# Playing with Cormas, a interactive ABM platform for managing natural resources collectively

## Game Play Session for ISAGA/JASAG2015 – 2 hours

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Cormas is an Agent-Based Modeling (ABM) platform dedicated to natural and common-pool resources management (Bousquet, Bakam, Proton, & Page, 1998). As a free and open-source software[1], it is used by an international community of researchers (Le Page, Becu, Bommel, & Bousquet, 2010) willing to understand the relationships between societies and their environment. Cormas is intended to facilitate the design of ABM and the monitoring and analysis of agent-based simulation scenarios. Indeed, the purpose of ABM is to understand how independent entities can interact, be coordinated and may co-evolve, while producing effects on the system as a whole. An agent can be described as an autonomous entity that has the capacity to adapt when its environment changes, and conversely his actions may modify the environment. A multi-agent system is made up of a set of entities that act at the same time, i.e. several agents that perform activities, share common resources and communicate with each other. Thus, Cormas is oriented towards the representation of interactions between stakeholders about the use of natural renewable resources.

From recent years, the development of Cormas has taken an innovative direction more oriented towards the collective design of models and interactive simulation. This new orientation has been taken to meet the increasing demand of our community of practice. Indeed, in parallel with the development of Cormas, a modeling methodology called the ComMod approach (for Companion-Modeling, Étienne, 2014) has been setup and formalized. If the classic use of simulation is for prediction, this is not the option we have chosen because the long-term economic and social future cannot be predicted, although it can be partially decidable. We assume that stakeholders can "decide" long-term objectives on the basis of a

[1] Cormas is freely available on http://cormas.cirad.fr or on the Public Repository of Cincom.

shared conception of how the present situation should evolve. It is thus possible to explore scenarios collectively to better understand if the desired situation may be reached. The underlying model for the simulations depends on the way the actors are represented. Two major types of representation can be distinguished: (i) human agents playing their role in a role-playing game (RPG), or (ii) virtual agents performing predefined activities in a computerized ABM. But between these two extremes, a range of intermediate situations exists where some decisions are human and others are computer-specified. The term hybrid agent simulation model covers all these intermediary situations (Le Page et al., 2014). The entire mediation approach presupposes that the stakeholders are well informed of the issues dividing them and of the fact that they all have an interest in solving the original problem.

For that purpose, we are developing Cormas towards two directions: 1) to facilitate the collective design and implementation of ABMs and 2) to enable the development of interactive simulations in order to let the users participating actively, alone or with others, in the execution of a scenario. As a generic framework, Cormas allows the user to specialize and refine pre-defined entities for his own model. But this new version is particularly suitable for:

- Changing the parameters of one or a set of agents,
- Manipulating an agent directly with the mouse on the computer: moving the agent-avatar on a precise location, sending him specific messages (predetermined behavior) or even designing new behaviors thanks to an activity diagram editor that is directly interpreted by the agent.
- Stepping back in time of a simulation and restarting the interactive simulation to a previous state (bifurcations), or replaying forward a previously stored simulation,
- Distributing a simulation on several machines, monitoring the evolution of a remote simulation and remotely manipulating the entities,
- Displaying particular points of view of the simulated landscape, opening several zooms and enabling specific “Habitus” for the available points of view.

Our intention is to involve more deeply the stakeholders into the modeling process. If adaptive management has become a buzzword, in practice people's participation is often just a catchy expression used by scientists to justify the process of extracting information. On the contrary, participatory modeling should encourage producing

models that are able to promote mutual recognition of perceptions, knowledge appropriation and collective decision-making.

For this it is necessary to have an easily changeable tool to act on the simulation and to modify the conceptual model on the fly. Our various field experiments have shown the need to create continuity between the conceptual model and its implementation. We hope this new version will achieve this goal…

*Keywords: Participatory modeling, Interactive simulation, Natural resources management, Stakeholders involvement, Agent-Based Model.*

For this Game Play Session, a distributed simulation will be used with participants. Each one will have a partial view on the landscape focused on his current location. He can then move his agent-avatar and send specific messages to him, or even design new behaviors. The purpose is to collectively resolve a challenge of an environmental stress (pollution or forest fire).

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