Companion Modelling
an introduction

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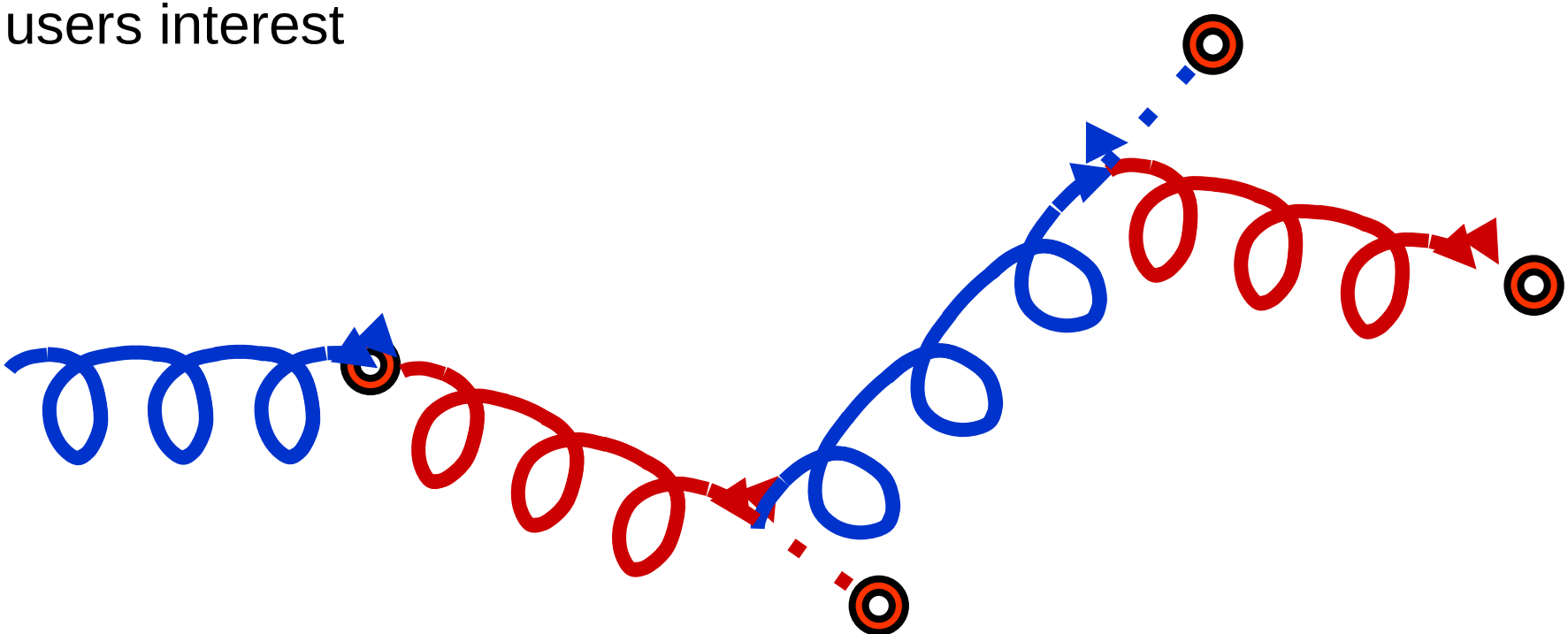
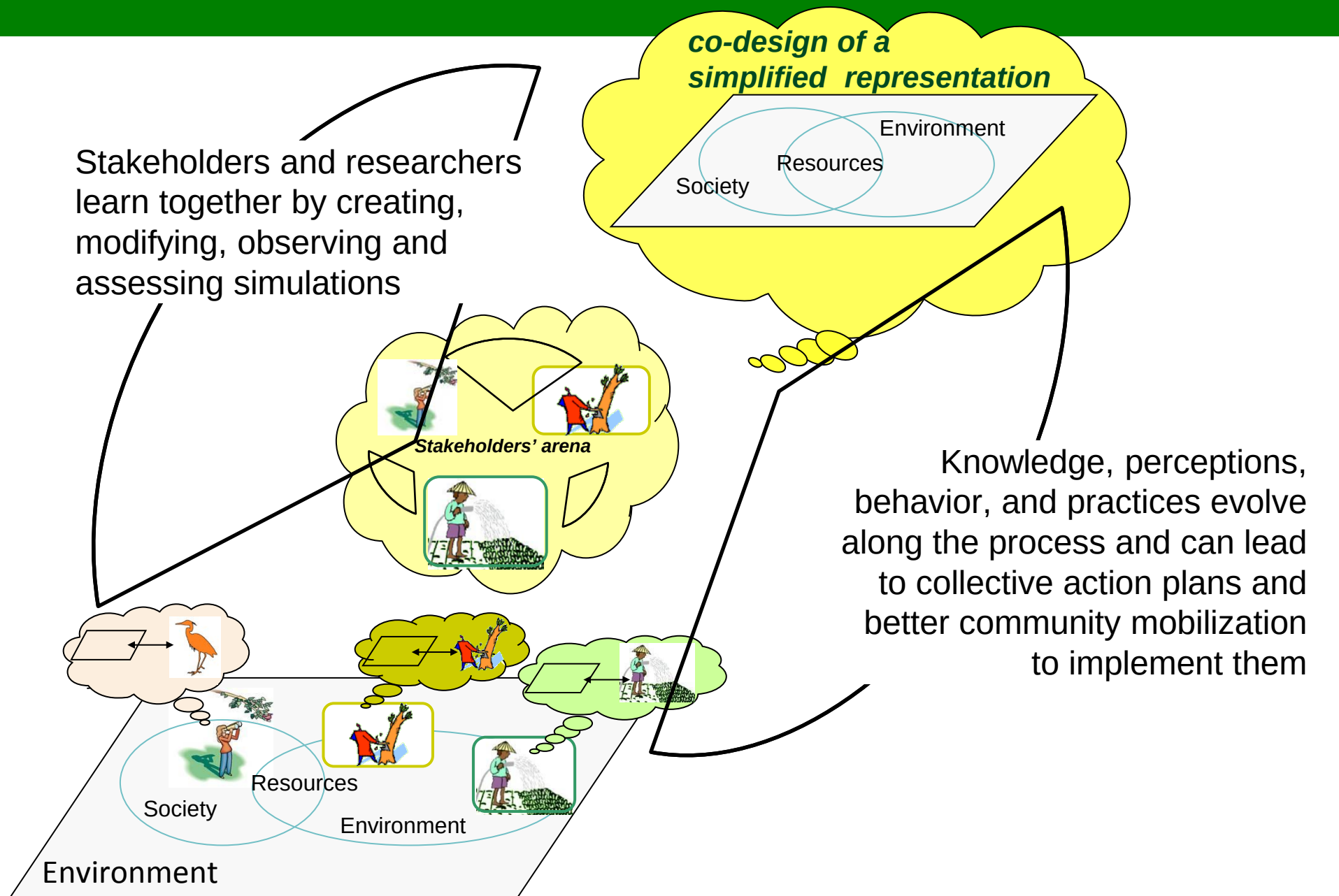
ComMod: a scientific posture on designing and using models

Companion **Mod**elling is an interactive process facilitated by evolutionary models used as mediating tools to support dialogue, shared learning & collective decision-making

The modeling and simulation activities are driven by end users interest



ComMod: a participatory modelling approach



ComMod: objectives

First objective: research on complex systems
=> to share and to produce knowledge on social-ecological systems

Second objective: action research=> to support and to improve collective decision-making on a key NRM / land management problem

In practice, both objectives often implemented simultaneously => be explicit about the main one !

ComMod: a brief history (1/2)

- ***1993*** : **Cirad-Green team** (Renewable resource management & environment) led by Jacques Weber
  - modelling interactions between renewable resource dynamics and socio-economic dynamics
  - decision-making process: processus of interactions amongst stakeholders with differents view points and weights

- ***1996*** : Formalisations
  - an approach, companion modelling (***ComMod***)
  - a dedicated agent-based simulation platform for renewable resources management (***Cormas***)

- Since ***1998*** :
  - various experiments in extremely diverse contexts
  - training modules (ABM and natural resources management, Cormas)

- ***1999***: Integration of a new tool, **role-playing games**

- ***2002:*** deontological framework, collectively written, the ComMod **Charter** (JASSS 2003, http://jasss.soc.surrey.ac.uk/6/2)

ComMod charter

Guiding principles in the Charter include:

- taking **equal account** of all identified stakeholder knowledge and viewpoints;

- **transparency**: each idea must be explicit and submitted for approval by participants (experts and field actors);

- **iterative and adaptive nature**: each new element can modify the process;

- **evaluation** of outcomes, not only in terms of technical outcomes but also in terms of collective learning outcomes, as seen in the evolution of viewpoints and interactions among stakeholders.

ComMod: a brief history (2/2)

- Since ***2002***: the ComMod scientific network (40+ members):
  - Inter-institutional
  - International (timidly…)
  - Multidisciplinary
  - Annual meeting, electronic list, working groups, collective publications, special issues in journals, organisation of workshops, training courses, etc.

<http://www.commod.org>

- ***2006-2009*** : « ANR Agriculture et Développement Durable» project
  - **Objectives**

    évaluer la capacité de la modélisation d'accompagnement à atteindre un objectif de décision collective pour la mise en œuvre d'un développement durable, et à mieux impliquer les parties prenantes dans ce processus de décision collective.
  - **Principles**
    - Ex-post evaluations of completed case studies (external reviews)
    - Crossed evaluations amongst researchers => comparative and reflexive process (evaluation «on the way»)
  - **End-products**
    - Collective book, QUAE (FR in 2010, ENG in 2011)
    - Methodological manuals

B0 – ComMod: methodology

A standard succession of 12 phases…

1. Sensitizing those involved in development issues to the ComMod approach and its possible applications in local problems
2. Definition of the question raised between project holders
3. Inventory of scientific, lay or expert knowledge, available through surveys, diagnostic studies and analysis of the existing literature
4. Eliciting knowledge for the model through surveys and interviews
5. Co-construction of the conceptual model with stakeholders concerned by the issue at stake
6. Choice of a modelling tool (computerized or not) and implementation of a model
7. Calibrating, verifying and validating the model with local stakeholders
8. Definition of scenarios with local stakeholders
9. Exploratory simulations with local stakeholders
10. Monitoring and evaluation of the effect of the process on the practices of the participants
11. Diffusion among stakeholders who have not participated in the process
12. Training stakeholders interested in using the tools developed

B0 – ComMod: methodology

…aggregated into 5

1. Sensitizing those involved in development issues to the ComMod approach and its possible applications in local problems
2. Definition of the [illegible]
3. Inventory of scientific, lay or expert knowledge, available through surveys, diagnostic studies and analysis of the existing literature

Block 1: Mandate, context, participants

4. Eliciting knowledge for the model through surveys and interviews
5. Co-construction of the conceptual model with stakeholders concerned by the issue at stake

Block 2: Co-construction of the conceptual model

6. Choice of a modelling tool (computerized or not) and implementation of a model
7. Calibrating, verifying and validating the model with local stakeholders

Block 3: Implementation

8. Definition of scenarios with local stakeholders
9. Exploratory simulations with local stakeholders

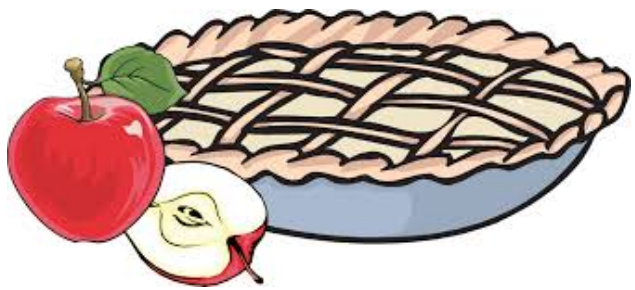
Block 4: Exploration and simulations

10. Monitoring and evaluation of the effect of the process on the practices of the participants

Block 5: Monitoring and evaluation

11. Diffusion among stakeholders who have not participated in the process
12. Training stakeholders interested in using the tools developed

Block 1: Initiation of a ComMod Process



Block 1:
mandate, context, participants

1. Sensitizing those involved in development issues to the ComMod approach and its possible applications in local problems
2. Definition of the question raised between project holders
3. Investigation of the context or exploratory phase, analysis of documents, diagnostic studies and analysis of the existing literature
4. Eliciting knowledge for the model through surveys and interviews
5. Co-construction of the conceptual model with stakeholders concerned by the issue at stake
6. Choice of a modelling tool (computerized or not) and implementation of a model
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BLOCK 1

ComMod

Preparation for Take-off Phase

(*Mandate: demand, question, objectives*)

(Context)

(Participants)

1. The <u>mandate</u>

- The demand: types, origins => rooted into the local context?
- The question to be tackle
- The objective(s) of the ComMod process

2. The initial <u>context</u> into account

- System boundaries to manage/represent
- Ecological dynamics
- Social dynamics
- Institutional and political context

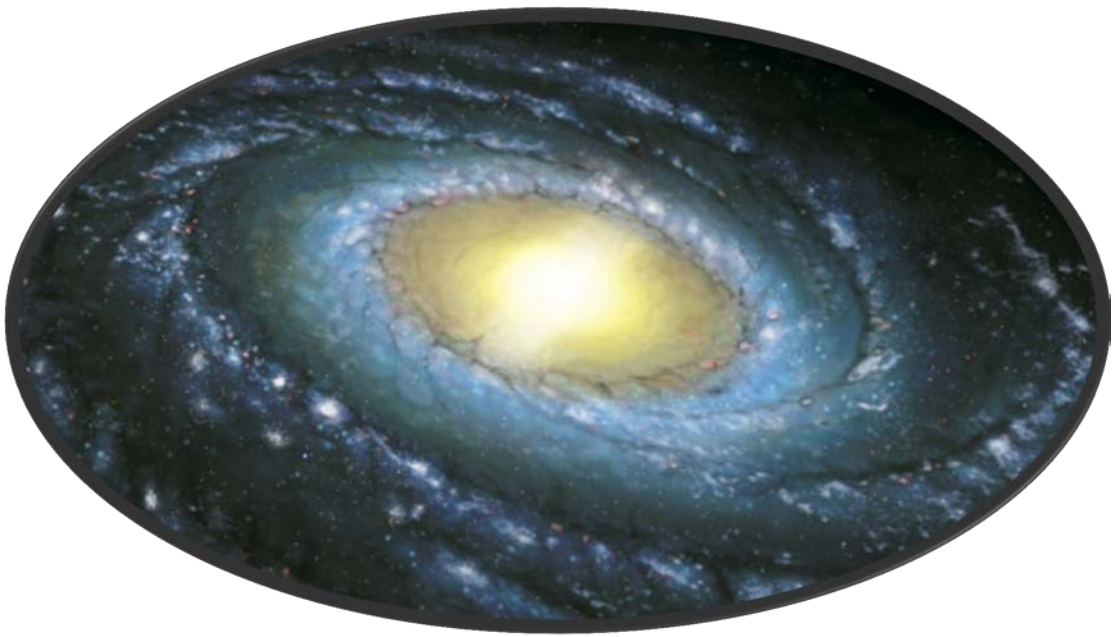
Characterization of the «initial state» => to be used in subsequent Monitoring and Evaluation activities

3. Selection of <u>participants</u>

- Identification and roles
- Selection and invitation
- Awareness and mobilization
- Group dynamic

1. The Mandate

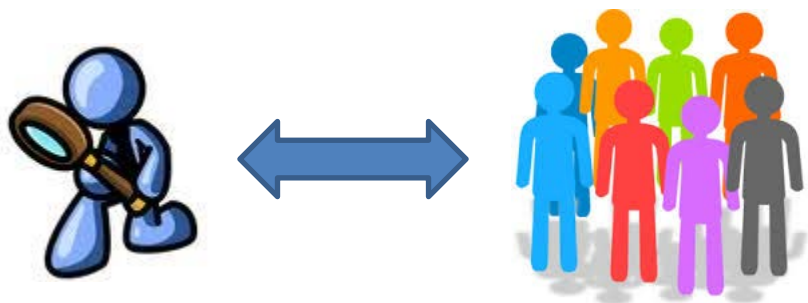
1.1 The demand



Several initial situations:

1. **A research question…involving non-academic partners**

2. **A social demand…+/- clearly formulated or to be clarified:**
   - the researcher offers to answer by a ComMod process
   - local partners request a ComMod process (suitability?)
   - emerging from a ComMod process tackling another question



In ALL cases, influenced by the posture of the Commodian researcher:
- transparency of his viewpoint
- and of his work hypothesis

Importance of local anchoring: need to tailor the objectives to the local context (not over ambitious!)

Transformation of a social demand into a clear and precise question motivating all the concerned stakeholders

Importance of sensitizing activities and mobilization/motivation of a “hardcore” group of participants , over a long period

If insufficient underpinning:

- Mere community intervention

- Frustration of stakeholders (can’t solve the problem because of interdepencies with other decision-making levels)

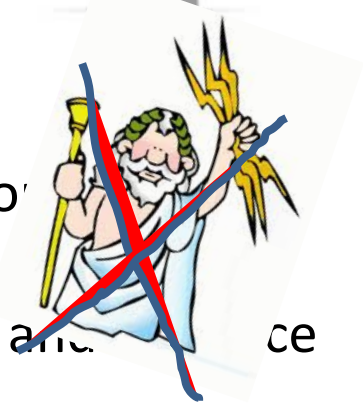
1. The Mandate

1.2 The question

Clear and **precise** definition of the problem/question

Should reflect:
- Multiplicity of viewpoints (all legitimate a priori)
- Unpredictability of complex systems
- Uncertainty around available knowledge

Is the ComMod process suited to tackle this question:
- Collective dynamics, ecology/society interface?
- Local development scale?
- Individual and collective learning



Only tackle **possible thematic**: land uses, water allocatio
biodiversity, conflicts over uses (agriculture/livestock
farming/forestry), tension between farming production a ce
conservation, urban/rural, etc….

B1 - The Mandate, the initial question

Two types:
- Collectively improve knowledge
- Facilitate decision-making process

Formulating the question, understandable by all stakeholders
- Preliminary dialog
- A clear question motivating all participants…

Non-neutrality of the question and its formulation:
- Can influence the involvement of some stakeholders
- Definition influenced by the ComMod team

1. The Mandate

1.3 Objectives

Some examples of concrete objectives (type 1 or 2)

- Facilitate dialog between stakeholders
- Improve knowledge about a given SES

Or

- Develop a collective management plan
- Reinforce negotiation/communication skills of some stakeholders
- Facilitation mediation over resources management conflict

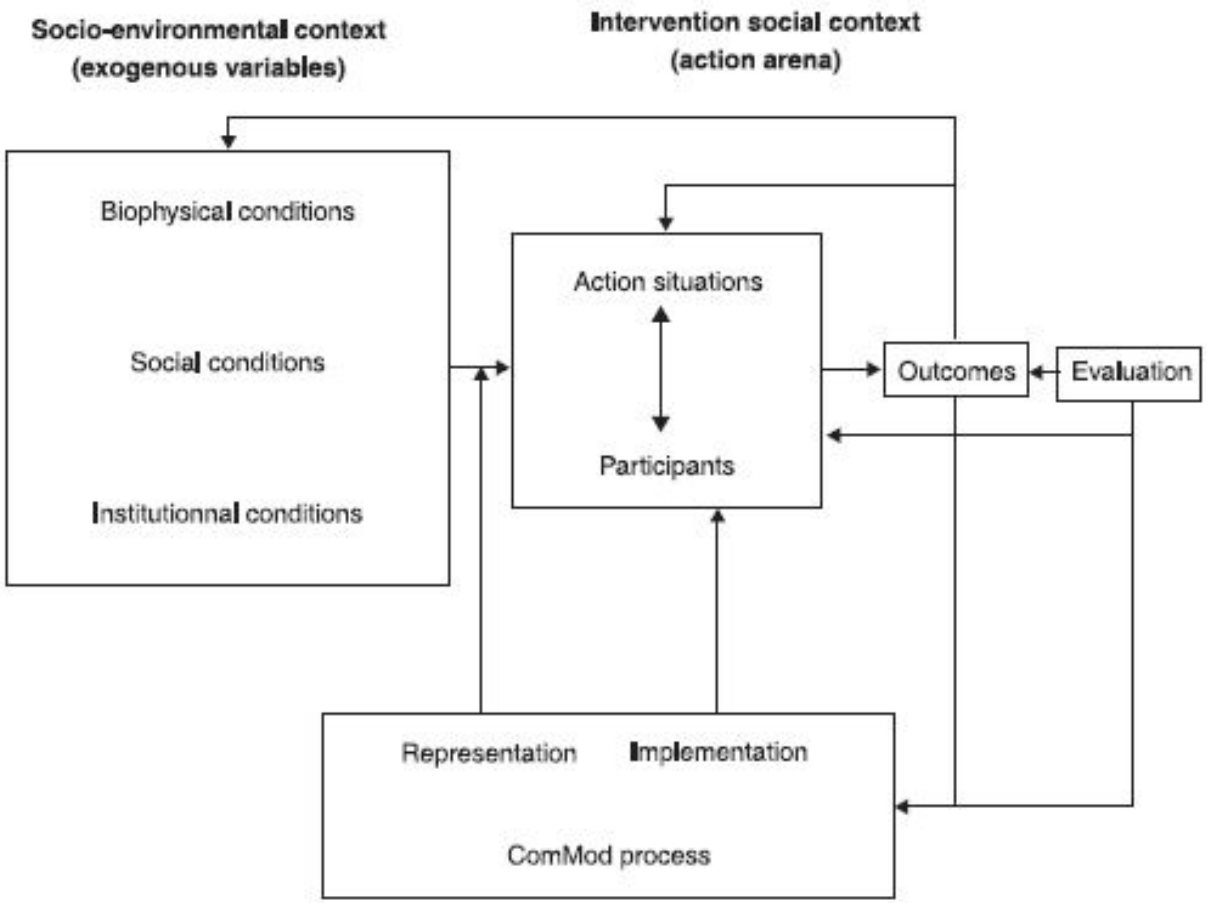
The objectives might evolve due to:

- A change in the stakeholders **arena**
- A change in the initial **question** or stakeholders expectations/concerns
- A change of key elements in the **context**: new policy, new infrastructure, job transfer, etc…

Advice: not overly ambitious at the onset !

2. The context

Context Analysis Framework (adapted from Orstrom, 2005)



When and how should the ComMod approach consider the socio-environmental context?
When and how should the ComMod approach consider the intervention context?
How does these considerations affect in return the process and its outcomes?

⇒ Diversity of practices with the ComMod community:
feasibility conditions of ComMod approach VS relative subjectivity/incompleteness

Some **key aspects** favoring an in-depth analysis of the context:

- Power relationships/power game between stakeholders (avoid leaving out some stakeholders)
- Evolution of these relationships: reinforcement of disparities?
- A monitoring and evaluation system is required to follow changes in the initial context

Conceptual framework of preliminary analysis: example of in-depth context analysis

Agrarian system theory

Interacting ecological & social dynamics
Farming households strategies

[M. Mazoyer & L. Roudard]

Institutional analysis

Power relations
Horizontal & vertical interactions
Representatives' accountability

[E. Ostrom]

Learning theory

Stakeholders' perceptions of:
- the problem
- other stakeholders
- possible solutions

[C. Leuwis]

evolution of power relations during the process →

← Change of perceptions during the negotiation and collective learning processes

Barnaud et al., 2008

1. System boundaries to limit complexity (always tricky!)

2. Socio-environmental context:

- **Biophysical**: Main processes, resources and multiple uses, scales, key infrastructures
- **Economic and social**: Heterogeneity of stakeholders, roles, strategies, practices, administrative constraints, conflicts (past or on-going), power game, trends, etc.
- **Institutional and political**: Involved institutions, strategies, relative importance, influence, history, relationship between institutions, etc…

3. Stakeholders analysis and institutions

Typology: categories, positions, interests, strategies, motivation, etc…

Relationships: power game, communication arena, history, existing social networks

Importance and influence by stakeholders categories

Specific diagnostic surveys/tools:

IAD: institutional analysis & development (Orstrom et al, 1994)

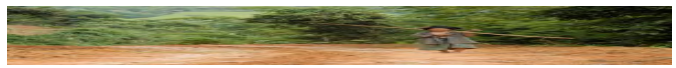
4R: rights, responsibilities, returns, relationships (Vira et al., 1998)

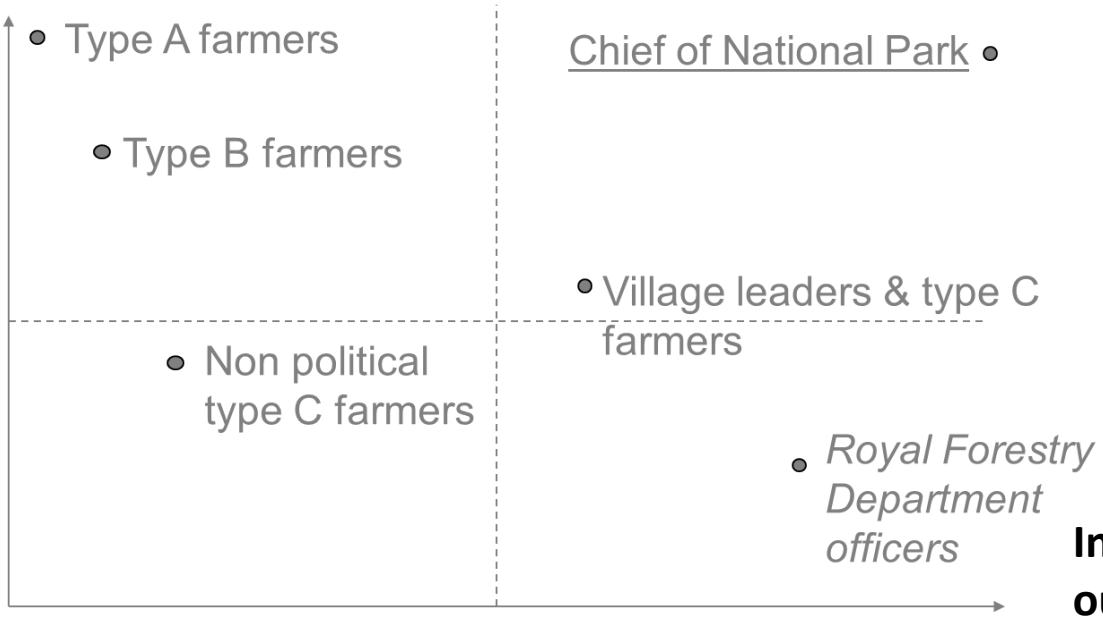
PACT: pro-active conciliation tool (*Jesus, 2001*) => problem definition

4. Role and status of the ComMod team: influence, history, relationship, trust, posture, etc.

Nam Haen case, Nan province (Thailand): Matrix of stakeholders' importance & influence

Importance of the problem (affected by the National Park issue)





Influence (regarding the outcome of the National Park issue)

Barnaud et al., 2008

3. The participants

B1: The selection of the participants

What is expected from them?

- Provide diverse representations of the problem
- Represent divers type of knowledge
- From different institutions, social groups and levels
- In relation to the objectives to be achieved
- Link to the legitimacy of the process
- Empower 1 category or strengthen a group & highlight interdependence?

How to build the list of participants? Criteria to be considered:

- Knowledge of the subject matter
- Personality; legitimacy, mandate, function in key institutions
- Capacity to link the process with other related social networks
- Availability and motivation

Invitation: adaptation/local customs

- How? When? By whom?
- Formal invitation, followed by informal reminder(s)
- By the process designer or the most legitimate institution taking part

Own position of process designer(s) / leader(s): control vs « laisser faire », personal choices, subjectivity

Evolution of the partnership strategy: how to manage / new participants & evolution of the question, transformation of the problem along the way

- A useful check list, but…
- The main message is: there is NO SILVER BULLET!
- « The context is everything » so…
- Be very adaptive to change!

- Also because

  “If you know EXACTLY what you are going to do, what is the point of doing it?”

  Pablo Picasso

Block 1: mandate, context, participants

Block 2: Co-construction of the conceptual model

1. Sensitizing those involved in development issues to the ComMod approach and its possible applications in local problems
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PARID

Problem

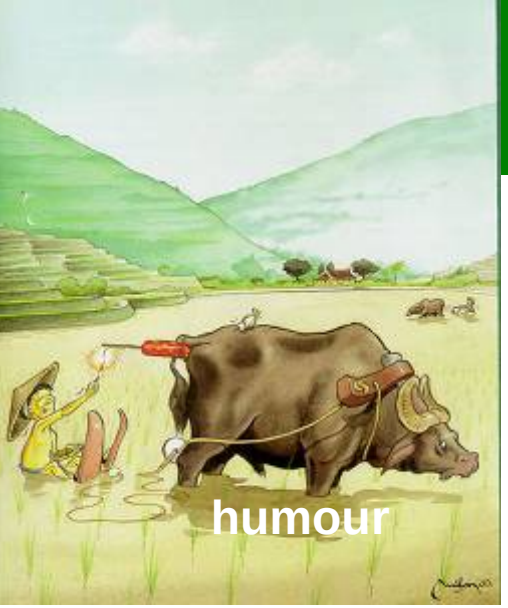
Actors Resources Interactions Dynamics

Adapted from Etienne M. (2011)...
ARDI: a co-construction method for participatory modeling in natural resources management

P-ARID is…

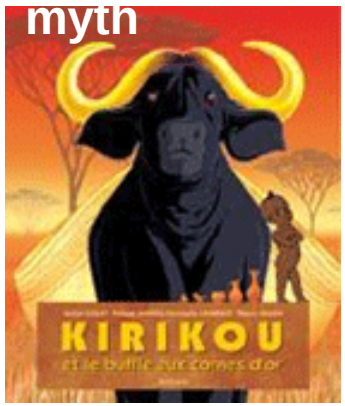
….a method to **elaborate** a conceptual model of socio-ecological interactions at work in a given human ecosystem (HE)

…used for **co-constructing** a representation of the system shared by relevant stakeholders



WWF

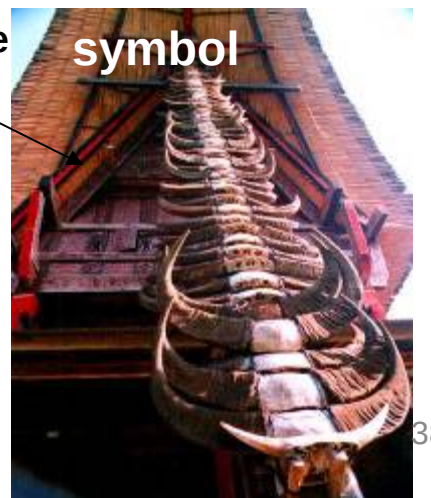
hunter



local society

Conflicting Viewpoints ?

village



family

farmer

P-ARID helps people to…

…**think** about the use and management of their resources

…become **explicit** about their interests

…**clarify** their pratices

P-ARID also helps people to…

…**share** individual viewpoints of the HE

…**accept** interactions with others

…**understand** other viewpoints

…**negotiate**

P-ARID and ComMod

P-ARID aims at **facilitating stakeholders' involvement** in the designing stage of the modelling process

P-ARID usually comes in at an early stage of a ComMod process

From the identification of problem(s)…

As a starting point, stakeholders are asked a simple question about their crude perception of the study site by using this general formulation

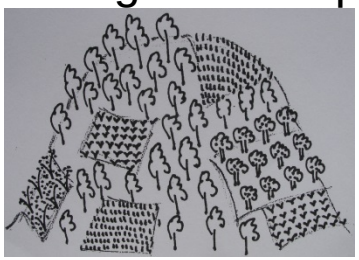
*« What do you think about …**some NRM scheme**… in …**a delimited location**…? »*

>>>>The diversity of viewpoints has first to be revealed

Each viewpoint should stress a specific problem (often directly related to some changes recently observed at the study site)

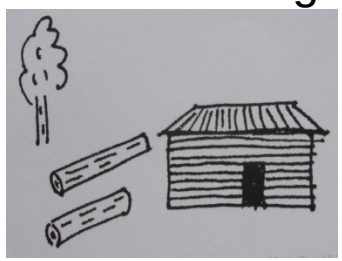
… to the selection of a single problem

Forest encroachment by new agricultural plots



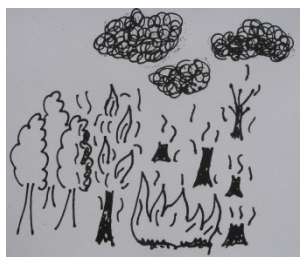
Collect of non-timber forest products

Over-timbering



Cattle grazing in the forest and environmental damage

Forest fire



Prohibition of holding a gun in the forest

From a problem to a question

« What are the driving factors/forces
that are causing **the problem selected**? »

Example: Kruger Park (South Africa)

What do you think about water resource use and management in the Crocodile Catchment?

Water scarcity

>>> What is driving change in the flow of the Crocodile River ?

Actors

Who are the **actors** whose practices drive *PROBLEM at stake*?

Kruger Park: What are the main stakeholders that seem to be able to or need to play a decisive role in managing the river flow?

Irrigation farmers	*Commercial farmers*	Industry
Subsistance farmers	Private Foresters	Corperate Foresters
~~Rural communities~~	Tourism operators	Developer
Local authorities	N & P authorities	Urban resident

Resources

What are the key **resources** involved in *PROBLEM at stake*?

Goods or products used by any of the stakeholders (infrastructure, water, stone, plants, animals).

List the relevant resources and relevant indicators for management decisions on these goods.

Some exogenous variables (i.e. the rainfall in arid or dry zones) critical in operating the system can also be included

Resources

Kruger Park: What are the main **resources** of the catchment in relation to water flow?

Interactions

What does X have to do to Y?

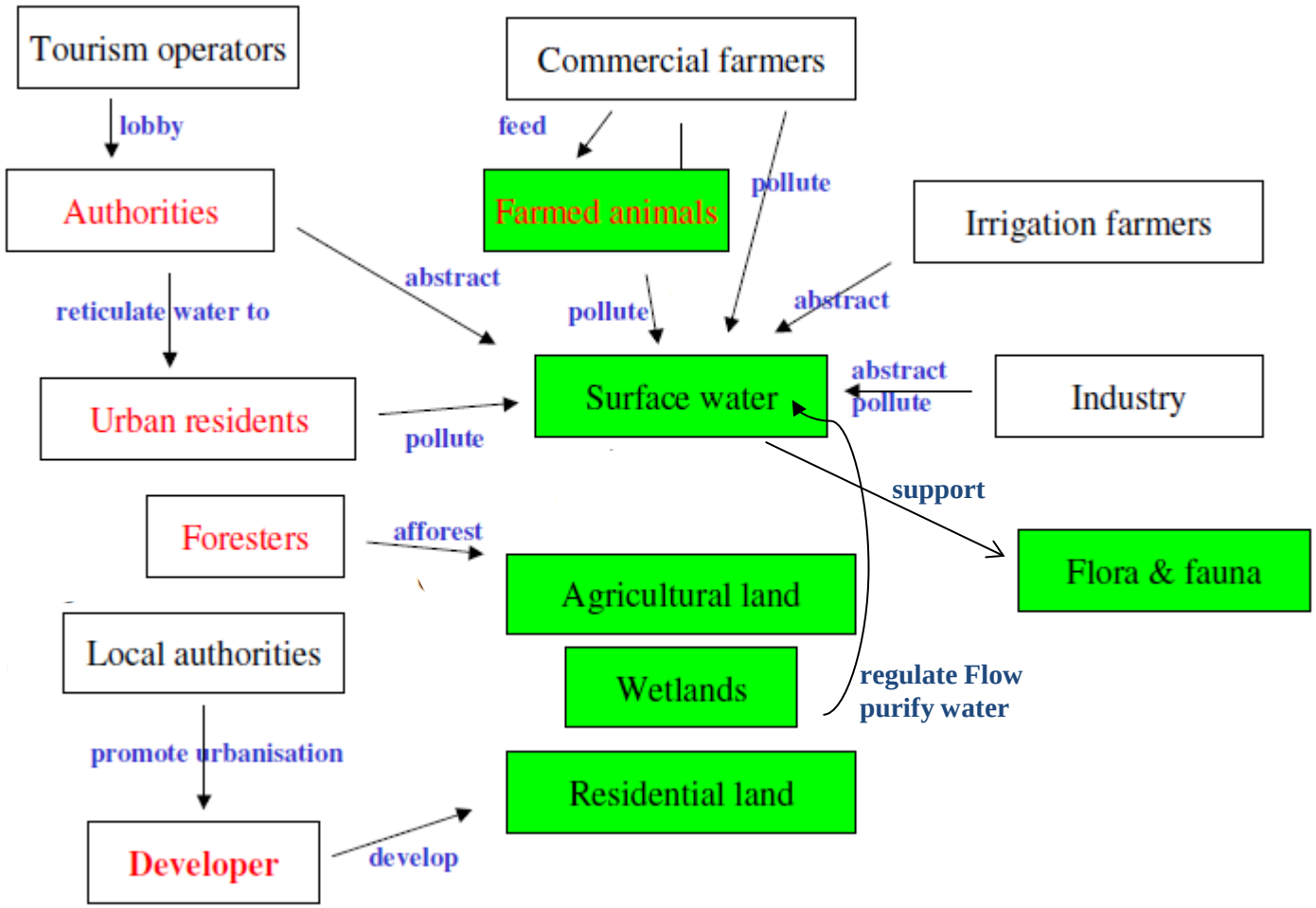
- For each new interaction, the facilitator draws an arrow associated with a **verb**

How do interactions emerge?

- Starting point: merging Actors and Resources diagrams
- Arrows are gradually drawn and the diagram is reshaped by bringing closer the stakeholders who have many relations and moving away those who do not have any.
- Lastly, the participants must identify and qualify the **management entities** (on what does this actor act upon?) used by each direct stakeholder.

Direct actor without ressources => is relevant?
Ressources without any use => missing actor?
Actor or resources? => controversies and debates
(i.e. Tourist, cow, God, ...)

Kruger Park: How does each stakeholder use the resources and modify the processes?



Dynamics (1/2)

typology and selection

- ecological dynamics (i.e. vegetation transitions or water flow),
- economic dynamics (i.e. market price changes, subsidies, …),
- social dynamics (social cohesion, knowledge transfer)

List no more than 10 processes

Sort out the 5 most significant processes (voting, ranking, consensus).

Dynamics

Kruger Park: What are the main **processes** that drive changes in the Crocodile Catchment that affect water flow?

DF Drought frequency
CP Crop production
NL Nutrient leaching (N)
WH Water heating
CM Chemical modification
UPI Urban population increase
WA water abstraction

SFRA stream flow reduction activity
FR flow regulation
WP water purification

LS life support

Dynamics (2/2)

state transitions

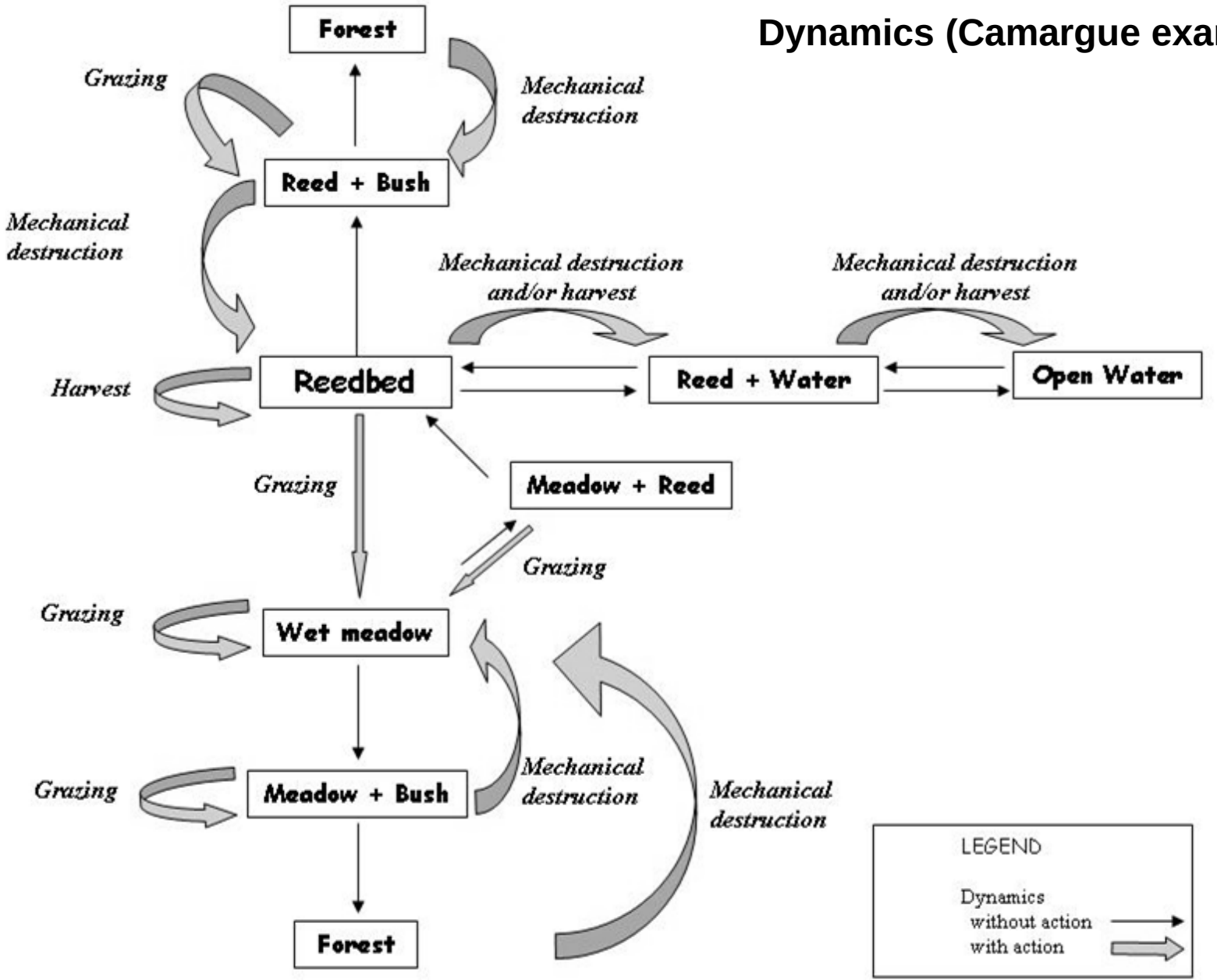
list the different states taken by the resource and specify:

- what causes the transition from one state to another
- How long it takes to go from one state to the next one

Separate

- transitions caused by human activities
- internal transitions

Dynamics (Camargue example)

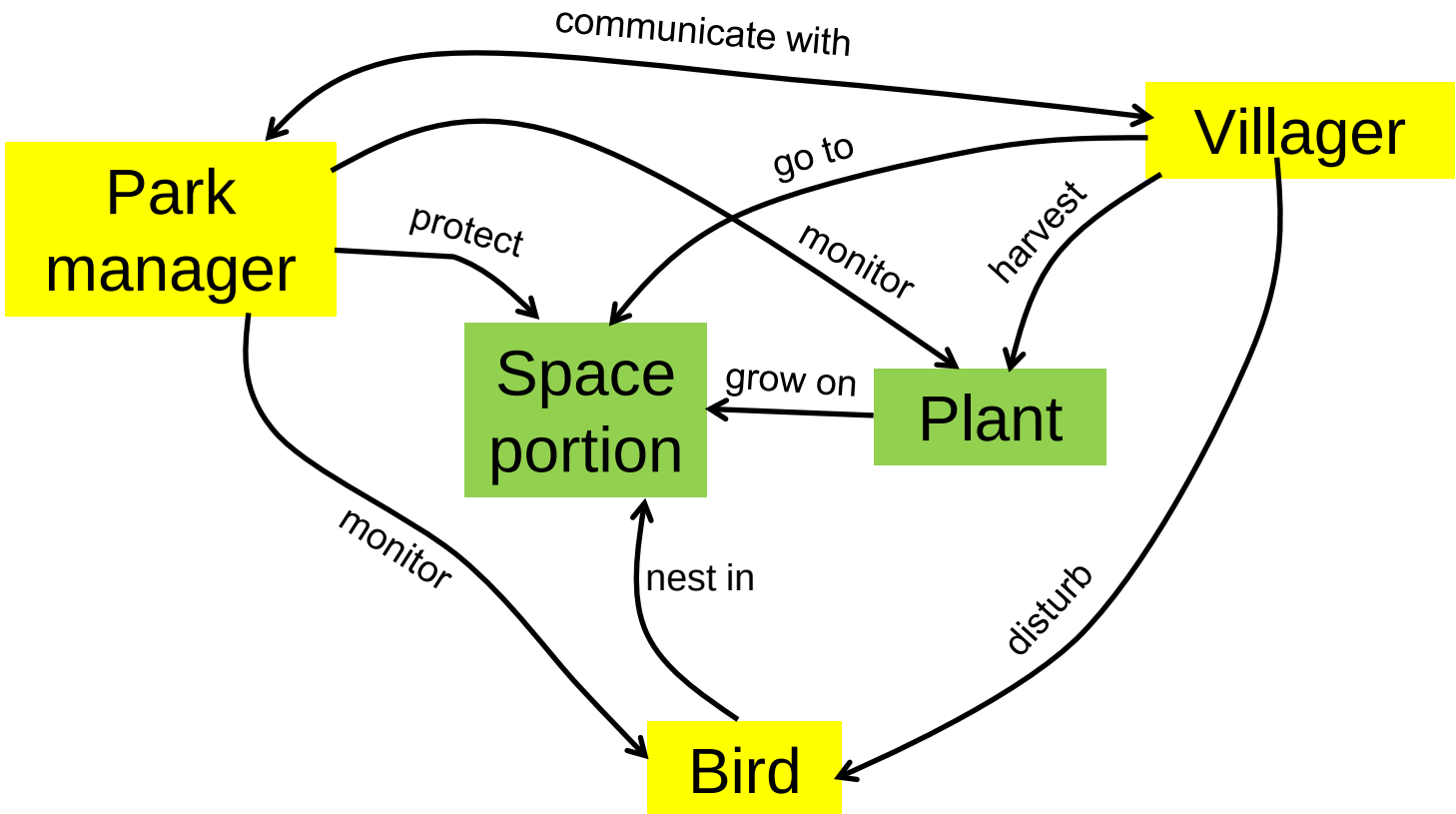


Back to ReHab

Biomass dynamics

round (*t-2*)	round (*t-1*)	round (*t*)	Δ *Biomass*
Any case	At least one	No *Harvester*	+1
At least one	No *Harvester*	No *Harvester*	0
No *Harvester*	No *Harvester*	No *Harvester*	-1

ReHab model
Interactions diagram



Biomass dynamics

state-transition diagram