Paper submitted to the 2005 Berlin Conference on the Human Dimensions of Global Environmental Change, "International Organizations and Global Environmental Governance" (2-3 December 2005):

"ComMod Simulations, An Innovative Management Tool at International Organizations' Disposal"

By Camille Washington-Ottombre[1] and Jacques Weber[2]

Introduction

Worldwide, International Organizations (IO), highly structured by a common and basic scientific culture, have organized collective action and implemented renewable resource "governance without government" (Meyer et al., 1997; Young, 1999, Hironika, 2002). Institutions have been implemented; reforming or supplanting international, national, and local resource management norms and rules (Meyer et al., 1997, Parks, 2005). After having supported strict conservationist approaches, IO have promoted a diversity of "eco-market hybrids", from ecotourism to bioprospecting (Zerner, 2000). However in many cases, such costly policies have been counterproductive to the stated objective, resulting in deeper renewable resource degradation and scarcity, local population exclusion, the increase of local disputes, and the concentration of resources and power in the hands of few (Ostrom et al., 1993; Zerner, 2000). We argue that scientists and policy makers, including IO, must operate a paradigm shift, from normality to complexity in order to build sustainable regimes of renewable management (Table 1).

Indeed, numerous scholars have demonstrated the interest of the complexity paradigm and non-normal science in exploring non-linear systems such as socio-ecological systems. Socio-ecological systems are "complex adaptive systems where social and biophysical agents are interacting at multiple temporal and spatial scales" (Janssen and Ostrom, 2004). The complexity paradigm states that "the laws that describe the behavior of a complex system are qualitatively different from those that govern its units" (Vicsek, 2002). Biophysical and social entities are both characterized by their resilient and adaptive aspects and not by a "perfect" or optimum stable state (Janssen,

[1] PhD student, Laboratory of Human-Environment Modeling and Analysis (HEMA), Forestry and Natural Resources Department, Purdue University (IN, USA). Contact: cottombr@purdue.edu.
[2] Economist and Anthropologist at the CIRAD (France), Head of the French Biodiversity Institute (IFB) and Vice-President of the French committee for UNESCO's "Man and the Biosphere" programme. Contact: weber@cirad.fr.

2002bis). In the study of complex systems, the objective is not to find and reach an equilibrium or multiple stable states, but to describe emergent phenomenon and recurrent patterns (Janssen, 2002). Models are used to "capture the principal laws behind the exciting variety of new phenomena that become apparent when the many units of a complex system interact" (Vicsek, 2002).

Theoretical framework	Normal, Newtonian science	Non-normal science
World views	Linear social and ecological systems	Complex socio-ecological systems
Systems behavior	Stable at an equilibrium or optimum	Resilient and adaptive systems
Research objectives	Describe mechanisms to reach the optimum using mathematical tools.	Describe emergent phenomenon and recurrent patterns using integrated models
Recommendations towards policy makers	Recommendations on how to reach the optimum.	Analyze and advise complex socio-ecological systems taking into account all of its components.

Table1: A paradigm shift.

In a paradigm of complex systems and post-normal science, it is much more difficult for scientists to provide recommendations for policy makers. It is also much more difficult for IO to promote uniform management tools. However, analysis of socio-ecological systems facilitates the definition of norms and rules that guide individuals and affect the system as a whole. New integrated tools are needed to analyze and advise socio-ecological systems. The integration of complex science into renewable resource management should lead to the consideration of impermanent equilibrium and resilient institutions able to react to shocks and adapt themselves to new environments (Young, 2005). More energy and money should be put towards collecting information on local socio-ecological systems in order to understand the conditions on which cooperative and sustainable solutions are implemented (Ostrom et al., 1993; Janssen and Ostrom, 2004). Integrated models, "that describe the interaction among people, economies, and nature to explore possible outcomes" should be used to advise innovative policies (Janssen, 2002bis). The Companion Modeling approach (ComMod) uses integrated models built to analyze complex socio-ecological systems.

The purpose of this contribution is to present and catalyze the use of the ComMod approach as an alternative management tool for IO environmental projects. First, we will give an overview of the two components of ComMod simulations: Role-playing games and Agent-based models. Drawing on passed and present research, we will describe the advantages of the ComMod approach in a context of support for decision-making and planning processes. Finally, we will present a future application of the ComMod approach to Biosphere Reserves, as an example of an IO environmental institution.

Role-Playing Games and Agent-Based Models as Integrated Models to Simulate Socio-ecological Systems.

Role-Playing Games (RPG) and Agent-Based Models (ABM) can both be used as simulation tools. As Shaftel and Shaftel note, simulation is particularly useful in social sciences since human beings can rarely be subjected to experiments (Shaftel and Shaftel, 1967). Simulation means “driving a model of a system with suitable inputs and observing corresponding outputs” (Brately et al., 1987). Simulation can target various goals such as predicting outcomes, performing certain tasks, training, entertaining, educating, testing hypothesis, and discovering new relationships and principles, among others (Axelrod, 2003). Along with deduction and induction discovery, simulation is a third scientific method. Axelrod clearly states that simulation, like deduction “starts with a set of explicit assumptions. But unlike deduction, it does not prove theorems. Instead, a simulation generates data that can be analyzed inductively” (Axelrod, 2003). In the context of socio-ecological systems, simulation tools such as RPG and ABM allow researchers to feed integrated models with explicit and simple inputs; and to observe emergent properties or dynamics at various scales (Axelrod, 2003).

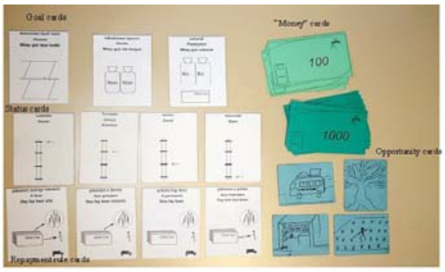
Used as a simulation tool in social sciences, a RPG can be defined as the performance of an imaginary or realistic situation played by people with given roles in order to analyze behavioral patterns (Barreteau, 2003). During a game session, players with specific roles play their play turn on a game set (e.g. platform, stage) (Figure 1). RPG have primarily been used as educational and training tools but are beginning to be employed for scientific purposes as support for collective decision-making and negotiation processes (Barreteau, 2003). RPG have proved themselves pertinent in a variety of situations that generally involve a conflict of interests, a number of alternatives opened at each phase of the game, and a decision-making process with a possible estimation of the consequences of players’ choices (Shaftel and Shaftel, 1967). The fact that they allow a close representation of the reality but one also distanced from conflicting situations make them particularly useful in negotiation processes. Depending on the design of the game, players can play the role that they have in the “real life”; they can exchange roles and perceive the reality of other stakeholders; and they can also demonstrate innovative behaviors and break game rules. In the ComMod approach, RPG are used as a support for collective decision-making processes and as learning tools for participants and researchers as well (Barreteau, 2003). Indeed, RPG allow researchers to have a simplistic but realistic overview of the institutions that govern renewable resource uses and to explore plausible scientific outcomes. The major difference between RPG and other games simulations, like game theory, is that contrary to a mathematical model, RPG do not intend to reach an equilibrium, the purpose of the game is qualitative and not quantitative (Shaftel and Shaftel, 1967). In the ComMod approach, they are used mainly as qualitative input information for the ABM design. RPG are useful tools but they are cumbersome and costly. During a game workshop, each player’s moves are recorded by a professional observer. The debriefing after each games session provides valuable information; but it is also very time and money intensive.

D’Aquino et al.2003

1. A game set

D’Aquino et al., 2003

2. Roles



Dare and Barreteau, 2003

3. Rules

Dare and Barreteau, 2003

4. A play turn during a game

Figure 1: Elements of a Role playing game (D’Aquino et al., 2003; Daré and Barreteau, 2003)

Agent-Based Models (ABM) can also be used as a simulation tools. An ABM “is a type of simulation characterized by the existence of many agents who interact with each other with little or no central direction” (Axelrod, 2003). By nature, ABMs constitute a bottom-up approach to understanding individual behaviors with the model (Alexandridis et al., 2004). ABMs have been used by numerous researchers for land use models. An ABM is formed by a cellular automaton and agents. A cellular automaton is a d-dimensional grid which forms cells onto which agents are positioned (Janssen, 2002). The cellular automata is governed by certain rules: time advances in discrete steps; the number of states of a cell is finite; cells change according to local rules, both in time and space; the transition rules are usually deterministic; the system is homogeneous because the same transition rules apply to all cells; and transition rules can be synchron or asynchron (Janssen, 2002). In the context of land use models, Geographical Information Systems (GIS) can be coupled with the cellular automata in order to supply a more realistic representation of the landscape and its dynamics. Agents have abilities inspired from artificial intelligence, making them autonomous adaptive agents (Janssen, 2002).

Indeed, as Alexandridis et al. remark, agents can "interact, communicate, evolve, learn and make complex decisions within a real time simulation framework" (Alexandridis et al., 2004). Agents can be human or non-human, passive or active. ABMs are particularly appropriate to simulate complex socio-ecological systems because they can represent in detail the biophysical architecture of the system as well as the socio-ecological institutions (Janssen, 2002). The Unified Modeling Language (UML) is often used to build the architecture of the ABM and to render it visible and accessible to other scientists (Figure 2). UML diagrams offer a possibility to discuss the framework of the model. However, ABM can easily become a "black box" when the complexity of the model itself makes it hard to understand. The complexity of ABM has led scientists to ask how to test their validation.

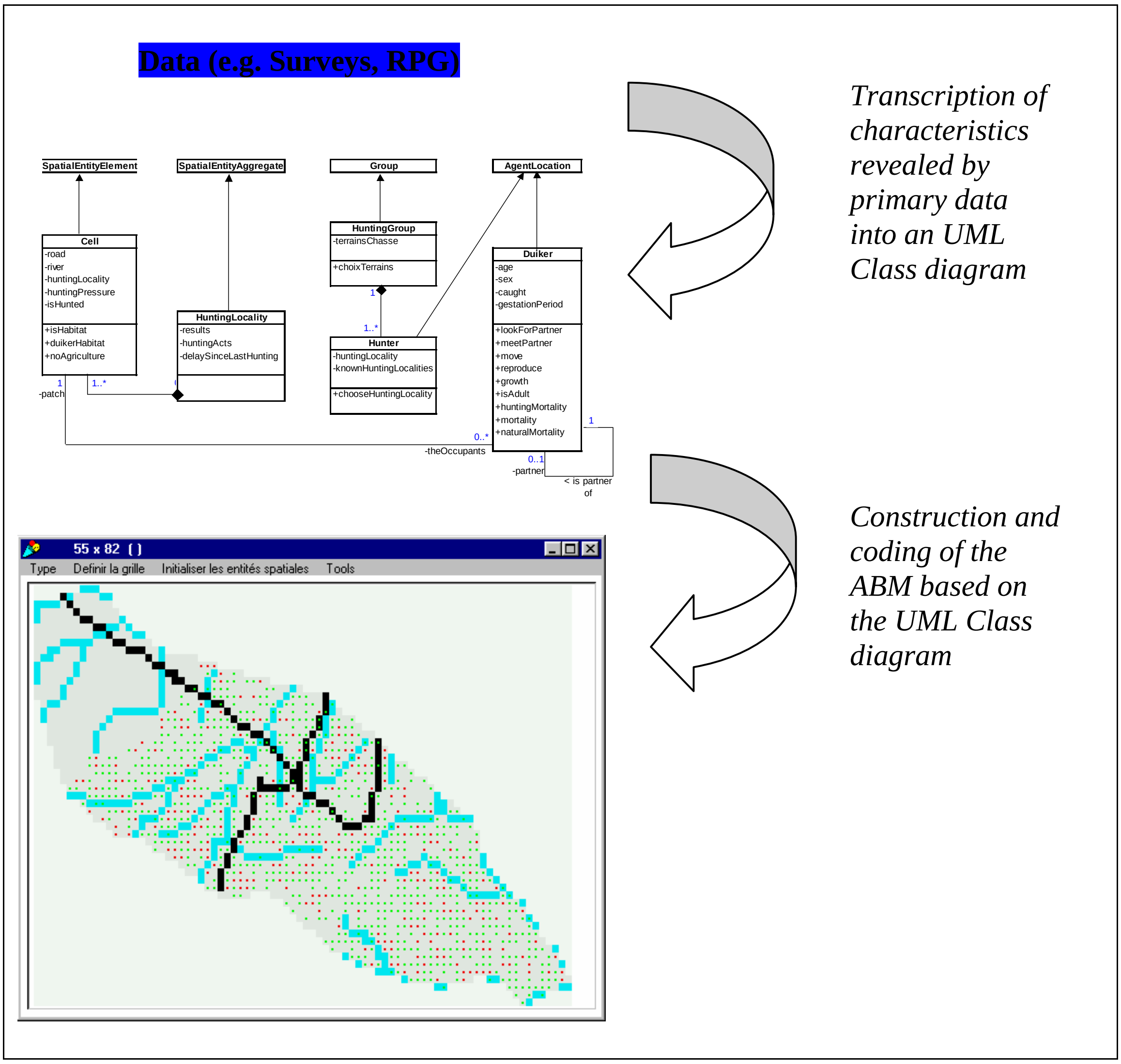


Figure 2: Partial example of construction of an ABM using UML diagrams(UML diagram and ABM, Bousquet et al., 2001)

The ComMod Approach in the Context of Support for Collective Decision-making and Planning Processes.

The ComMod approach "uses a combination of field surveys, role-playing and simple computers models that simulate different members of a community and their interactions when exploiting a common environment" (Bousquet et al., 2005). Researchers using the ComMod approach define their activity as "science-action" and have composed a charter, constituting a binding ethical and scientific framework for future research and decision-making support (Collectif Commod, 2004). The Version 1.1 of the Charter of the Companion Modeling Approach stresses the importance of an iterative research process of three steps: understanding through field studies and literature reviews; analyzing information with an Agent-based model; and juxtaposing the model with the local perceived reality in order to question the social validation of the model through role-paying games and/or simple-designed models (Barreteau, O. 2003). The Charter's signatories have committed themselves to explicating all hypotheses backing the models; questioning the results and validation of the models; and integrating into their "research-action" the impact of the initiated processes (Collectif Commod, 2004). The objectives of the ComMod approach are the production of a working knowledge of complex systems and the support of collective decision-making processes (Collectif Commod, 2004). This methodology, based on the exchange between actors, does not aim to produce ready-made natural resource management plans. It focuses on participating in the long process of creating a common knowledge and shared representations. ComMod does not seek to cover the entire mediation process but to participate in it, based on the assumption that "the question is not the quality of the choice but the quality of the process leading to it" (Collectif Commod, 2004). The Charter's signatories affirm that, through the whole decision-making process, both technical and scientific viewpoints and recommendations constitute one legitimate perception among equal others (Collectif Commod, 2004). In doing so, according to the authors, the ComMod approach could lead to an improvement in stakeholders' knowledge of the socio-ecological system; enhanced dialogue between local and scientific communities; and increased negotiation support (Collectif Commod., 2004).

So far, the ComMod approach has been introduced in multiple cases, primarily in Asia and Africa. Every case study evolved in a different context and with various objectives; but all have followed the research processes described in the Charter of the Companion Modeling Approach. The ComMod approach has been applied to very conflicting situations concerning renewable resource management. We are presenting here a brief overview of some of the ComMod simulations. The first simulations were conducted on the Senegal River Valley to investigate irrigation systems management and conflicting uses of water between farmers and cattle breeders (Barreteau et al., 2001; D'Aquino et al., 2003). An interesting project has been undertaken in France, in the context of a protected area. Etienne et al. have conducted a ComMod simulation on the negotiation of long-term planning between livestock farmers, National Park rangers and foresters confronted with massive pine encroachment on the park territory (Etienne et al., 2003). Several simulations have also been conducted in Asia. In Northern Vietnam, Castella et al. have studies large-scale deforestation patterns in a context of decentralization, institutional failure and ethnic conflicts (Castella et al., 2005). In Bhutan, Bousquet et al. have worked on conflicting uses of water between two villages for high altitude terraced rice crops irrigations (Bousquet et al., 2005). Even if every case study differs and a "handcrafted" simulation has been employed for each situation, similar outcomes have been observed on the fields (Barreteau, 2003). These ComMod simulations resulted in one or many of the following outcomes: point of view legitimatization, collective learning about complex systems, improved values and perception sharing, elaboration of collective scenarios, agreement on a collective objective, definition of new access rules to the resource, implementation of innovative resource management rules, and the creation and implementation of new institutions (Barreteau et al., 2001; D'Aquino et al., 2003; Etienne et al., 2003; Castella et al., 2005; Bousquet et al., 2005).

These results can largely be attributed to the methods used for the simulations (Barreteau, 2003). Indeed, these simulations have demonstrated the utility of coupling RPG with ABM in an iterative process (Figure 3). In most cases, after an extensive research operated from surveys and literature review a first ABM is designed. Then a workshop with the participants of the simulation is held to validate or invalidate the theoretical model and design all elements of the RPG: game set, roles and rules. The landscape on which the game is set often derives from local users' knowledge and perceptions (D'Aquino et al., 2003). Players can attribute different values to the land according to different uses and represent various legitimate point of views (D'Aquino et al., 2003; Etienne et al., 2003). Observations on players' behaviors are collected during the game; individual and collective interviews are carried out after the game to understand players' strategies. Then, thanks to information collected during the RPG, an ABM is designed. Researchers and modelers use CORMAS (Common-pool Resources and Multi-Agent Systems), a platform developed and improved through successive simulations, in order to code the ABMs more quickly and keep the simulation's participants in an interrupted dynamic (Bousquet et al., 2005). At this step, a GIS can be incorporated into the model in order to include more accurate landscape attributes. A new workshop is then organized where the ABM is used to test various scenarios. After the workshops, a collective debriefing is organized during which participants can explore the possible outcomes of the simulations. As ComMod is an iterative approach, this process can be repeated until the RPG and the ABM is validated by the participants.

The joint-use of RPG and ABM allows for the combination of the advantages of the two tools and the compensation for their disadvantages. RPGs are often perceived as games by players, which create a distance from the reality and avoid conflicting interactions (Barreteau, 2003). Rules and roles designed by the participants are often close to the perceived social reality and personal history of the players (Barreteau, 2003). RPGs can therefore be used to simulate scenarios and generate discussions among stakeholders. However, RPGs' simulations are long, costly and tedious to test various scenarios (Barreteau, 2003). It is also difficult to integrate further knowledge and information to a RPG in an iterative process. On the contrary, ABMs can easily represent complex systems, quickly test various scenarios and help to observe emergent phenomenon (Barreteau, 2003). ABMs can display numerous interfaces representing the points of view of various human or non-human agents, active or inactive (Etienne et al., 2003). Pragmatic processes such as decision-making processes or biophysical changes can be dissected and analyzed thanks to the ABM (Bousquet et al., 2005). But, ABMs may be perceived as a mysterious “black box” by players who are often illiterate and unfamiliar with computer devices (Barreteau, 2003). Using a similar interface during the RPG session allows players to familiarize themselves with the ABM mechanisms. Simulations led by the ComMod approach suggest that both tools are highly complementary and have a positive impact on natural resource decision-making and planning processes.

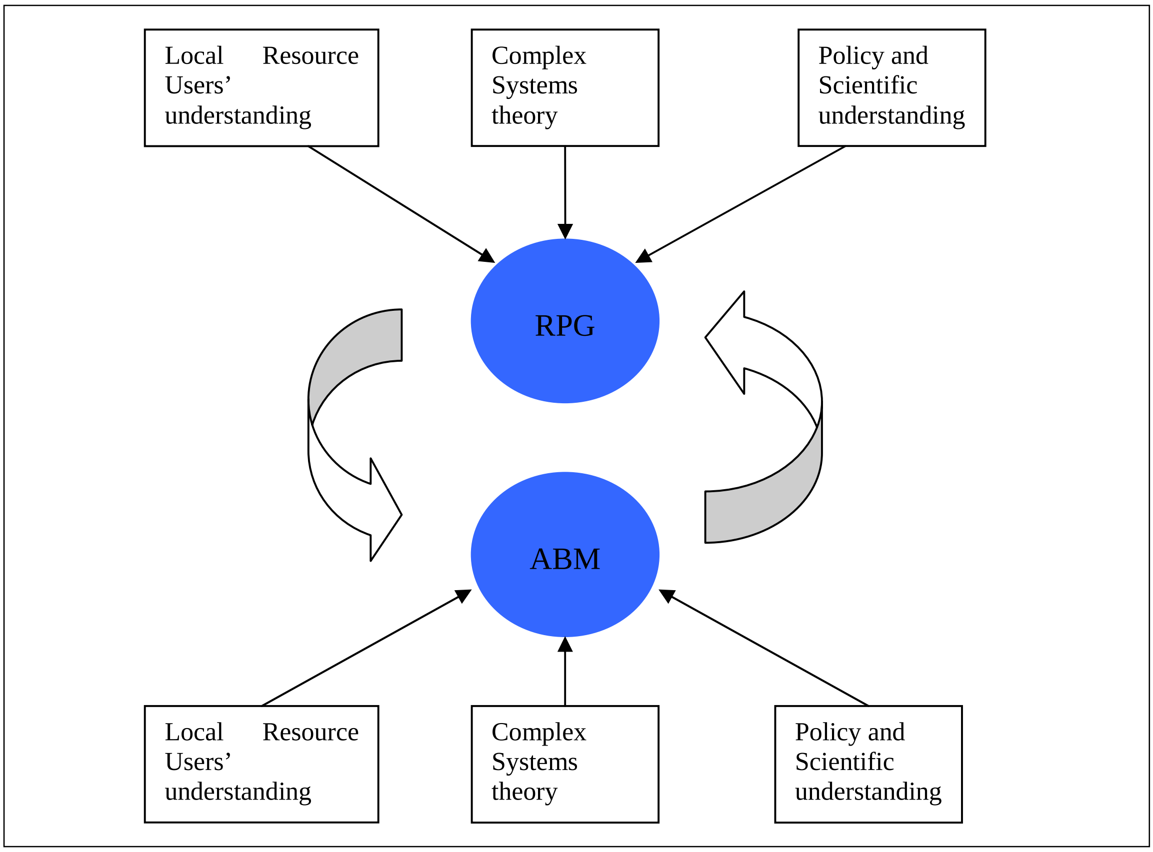


Figure 3: The ComMod approach: the iterative joint use of RPG and ABM designed from local resource users understanding, policy and scientific understanding and complex systems theory implications.

Application to International Organizations' Natural Resources Management Projects: Applying ComMod to the Biosphere Reserves

The Convention on Biological Diversity (Rio, 1992) that occupies an important position in the international environmental regime has emphasized the importance of indigenous knowledge of natural resource management (art. 8) and of sharing the benefits of biodiversity's exploitation (art. 16). However, the application of these two articles is being questioned. As Le Prestre notices, constraints put on international and local actors to develop fair and equitable sharing of the benefits are minimal (Le Prestre, 2002). The measures implemented prevent the worst abuses of “bio-imperialism”, but nothing has been done to secure a procedure that would assure equitable results (Le Prestre, 2002). Seemingly, little has been done to integrate the role of indigenous populations promoted by the CBD and to take into account local institutions in decision-making processes concerning biodiversity management (Le Prestre, 2002). In fact, cross-scale pathologies constitute a major source of environmental degradation, and excluding local institutions from decision-making processes can have major consequences on social-ecological systems. Since IO are often major actors in developing countries, it is their responsibility to participate in the creation of resilient institutions to govern local socio-ecological systems. These institutions should embrace the socio-ecological system as a whole; include local populations in decision-making processes; and consider scientific paradigms and international actors as one legitimate view point among others. We argue that the ComMod approach could offer an effective tool for addressing these challenges.

Several characteristics of Biosphere Reserves make them an ideal field of experimentation of the ComMod Approach applied to IO environmental projects. Biosphere Reserves rest on the core assumption that biodiversity can not be maintained only through protected areas (Batisse, 1997). Indeed, Batisse points out numerous limits of protected areas: they can be implemented only in low populated areas and therefore do not cover all ecosystems; they do not prevent deforestation outside the park boundaries; they are often top-down initiatives characterized by managerial rigidity which can lead to the hostility of local populations and park boundaries encroachment (Batisse, 1997). Therefore, Biosphere Reserves have been implemented since 1976 by the Man and the Biosphere Program (MAB) of the UNESCO. Biosphere reserves intend to combine conservation, sustainable development, and research on a zoned landscape. Each Biosphere Reserve is composed of three distinct territorial components with no distinction of property type: (1) core area(s) devoted to long term conservation from which all human activities are banished; (2) buffer zone(s) where only activities compatible with conservation can take place such as research, education, non-destructive recreation, tourism and sustainable resource use; (3) flexible outer transition area(s) dedicated to sustainable activities in cooperation with local population (Batisse, 1997). We argue that ComMod simulations could be effectively used when periodically discussing the zoning pattern of the Biosphere Reserve.

ComMod simulations would include all institutions and stakeholders of the social-ecological system. On the IO side, the manager of the reserve should be present but also UNESCO representatives and scientists who work in the reserve. During the simulation, they would represent the scientific point of view and conceptions of biodiversity management but also IO’s specific representations and interests. The presence of these particular stakeholders would render visible the conceptions and actions of IO representatives or affiliated stakeholders and allow an evaluation of their local impact (Zerner, 2000). In a context of extensive decentralization processes in developing countries, not only national but also regional and local officials should take part in the simulations to express their points of view. Of course, local resource users should also participate in the simulations and have a voice as legitimate as that of other participants.

This design is very similar to classic incentives of collaborative management with the exception of two points. First, this collaborative process would focus on a socio-ecological system as a whole since RPG and ABM, for the most part, offer the possibility of representing complex biophysical dynamics. Second, ComMod simulation would formalize and institutionalize a negotiation process between the IO and other stakeholders in which IO would be considered as one legitimate stakeholder among others. ComMod simulation would help to analyze very complex systems in which IO take part. In particular, it will reveal “the internal decision rule [of each resource stakeholder]; [highlight] the importance of communication; facilitate collaborative efforts […] and address the problems of scale explicitly” (Janssen and Ostrom, 2004). Globally, ComMod simulation could help to analyze the role of IO on local socio-ecological systems. Locally, it is anticipated that the ComMod approach could result in a more widely accepted planning, the limiting of reserve boundary encroachment, and the favoring of concerted sustainable activities around it. The ComMod approach would innovate by encouraging a collaborative management process based on models able to handle the complexity of socio-ecological systems.

Conclusion and Summary

In a context of complex systems and non-normal science, integrated models should be used to observe patterns and emergent phenomenon. The ComMod simulations based on the joint use of Role-Playing Games and Agent Based Models have been proven to be efficient support tools for collective-decision making processes. As a major actor in natural resource management, International Organizations should initiate a paradigm shift and employ integrated models to analyze and advise complex social-ecological systems.

We propose to experiment using ComMod simulations on Biosphere Reserves which offer an adequate framework. In order to reduce the costs of these simulations and to encourage their use by IO, a solid replicable methodology should be designed. But, the main obstacle could be to convince IO representatives to participate in this collaborative management tool based on the equal legitimacy of all stakeholders. The ComMod approach nonetheless offers an innovative way to include indigenous populations in decision-making processes regarding complex socio-ecological systems. This approach could contribute to the wider distribution of equity in the international environmental regime.

References

Alexandridis, K. T.; Pijanowski, B. C. ; and Lei, Z. : 2004, "A Multi-Agent-based Behavioral Economic Landscape (MABEL) Model of Land Use Change", *Journal of Environmental and Resources Economics*

Antona; M., d'Aquino' P., Aubert, S.; Barreteau, O.; Boisseau, S.; Bousquet, F.; Dare, W.; Etienne, M. ; Le Page, C. ; Mathevet, R. ; Trébuil, G. ; and Weber, J. (Collecitif Commod): 2004, "Companion Modeling Approach, Version 1.1" (April 5th, 2004), http://cormas.cirad.fr/pdf/ComModCharter2004.pdf

Axelrod, R.: 2003, "Advancing the Art of Simulation in the Social Sciences", *Japanese Journal for Management Information System*, Special Issue on Agent-Based Modeling, Vol. 12, No. 3, Dec 2003, 19p.

Barreteau, O.: 2003, "The joint use of role-playing games and models regarding negotiation processes: characterization of associations", *Journal of Artificial Societies and Social Simulations*, Vol. 6, No. 2, 21p.

Barreteau, O., Bousquet, F., et Attonaty, J.M. 2001. "Role-playing games for opening the black box of multi-agent systems: method and lessons of its application to Senegal River Valley irrigated systems". *Journal of Artificial Societies and Social Simulation* 4(2).

Batisse, M.: 1997, Biosphere reserves: "A challenge for biodiversity conservation & regional development", *Environment*, June 1997, pp 6-20.

Bousquet, F., Le Page, C., Bakam, I. et Takforyan, A. 2001. «A spatially explicit individual-based model of blue duikers population dynamics: multi-agent simulation of bushmeat hunting in an eastern cameroonian village. *Ecological Modelling*, 138(1-3): 331-346

Bousquet, F.; Raj Gurung T.; and Trébuil, G.: 2005, "The Game of Life", *Rice Today*, April 2005, pp 25-27.

Bousquet, F.; Barnaud, C.; Trébuil, G; Bécu, N. and Torii, D.: 2005, "On-going test of methods to conceive multi-agent simulations form field observations and the proposal of companion modeling", Contribution to the Workshop on Empirical techniques of Agent-based Modeling, IU Bloomington, June 2-5 2005, 19p.

Castella, J-C.; Tran, N.T.; and Boisseau, S.: 2005, "Participatory Simulation of Land-Use Changes in the North Mountains of Vietnam: the Combined Use of an Agent-Based Model, a Role-Playing Game, and a Geographic Information System", *Ecology and Society*, 10(1), art 27, 15 p..

Daré, W. and Barreteau, O.: 2003; "A role-playing game in irrigated system negotiation: between play and reality", *Journal of Artificial Societies and Social Simulation*, Vol. 6, No. 3, 21 pp.

Etienne, E.; Le Page, C. and Cohen, M.: 2003, "A Step-by-step Approach to Building Land Management Scenarios Based on Multiple Viewpoints on Multi-agent System Simulations", *Journal of Artificial Societies and Social Simulations*, Vol. 6, No. 2.

Funtowicz, S.; and Ravetz, J.R.: 1994, "The Worth of a songbird: ecological economics as a post-normal science", *Ecological Economics*, 10, pp 197-207.

Gibson, C.; Ostrom, E.; and Ahn, T.K.: 2000, "The Concept of scale and the human

dimensions of global change: a survey", *Ecological Economics* 32 (2000), pp 217-239.
Hironika, A.: 2002, "The globalization of environmental Protection: The case of Environmental Impact Assessment:, *IJCS* 43 (1):65-78
Janssen, M. Ed.: 2002, *Complexity and Ecosystem Management, The Theory and Practice of Multi-Agent Systems*, Edward Elgar, 342p.
Janssen, M. and Ostrom, E.:2004, "Governing Social-Ecological Systems", In *Handbook of Computational Economics II, Agent-Based Computational economics,* Ed. by L. Tesfatsion and K.L. Judd, Elsevier Publisher.
Janssen, M.: 2002bis, "A Future of Surprises", in Gunderson, L.H. and Holling, C.S. Ed.: 2002; *Panarchy, Understanding Transformations in Human and Natural Systems*, Island Press, 507p.
Le Prestre, P. G., Ed: 2002; *Governing Global Biodiversity, The evolution and implementation of the Convention on Biological Diversity*, Ashgate Publishing Company, 428p.
Meyer, J.; Frank, D.J.; Hironaka, A.; Schofer, E.; and Tuma, N.B.: 1997, "The structuring of a World Environmental Regime, 1870-1990", *International Organization*, Vol. 51, No 4 (Autumn, 1997), pp 626-651.
Ostrom, E.; Schroeder, L.; and Wynne, S.: 1993, "Analyzing the performance of alternative institutional arrangements for sustaining rural infrastructure in developing countries", *Journal of Public Administration Research and Theory: J-PART*, Vol. 3, No. 1 (Jan. 1993), 99 11-45.
Park, S.: 2005, "It ain't easy becoming green: the world bank group, norm diffusion and transnational environmental advocacy networks", Draft paper for the Research Bank on the World Bank, Central European University, Budapest, April 1-2 2005.
Shaftel, F.R.; and Shaftel, G.:1967, *Role-playing for social values: decision-making in the social studies*, Prentice-Hall, NJ, 431p
Vicsek, T.: 2002, "The bigger picture", *Nature*, Vol. 418, 11 July 2002, p 131.
Young, O.: 1999, *Governance in World Affairs*, Ithaca and London, Cornell University Press, 224p.
Young, O.:2005, Institutional Dynamics: Resilience and Vulnerability on Environmental and Resource Regimes
Zerner, C. Ed. : 2000; *People, Plants and Justice: The Politics of Nature Conservation*, Columbia University Press, New York, Chichester, West Sussex, 449p.