A step by step guidelines to the construction of a conceptual model with the PARDI* method

*Problem, Actors, Resources, Dynamics, Interactions

ComMod

M. Etienne, C. Le Page and G. Trébuil

Problem: a question to be examined collectively by the participants

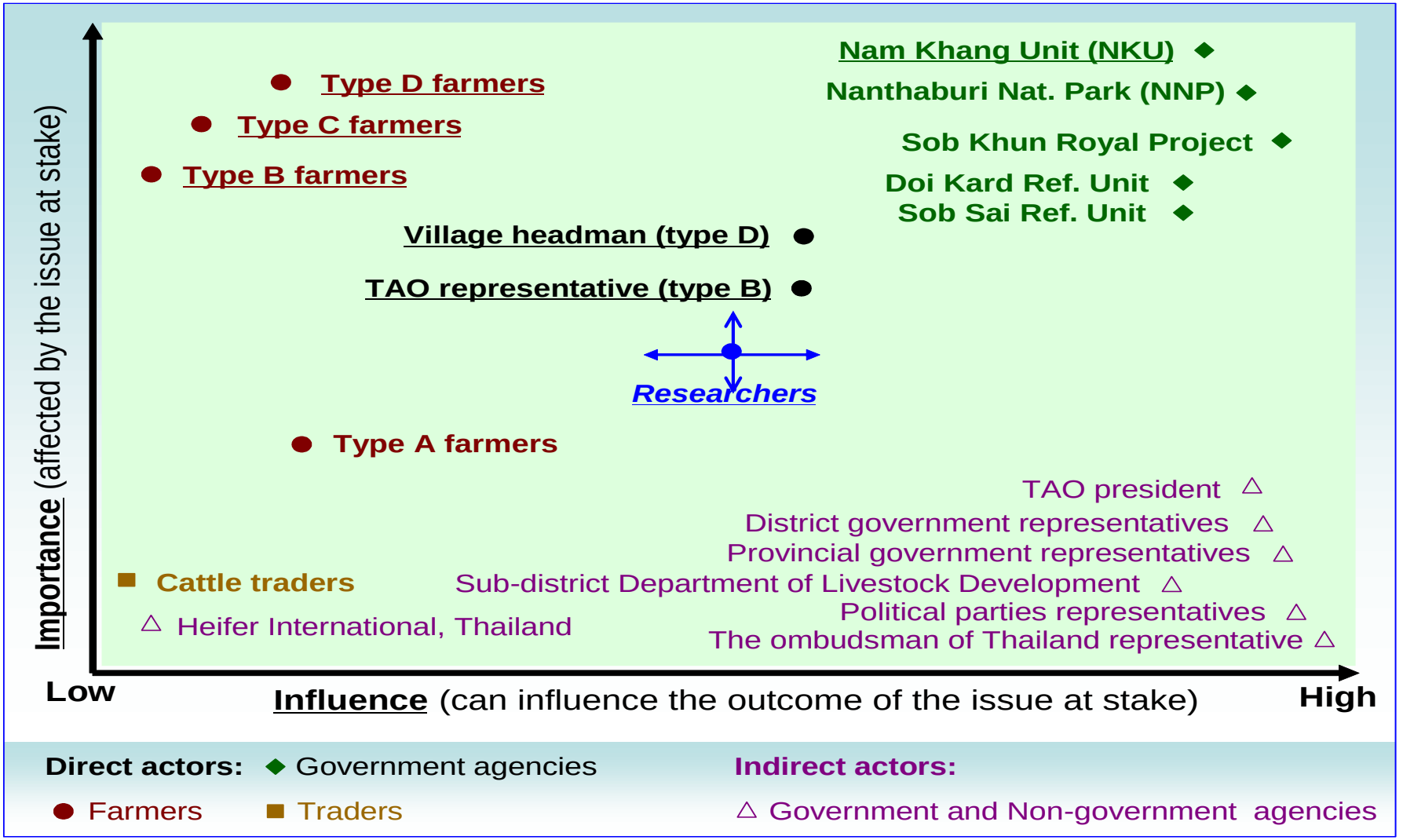
- Designation of a facilitator in each group
  - Manage exchanges among members
  - Guarantee an equitable participation from every member
  - Ask each member to justify their choices & suggestions
  - Production of a set of diagrams easy to understand by all members
- **Agreement on a clear & concise definition of the problem**
  - Do not be over ambitious !
  - To limit the degree of system complexity to be taken into account
- **Agreement on the relevant boundaries of the system to be investigated**
  - A piece of land: (sub-)watershed, irrigation scheme, « territory »
  - A delimited social-ecological system, agricultural system

Actors: identify the main actors concerned by the problem under study

- **List of the actors who could or should play a role in managing the problem**
  - Distinguish between the **Direct** & **Indirect** (influence) actors
- **Show the linkages between these actors**
  - Make this link explicit on a diagram (key & precise verbs)
  - Bring actors with strong linkages close to each other on the diagram
- **Associate a management entity to each of these actors**
  - A spatial one (field, herd, farm, catchment, province, etc.)
  - Or not (market, commodity chain, credit system, etc.)

Stakeholder Diversity & Heterogeneity / Importance of issue & influence on the outcome **(Grimble & Wellard, 1997)**

Doi Tiew case study, Nan Province, Northern Thailand (Dumrongrojwatthana, 2011):
LU conflict between types of herders & 2 forest management agencies (NKU & NNP)



Resources: what are the main resources & the crucial information needed for their sustainable use?

- **List of the key resources involved in the question being examined**
  - Group members to propose resources & justify their suggestions
- **Associate pertinent monitoring indicator(s) to each of the selected resources**
  - Quantitative or qualitative ones
  - More than one per resource if needed (if no agreement, etc.)
- **Any important time unit linked to resources?**
  - Day, season, year (with specific characteristics), etc.
  - Temporary vs perennial resources…

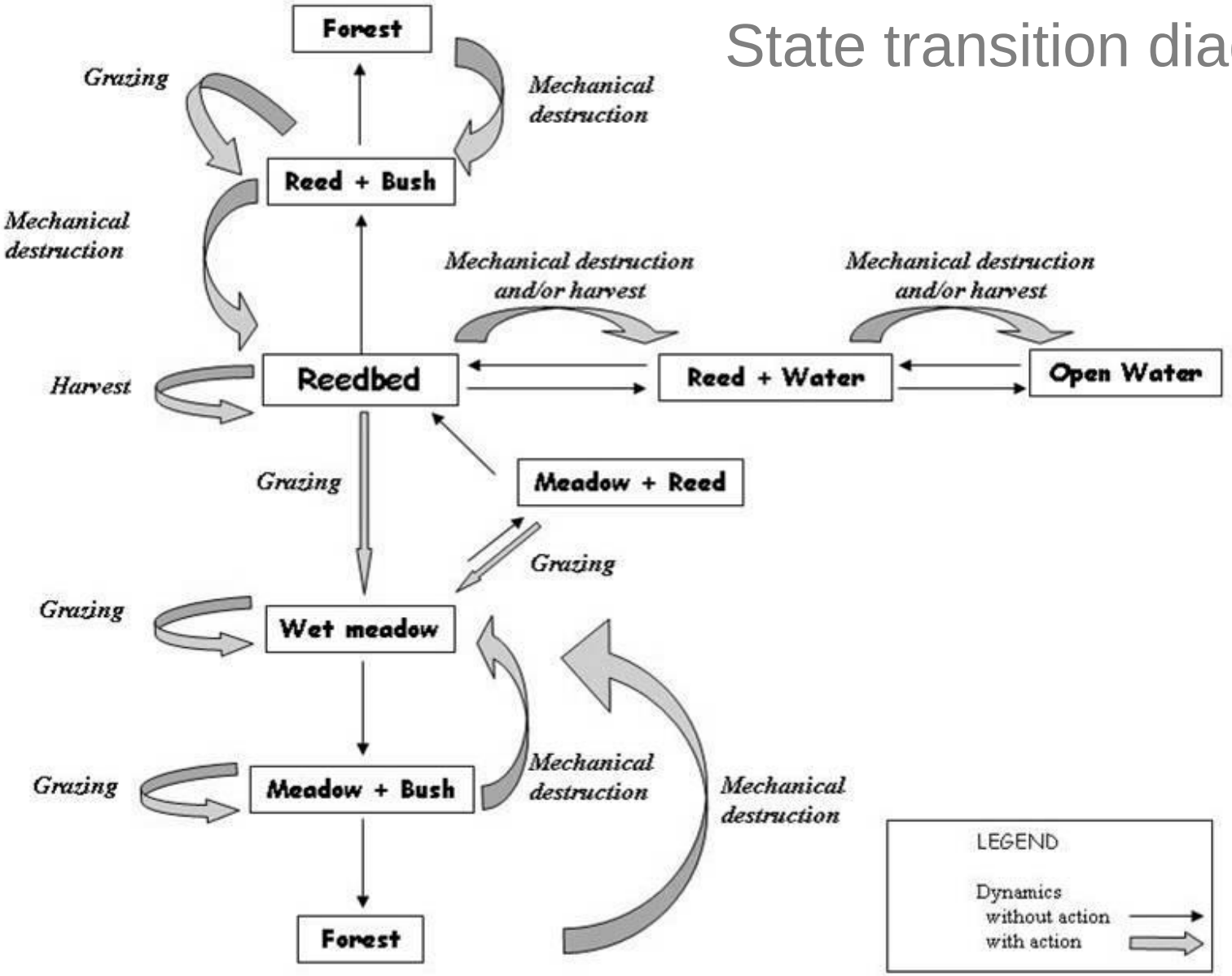
Dynamics: what are the main dynamics at play? How are they modified by the actors' actions?

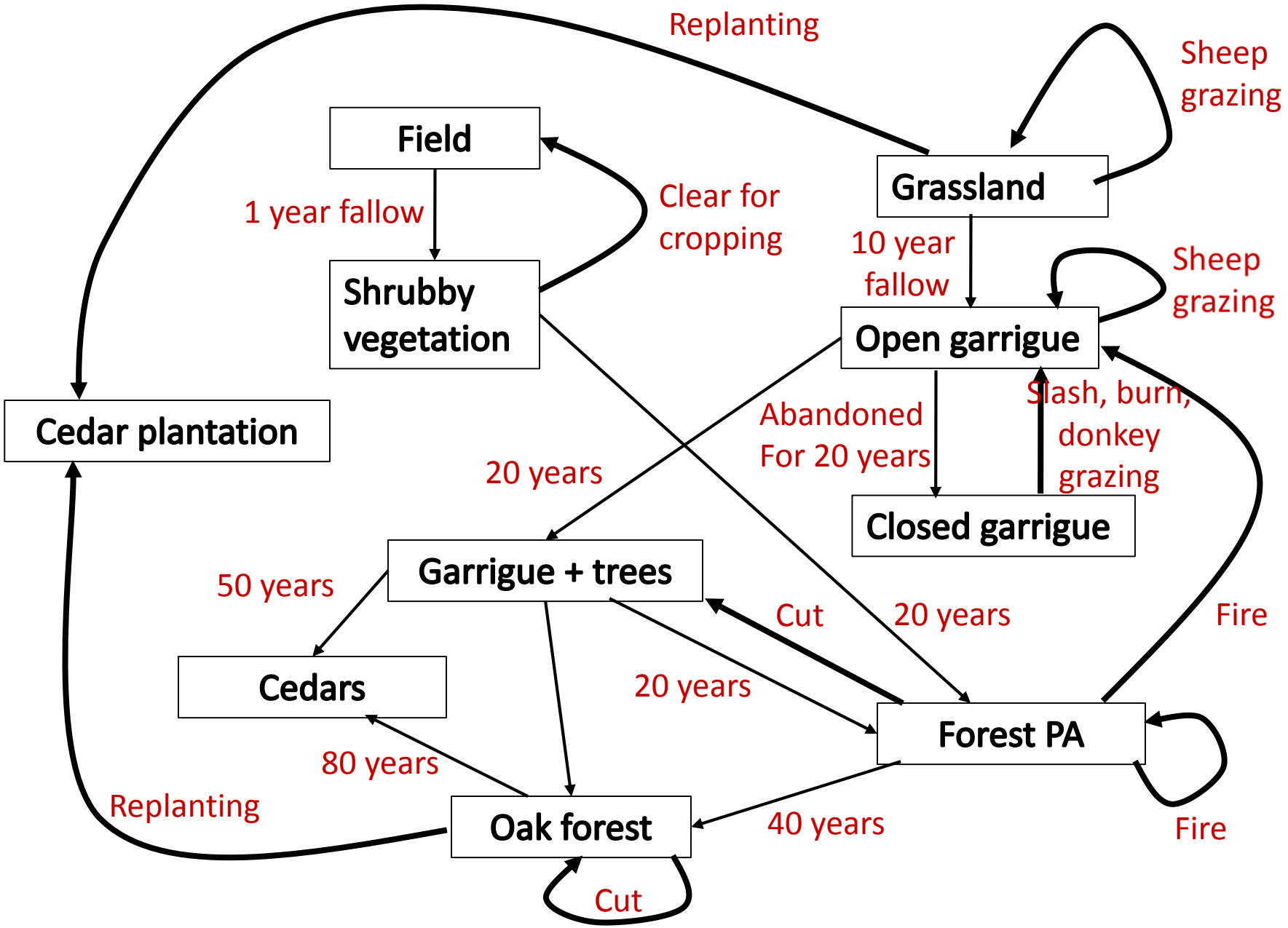
- **What are the <u>main processes creating change</u> in the sub-system & problem?**
  - Select among the key ecological, social, economic, policy, etc. ones
  - If too many, rank 10 most important + select top 5 & assign codes
- **When several ecological processes are at work: <u>Need for specific diagrams</u>? Such as:**
  - State transition (succession of states of the resource) diagram or
  - Flow (of individuals, goods, materials) diagram
- **Distinguish between <u>two main kinds of dynamics</u>:**
  - Human activity-based ones (effects of human actions & techniques)
  - Natural ones (based on the own evolution of the resource)

Examples of resource dynamics diagrams

1. Dynamics of reeds in Camargue wetlands (Mathevet et al.)

State transition diagram





2. Lubéron biosphere reserve: vegetation transition diagram (M.Etienne)

Recapitulation: Based on the three diagrams produced in previous steps

- **Any obvious gap(s)?**
  - Any activity or resource poorly documented (knowledge gap to be filled, if yes how?)? Specify
  - Any important stakeholder forgotten & to be added? Specify
- **Any disagreement among group members?**
  - Need for further information to settle the debate? What kind?
  - Proposed source of information (expert, field survey, etc.)?
- **Then move on to the final step: Construction of the interaction diagram**
  - A synthesis of the previous 3 steps…
  - Focusing on the linkages between resources & their users

Interactions: Final conceptual model on how the stakeholders perceive the sub-system to function

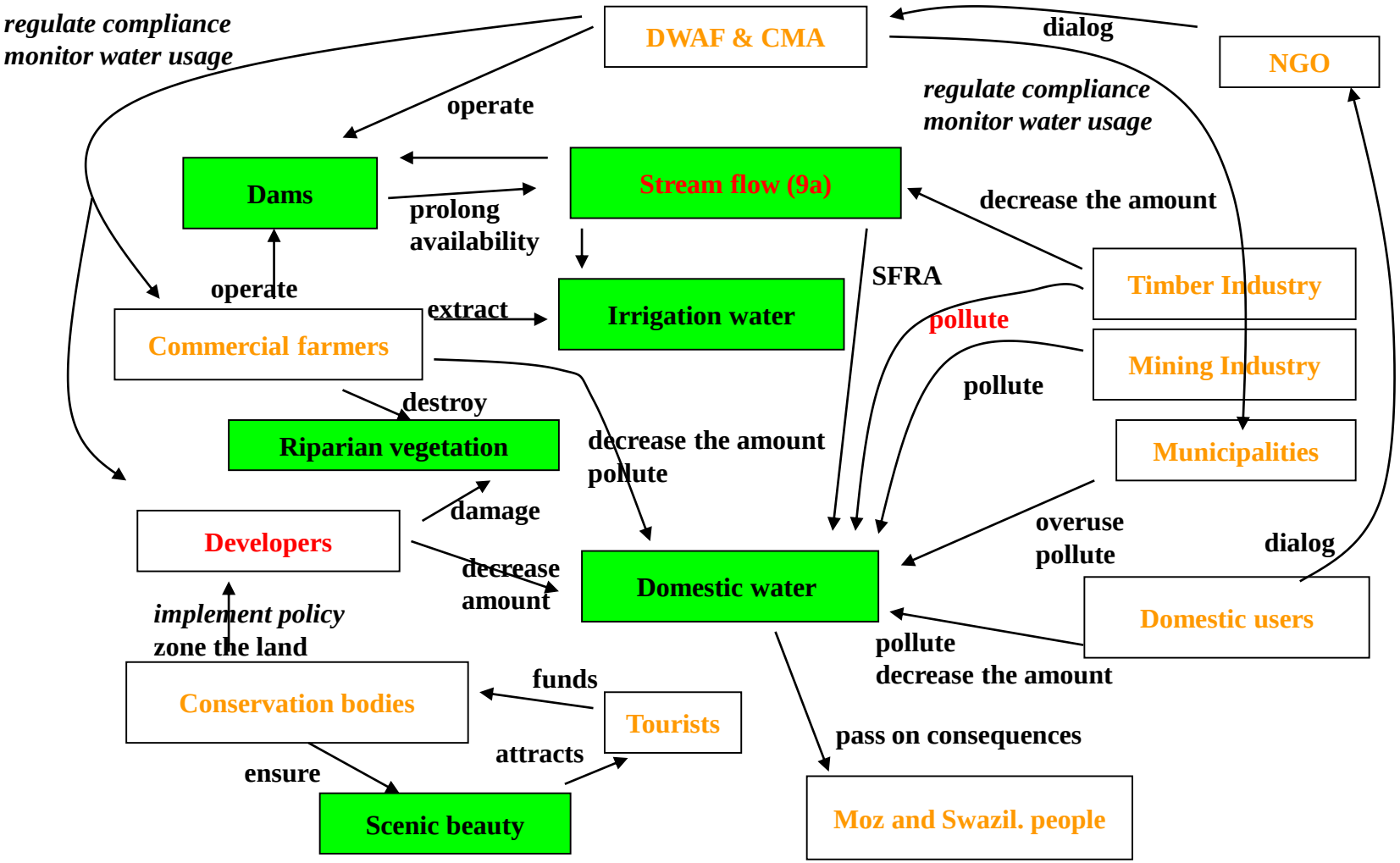
- **First, locate the key selected resources at the centre of the diagram**
  - Facilitator draws the list at the centre of the diagram
- **Show how each actor is using these resources**
  - Each participant draws an arrow between an actor & a given resource, or between two different actors & justify his/her suggestion (type of information used by actors?)
  - Each arrow/interaction is characterized by an action verb precising the corresponding action performed by the actor
- **Key role of group facilitator in this final step**
  - Product easy to read set of relevant, agreed upon & clear interactions
  - Be flexible to allow final corrections of gaps, precision of terms, etc.

Interactions: options for managing cases dealing with complex issues

- **1st option: produce an Interactions diagram per challenge**
  - Same method as above is used for each challenge

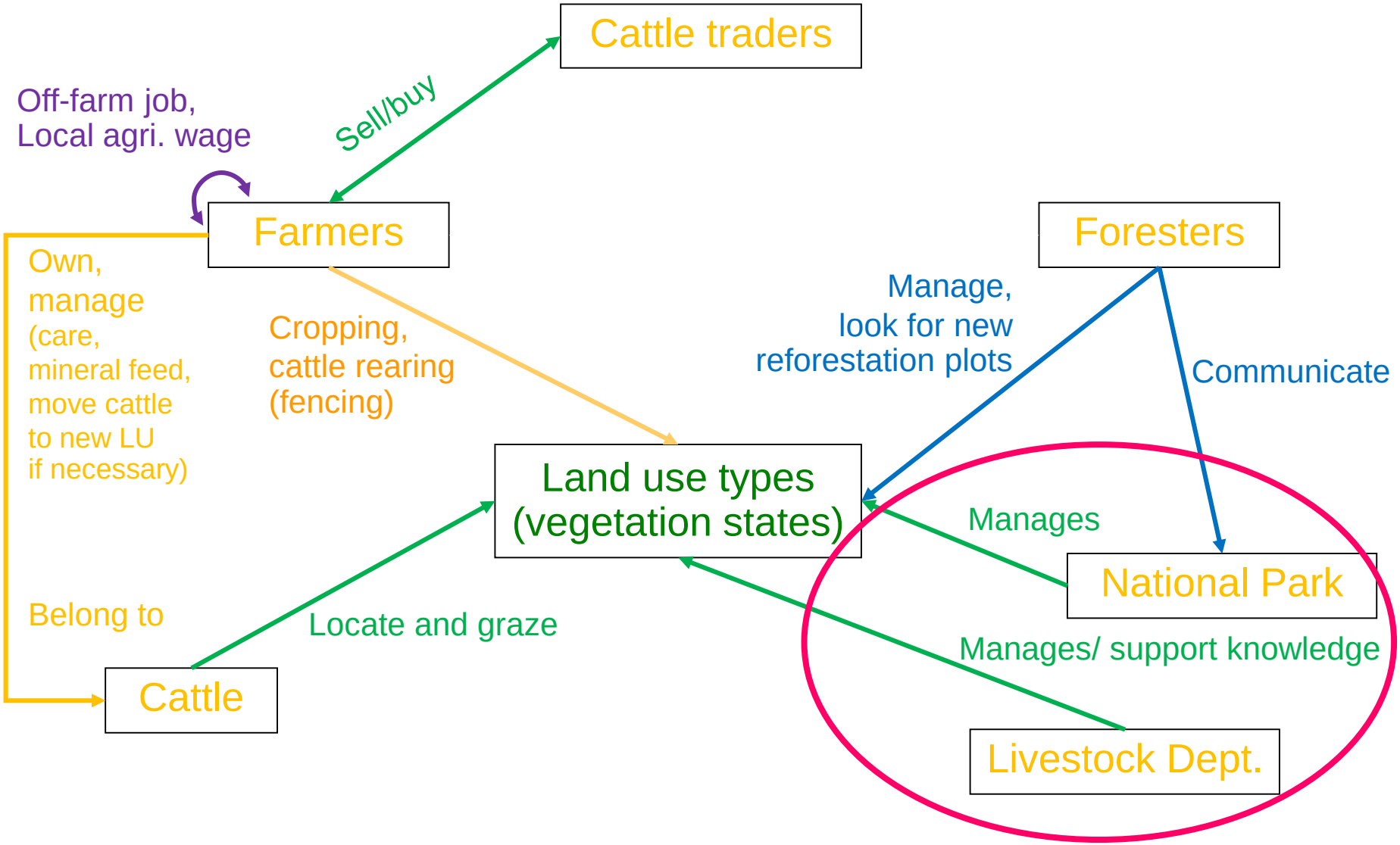
- **2nd option: if no clearly identified challenge, then group the resources by categories &**
  - Rank these categories according to their relative importance/problem
  - Participants select 3 or 4 most important resource categories
  - Produce interactions diagrams for each selected resource categories &
  - Add a step to merge these different sub-diagrams into a single one

Examples of PARDI Interactions diagram

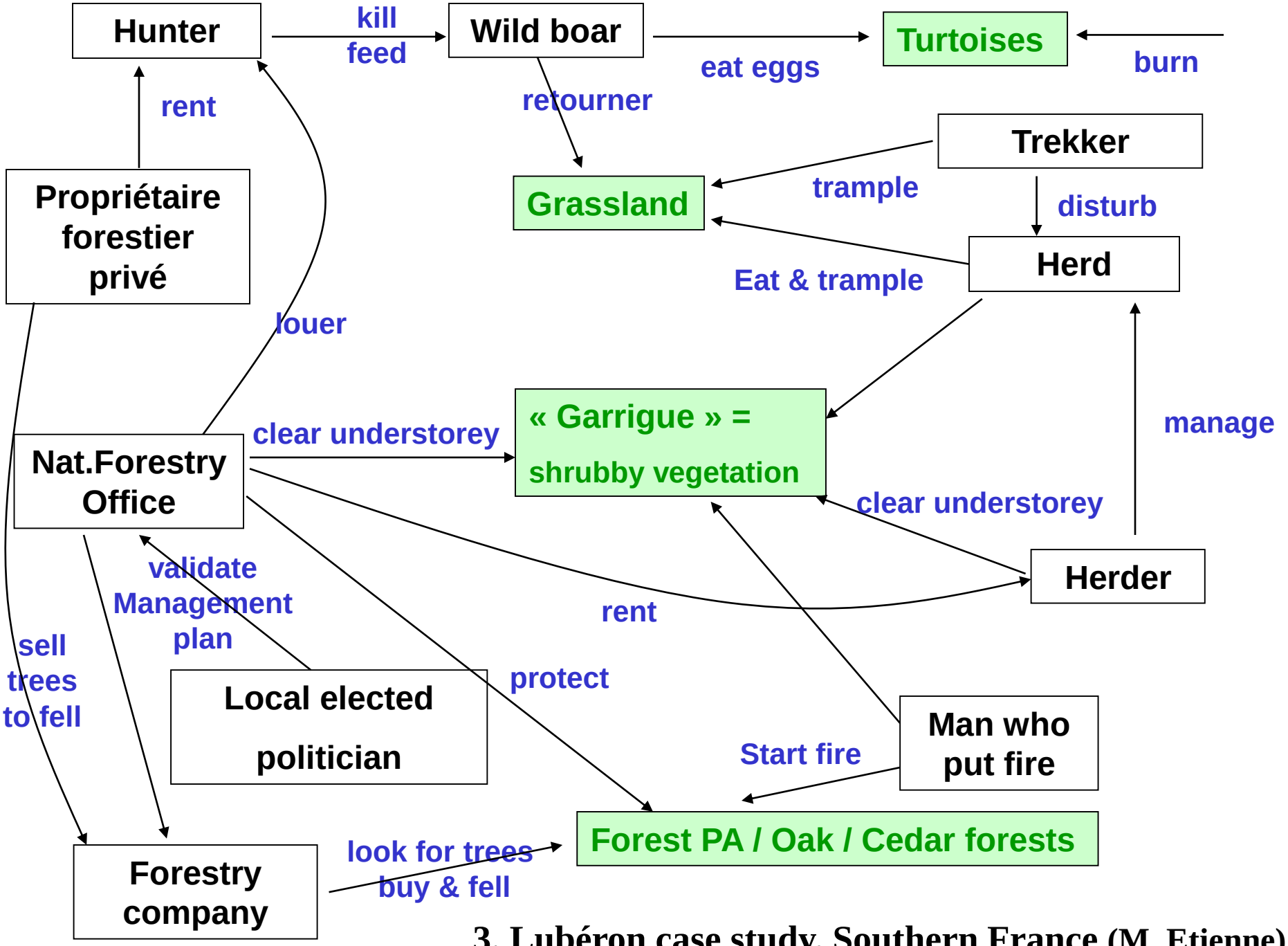


1. Water management, Crocodile River Case, South Africa

2. Doi Tiew, Nan Forest-Farmland interface case

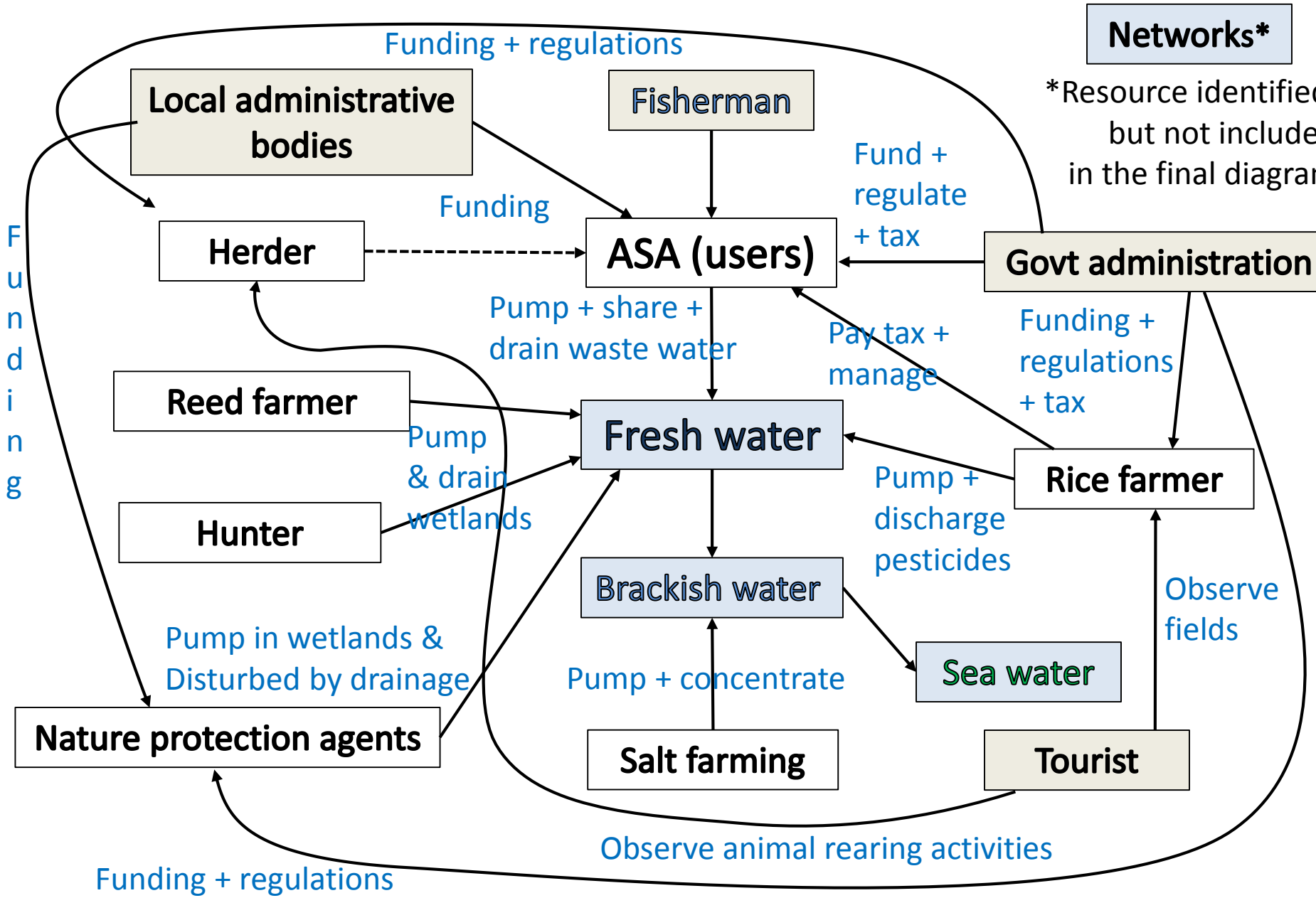


(Source: Dumrongrojwatthana P. , 2013)



3. Lubéron case study, Southern France (M. Etienne)

4. Camargue wetlands: Crops–Herds–Water user interactions

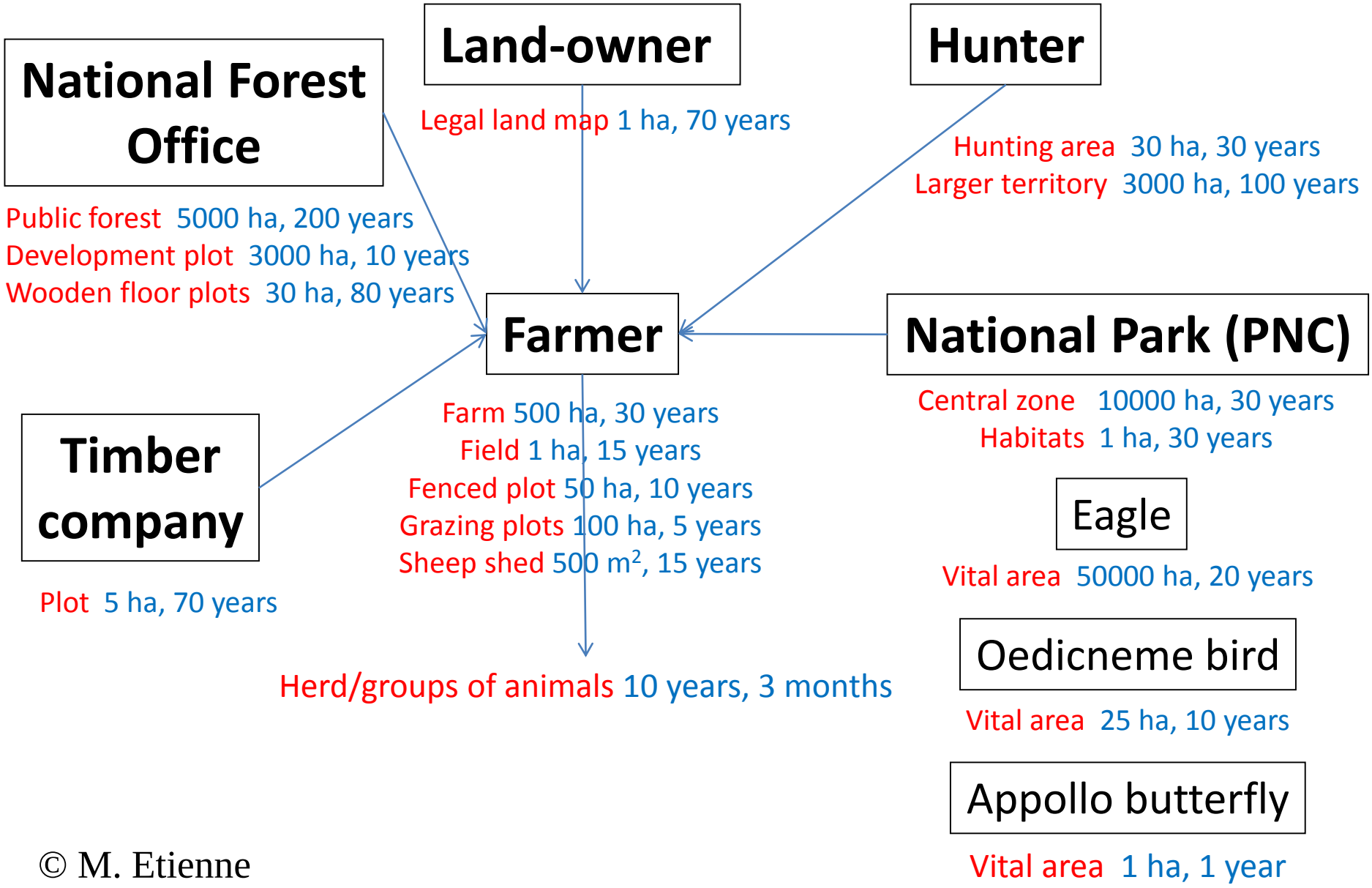


Selection of the spatial & time scales of the model

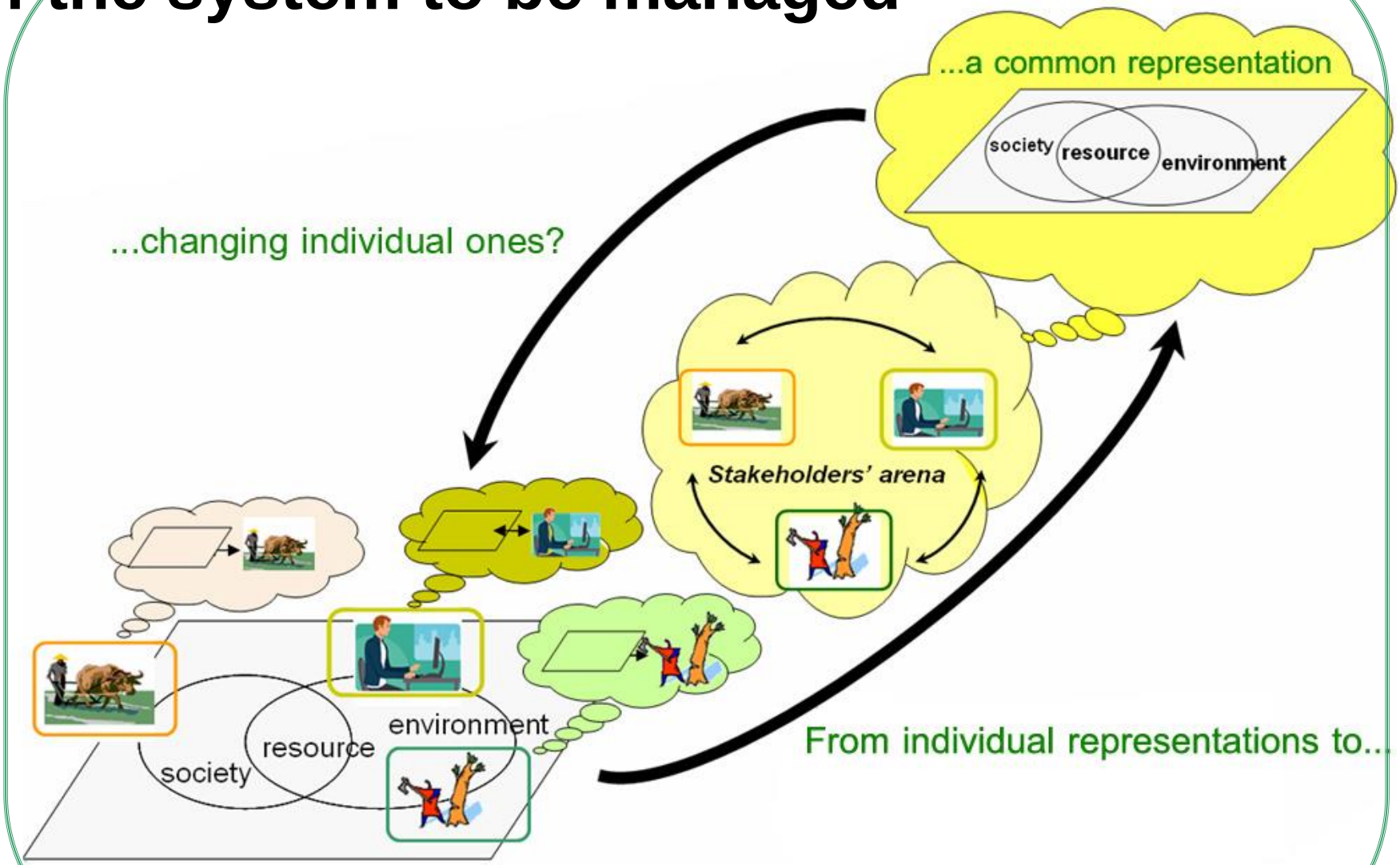
- **Criteria to be used when selecting scales:**
  - Must allow visualization of the main indicators selected by participants
  - Take into account the average size of management entities & precision level required regarding main processes
  - Based on available information & means to fill knowledge gaps
  - Compatibility with gaming & computer simulation constraints

- **A tip: save the successive versions of your 4 diagrams = milestones of the co-construction process**
  - To know later when/why any actor, resource, interaction, was selected, deleted or modified, etc.
  - Use a recorder, observer, interactive board, sets of digital photos, etc.
  - Refer to them later on in the ComMod process as needed.

Ex: Defining Time & Spatial scales in Causse Méjan



Towards a shared representation of the system to be managed



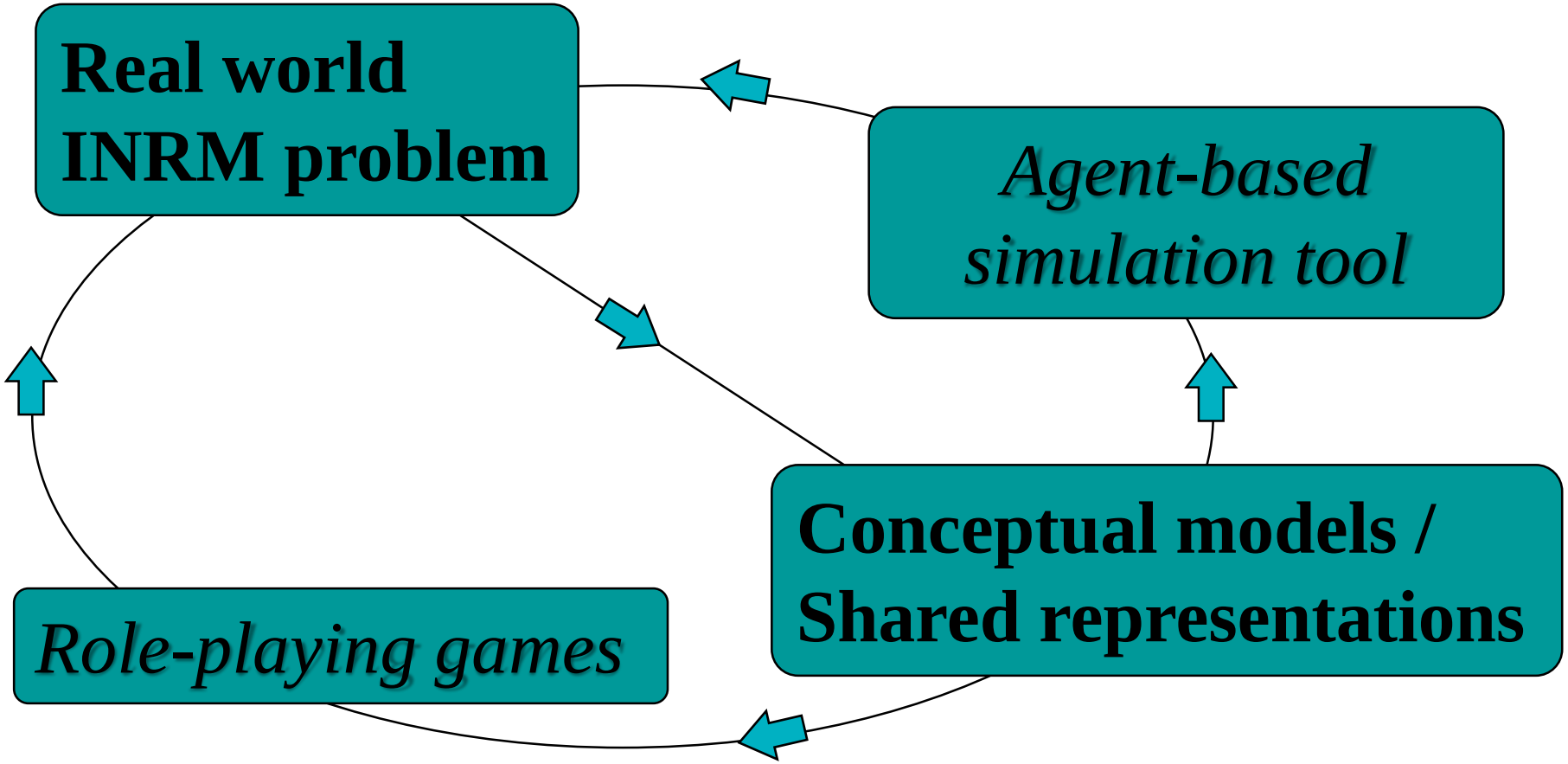
Use of PARDI outputs: taking the perspectives further

- **In a ComMod process**
  - Set-up a more complete arena of stakehodlers for field testing & improvement of the prototype conceptual model
  - Convert the conceptual model into a role-playing game (RPG) as a way to submit it to the stakeholders for enrichment / validation / rejection
  - Produce a set of formal UML diagrams from the PARDI ones as a step toward the implementation of a computer Agent-Based Model (ABM)

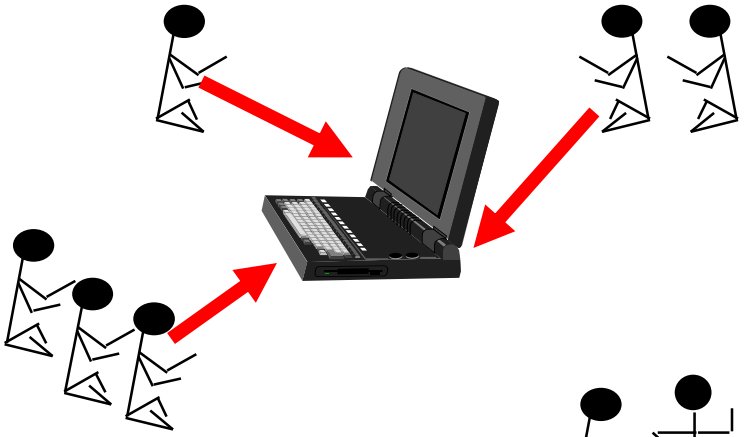
- **Use of PARDI experience/process to build a multi-stakeholder collaborative platform to**
  - Design, implement & assess a resource management plan
  - Negotiate rules, coordinating mechanisms & monitoring indicators
  - Agree on collaborative research priorities, etc.

Real world - Role-Playing Games (RPGs) & ABM in ComMod:

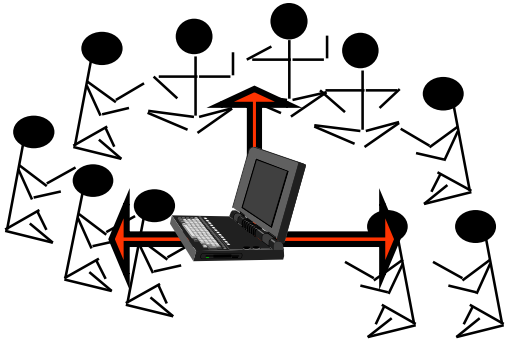
various kinds of associations



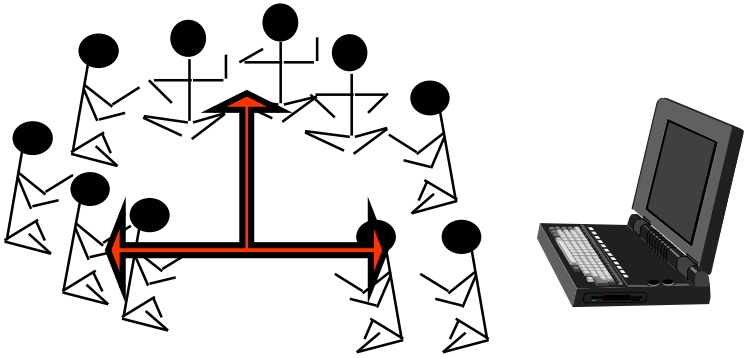
Co-construction & use of formal models with stakeholders in a ComMod sequence



1. Co-construction of a shared representation of the problem to be examined collectively



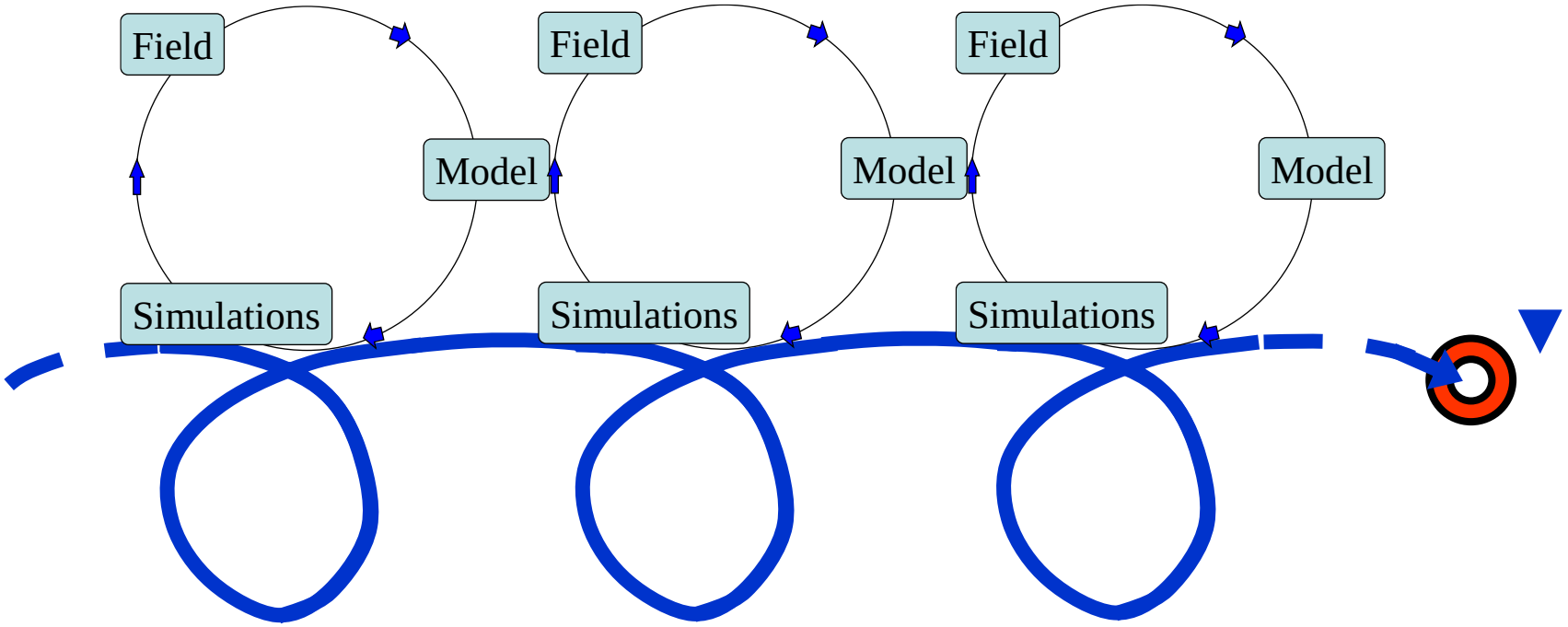
2. Collective visualisation of social & resource dynamics



3. Assessment & discussion of scenarios of change in context or stakeholders' practices

(Role-Playing Games and/or computer Agent-Based Models)

Dynamics of collective learning & decision-making processes about land / resource management in ComMod



Use of PARDI outputs: taking the perspectives further (2)

- **Comparison of the stakeholders' mental models on the problem/issue at stake**
  - Build the diagrams with each key stakeholder individually for knowledge elicitation (and recognition of different knowledge systems), then
  - Co-construct collectively a shared representation of the sub-system
  - Comparative analysis & emergence of co-management of the resource
- **Importance of process facilitation skills**
  - Ensure mutual respect, conviviality & psychological safety to promote collective empowerment of the participants, equity, trust, learning
  - Specific skills to anticipate unexpected stakeholder's reactions
  - Be sensitive & responsive to power relations among the participants
  - Pay attention to the process legitimacy & actors' representativeness
  - Because of complexity & uncertainty: recall process objectives regularly.

3 références pour aller plus loin:

- Etienne M., 2009. **Co-construction d'un modèle d'accompagnement selon la méthode ARDI : guide méthodologique**. Cardère éditeur, Laudun, 71 p.

- Etienne M., Du Toit D., Pollard, S., 2011. **ARDI: a co-construction method for participatory modeling in natural resources management**. Ecology and Society 16(1): 44. [online] URL: http://www.ecologyandsociety.org/vol16/iss1/art44/

- Mathevet R., Etienne M., Lynam T., Calvet C., 2011. **Water management in the Camargue Biosphere Reserve: insights from comparative mental models analysis**. Ecology and Society 16(1): 43. [online] URL: http://www.ecologyandsociety.org/vol16/iss1/art43/