(Ecologists, naturalists, local authorities)

Identification of a threatened species (flow of high value)

↓

Analysis of its supporting ecological processes

↓

Management measures to increase its provision

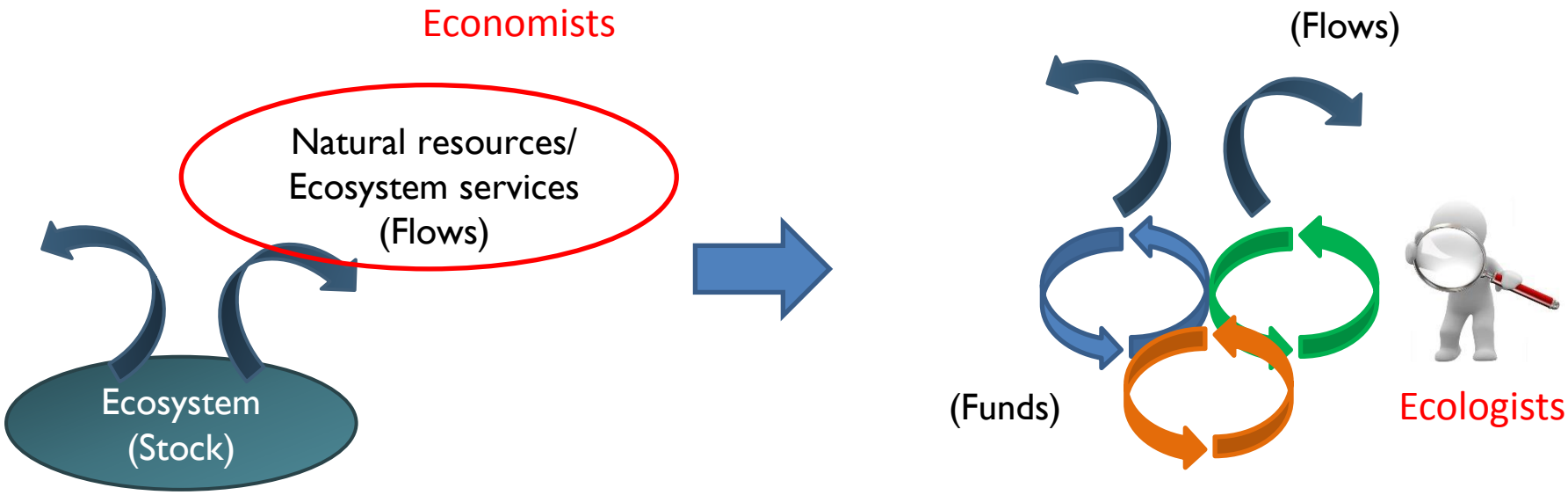
↓

Policy instruments

Problems: public spending, conflicts…

Toward a model for agro-ecosystem design

- Proposition 1: Ecosystems are not stocks, but funds



A need to identify key regulations
⇒ knowledge in ecology
- Ex. “Landscape”

Georgescu-Roegen 1965, 1971

- Proposition 2: Ecosystems can be designed

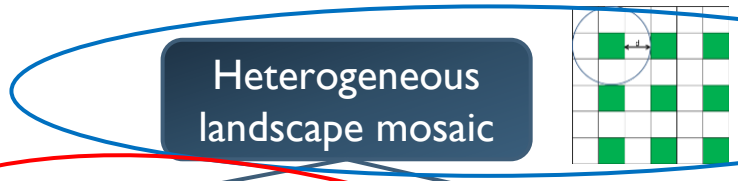
- Are all flows known?
- A change of perspective

Ecosystems considered as **given**, values as known
=> **negotiation, conflicts**

Ecosystems considered as a **potential** to explore
=> **creativity, collective design**

- Ecological funds: departure point of a design process
  - Ecological core regulations as basic rules for design
  - Exploration of various configurations and potential values of these funds

Exploring the potential of the ecological funds



Heterogeneous landscape mosaic

Ecological funds (*initial concept*)

With perennial elements (hedges, trees…)

With semi-perennial crops (SPC)

Possible configurations of the funds

Manage SPC distribution

Manage SPC production

Soil improvement
Forage production
Reduced used of pesticides
⇒ Improve water quality

Dense and regular distribution

Legumes

Spread mowing dates

Improve pollinators' feed resource availability

Insect colonization processes
⇒ Trophic web
⇒ Auxiliaries

New values explored

Ecological funds and the management of innovation

- Identification of key regulations

  ⇒ Initial design **specifications**

- Not a common good, but a **common unknown**
  - Funds are open-ended
  - A variety of stakeholders may be involved in their design to ensure acceptability

Ecological funds and technological platforms

	Ecological funds	Technological platforms
Structure	A fund as a common unknown	A core and a periphery (modules)
Context	Conflicts and innovation deadlock	Competition by innovation
Leader	No leader	Leader firm
Aims	- Initiate innovative design for a sustainable management of AES - Involve and coordinate stakeholders	- Control value creation - Stimulate innovation of complementors - Address uncertainty
Principle	- Identify key ecological regulations - Then consider funds as open-ended (New properties)	- Define design standards - Generate new uses/applications
Role in a design process	- Initial specifications - Make visible interdependences between stakeholders	- Initial specifications - Facilitate complementation - Generate interdependencies

Gawer & Cusumano 2002; Gawer 2014; Bresnahan and Greenstein 1999

Implication for design theories

- Ecology: From a modeling science to a design science
  ⇒How to support this shift?
  ⇒From « scientific concepts » to « concepts for design »
    - Ex.: landscape

- Identifying « funds » for design issues in other contexts: e.g. sustainable cities
  - Key regulations as « grips » for design
  - Orientation of collective learning
  - Identify a common unknown to involve stakeholders in conflict

Thank you for your attention

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