Effects of Companion Modeling on Water Management: Comparative analysis across five sites in Bhutan and Thailand

T.R. Gurung[1], P. Promburom[2], W. Naivinit[3], M. Thongnoi[4], C. Barnaud[5], and G. Trébuil[6]

Abstract

The trans-disciplinary companion modeling (ComMod) approach for adaptive renewable resource management aims to facilitate knowledge integration, collective learning, creative negotiation, and institutional innovation about concrete problems faced by communities. In this paper, we compare the effects of different ComMod processes on collective water management at five sites located in northeast and northern Thailand, and west-central Bhutan. At the three highland sites, agricultural commercialization leads stakeholders to review the local water management rules while in Northeastern Thailand land/water management dynamics are interlinked with labor migrations and the market integration of farming activities. The main effects of the ComMod processes at these sites are analyzed based on a common framework focusing on the stimulated processes of individual and collective learning, communication, negotiation, and coordinated action. The following effects are documented: individual learning about current situation, increased awareness of a collective problem, understanding each other's perceptions, reaching a common agreement on the problem, exploration of new water management rules, implementation of new practices, and institutional innovation. The discussion focuses on how methodological choices made in the implementation of ComMod influenced the observed effects. The factors contributing to, or limiting, the achievement of institutional innovation are underlined, in particular the role of the local institutional context and the possibility to establish inter-institutional dialogue among multiple levels of organization are highlighted. Finally, we point out the need for specific monitoring and evaluation procedures adapted to such highly interactive and adaptive processes.

Media grab: ComMod, a pragmatic methodological approach facilitates communication between social hierarchies relaxing the conflict situation and strategizing water management issues.

Introduction

Traditionally a public good not to be expropriated "Water" has become a highly contested renewable resource as a valuable part of cultural identity worldview. This has resulted from the pressure of diverse users and declining clean water resource, compounded by the breakdown of social fabrics due to globalization vis-à-vis commercialization. As seen by the changing and conflicting stakeholder role from relevance of issue to their ability to influence, further makes it a multi-dimensional problem. Within the complexity of multiple social-ecological systems, modeling approaches offer pragmatic means to enhance better understanding and strategizing water management issues.

The contrasting problems associated with water use and management in different sites across Thailand and Bhutan provides a unique methodological challenge (Bousquet et al. 2005). Developing a common understanding among stakeholders to harness collective decision can achieve longer lasting influences and impacts. Companion modeling (ComMod) approach, facilitates dialogue and shared learning through collaborative multi-agent modeling and simulation activities developed during the last 10 years by a group of researchers (Trébuil et al. 2008). Its methodologies rely on iterative coupling of Role-Playing Games (RPG) and Agent-Based Models (ABM) ComMod is an approach making use of evolving simulation models in a collaborative and integrative way to understand complex systems and facilitate stakeholders collective decision making processes when sharing a common resource (Bousquet et al. 2005).

In recent years, 4 sites in Thailand (Mae Salaep, Mae Hae and Nam Haen upland catchments in Chiang Rai, Chiang Mai and Nan provinces respectively and Lam Dome Yai in the rainfed lowlands of Ubon Ratchathani) and 1 in the highlands of west-central Bhutan (Bousquet et al. 2005) have been testing the use of ComMod approach to examine different water management issues and develop methodologies to enhance adaptive management capacities of community by inducing experiential and explorative learning(Barnaud et al. 2006). This paper presents a brief comparative analysis of ComMod effects on water management.

Contexts

The five sites provide a very strong contextual diversity for applying ComMod approach (Barnaud et al. 2006). To give a better insight of the sites in relation to water management issues, a simple framework (Table 1) is used to compare and contrast the cases. The principle focus in all sites is associated to water management concerns from plot to catchment level which has evolved over generations. The problems are legitimate, however demand to address the issues have not always come from farmers (or stakeholders), in 2 cases (Nam Haen and Lam Dome Yai) it has been researchers addressed the problems based on the opportunities and experiences from past research.

[1] Council for RNR Research of Bhutan, Ministry of Agriculture, Bhutan; [tayangurung@yahoo.com]
[2] Multiple Cropping Centre, Chiang Mai University, Thailand & Ph.D. candidate at Lyon I University, France;
[3] Faculty of Agriculture, Ubon Ratchatani University, Thailand & Ph.D. candidate at Chulalongkorn and Paris X Universities.
[4] Faculty of Agriculture, Ubon Ratchatani University, Thailand,
[5] CIRAD UPR GREEN, , Montpellier, F-34398 France & Ph.D candidate at Paris X University
[5] CIRAD, UPR GREEN, Montpellier, F-34398 France & CU-CIRAD ComMod Project, Chulalongkorn University, Bangkok, Thailand.

Table 1 Characterization of ComMod for water management contexts at the different sites.

Topics/Sites	Lingmuteychu (L)	Mae Salaep (MS)	Nam Haen (NH)	Lam Dome Yai (LDY)	Maehae (MH)
Problem	Irrigation water sharing for rice cultivation	Irrigation water sharing in cash cropping	Forest conservation in upper catchment	Water and labor management in rainfed lowland rice	Shortage and unequal access of water
Scale of the problem	7 villages	1 Akha village (48HH)	2 Mien villages	11 households	14 Villages
Age and evolution of the problem	Since the settlement and increasing conflict	Recent / rising due to more cash cropping	Recent /establishment of new national park	Since the settlement & rising with mobility	Since 2005
Severity of the problem	High for 7 villages	Low to medium, rising	Severe for small farms	Low	High
Researchers-stakeholders linkage	Since 1987	Several years of on-farm research	No previous collaboration	Several years of on-farm research	Since 2002
Origin of demand and legitimacy.	Down stream communities. Highly legitimate	Villagers after previous ComMod activities; good legitimacy	Researcher to local devpt. agency & village leaders; low legitimacy	Researchers, low legitimacy	Local watershed management officer & local dev. agency
Opportunities/incentives to act	Increased access to irrigation water	Decentralization policy & allocation of financial resources	New park: redefinition of rules for accessing NTFPs	New plan for more investments in water infrastructures	Emerging regulation to equitable water sharing
Potential of ComMod in these contexts	Approach for learning and communication	Villagers already aware of ComMod and ask for more	Poor communication & information sharing	To enhance a joint understanding of the water – labor issue	Weak communication & need to facilitate collective action
Key development question	Sharing irrigation water & foster community cooperation	Inequity in decision-making about water & power relations	Public awareness & communication about the new national park	Water availability and labor migration management	Strengthening of local institutions
Key research question	Can ComMod facilitate better understanding and communication in resolving water sharing conflict?	Can ComMod facilitate the emergence of new equitable water sharing rules?	Can ComMod facilitate information sharing and consultation between stakeholders?	Can ComMod enhance understanding of the water management – labor migration interaction?	Can ComMod support improved water sharing & better understanding of resource management
Specific ComMod objectives	Understand decision-making in sharing irrigation water	Set up a consultation mechanism on irrigation water sharing	Improve communication among stakeholders	Integrate and produce new knowledge	Use ComMod & tools with different stakeholders

The diversity of stakeholders and their stake is a challenge. Categorizing the stakeholders according to their relative influence (*control on outcome of issues*) and importance (*need to resolve the issue)* (Figure 1), indicates the position of farmers (small – majority) highest in importance and lowest in influence. Thus the actual control of the issue lies with other stakeholders for whom the issues may not be as pressing as it is to a farmer. It is the diversity of the stakeholders, power relations and conflicting interests that provides a basis to establish key development objectives of awareness building, strengthening social capital, and networking; and key research objectives to test ComMod for better understanding, networking and institution building.

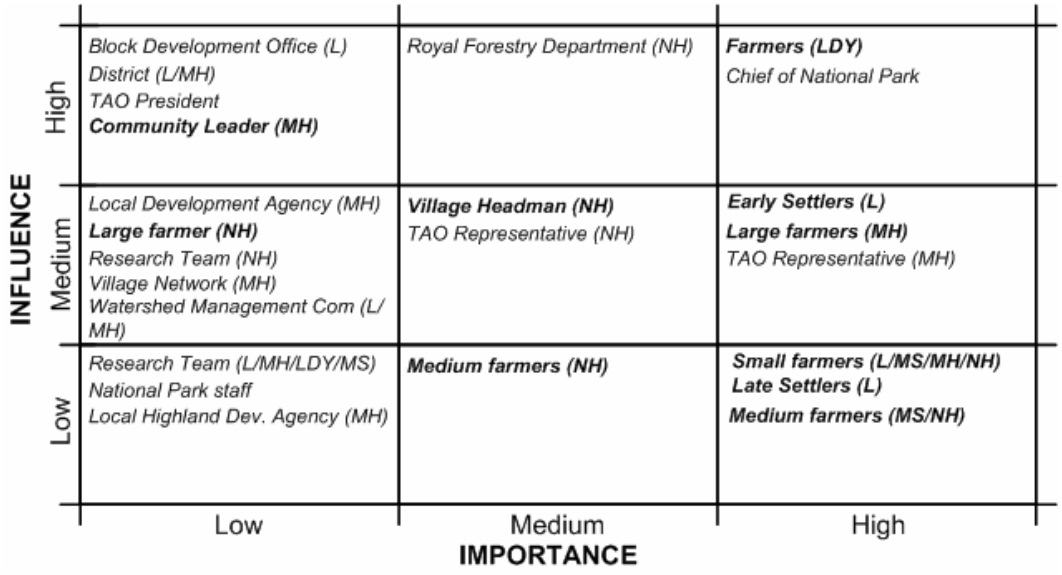

Figure 1. Diversity of stakeholders and their relative role in water issues at five sites.

Process

ComMod uses different tools such as RPGs, ABMs, geographical information system (GIS), participatory mapping, etc. Within a ComMod process, tools are used iteratively to build up learning by involving in the proceedings. These tools can be used in different ways to associate them depending on the context, objectives, and dynamics of a given ComMod process (Trébuil G, 2008). In five test sites, the processes have been adapted to suit the situation. As represented in Figure 2, the process started with problem identification and analysis, and sensitization of stakeholders about ComMod in all sites. Studies addressed complex ecosystem issues (soil erosion in Mae Hae and Mae Salep, hydrological dynamics in Lam Dome Yai, park-people interaction, and water sharing in Lingmuteychu).

Conceptualization of RPGs was done in participatory way by using real situations and simplifying the problem context. While the ABMs were conceptualized based on previous RPGs in all sites except. In Mae Salaep and Nam Haen hybrid gaming ABMs were used. Figure 2 shows that conception and implementation of RPGs and ABMs were iteratively done in all sites and with no definitive order. In all cases CORMAS simulation platform was used to implement the ABMs and simulate scenarios which were presented and discussed with the stakeholders.

Following the validation of scenarios stakeholders make decisions for next steps, which often takes to next cycle with higher level problem or new problem altogether. For instance farmer mobilized for tea plantation in Mae Salaep, from a simple water sharing problem of 2 villages in Lingmuteychu watershed led to need for a watershed management committee, new NTFP harvesting rules and livestock-forest interaction as new issue in Nam Haen, and forest-arable land management to water conflict in Mae Hae from initial issue of land use change).

The process promotes stakeholders to develop common action plan benefiting the community as in Lingmuteychu and Mae Hae as an off-shoot from the usual loop. Implementing the common action plan have lessened the tension on water sharing, instituted watershed management committee, and acquired donor fund to implement collective plans in Lingmuteychu.

The spiral within the RPG and ABM network represents continuous iteration between model and reality enhanced incremental advances in collective understanding of the different view points (D'Aquino et al. 2002) Such iterations used in all sites efficiently promoted knowledge integration in collective learning process. Thus in all sites 2 to 3 cycles have been completed with every cycle opening up new frontiers learning experiences.

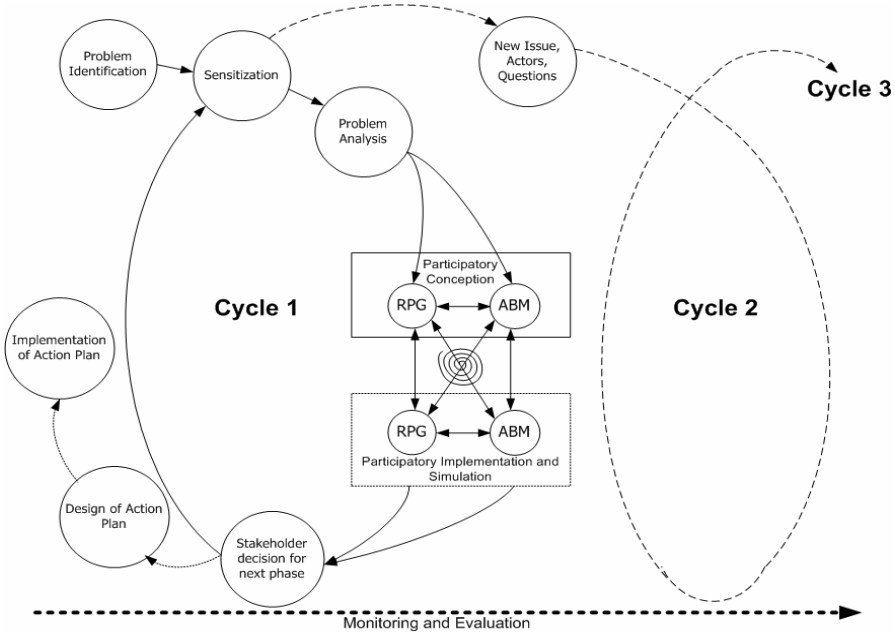

Figure 2. Schematic representation of a companion modeling process.

Diversity of effects

The effects of ComMod process in all sites have been diverse and tangible. To analyze effects over five sites, a simple framework based on experiences of the researchers is used (Figure 3). The foremost effect has been the acquisition of new knowledge on discovering farm dynamics in Mae Salaep and Lam Dome Yai, resource sharing as a key to community cooperation in Lingmutychu, and ecological dynamics in Mae Hae and Nam Haen. It is also evident that knowledge acquisition is at individual, collective and institutional levels which leads to subsequent changes. Acquired knowledge helped in better collective understanding and awareness of the situations. For instance, severity of complexity became clearer in Lingmuteychu, Nam Haen, and Lam Dome Yai; while people became aware of opportunities for collective management in Mae Hae and Mae Salaep. Such awareness at individual and collective level engages people to collective learning leading to series of changes.

Individual interview of players in all case studies and monitoring of ComMod process using Most Significant Change approach and Logbook method revealed that in all the cases there was distinct display of changes in perception, behavior, decision-making, and practices. Change in perception from neglect and isolated in dwindling resource situation changed with new knowledge and

understanding to confident, well connected and bold to negotiate resource management. People in Lingmuteychu started discussion on water issue openly beyond village, solidarity extended from kinship to community level and resource-poor's voice was heard in Mae Salaep. However a contrasting behavior was observe as people in Mae Hae participating in consultative process while in Nam Haen people who freely accessed forest choose to stay away from the process. Behavior change was broadly in terms of communication, networking and engagement. Change in decision-making and practices from individualistic to collective mode supported emergence of adaptive mechanisms in most cases, except in Nam Haen. Overall the effect of these changes was on the evolution of the initial problem from a simple to complex and more legitimate that impacted their livelihood.

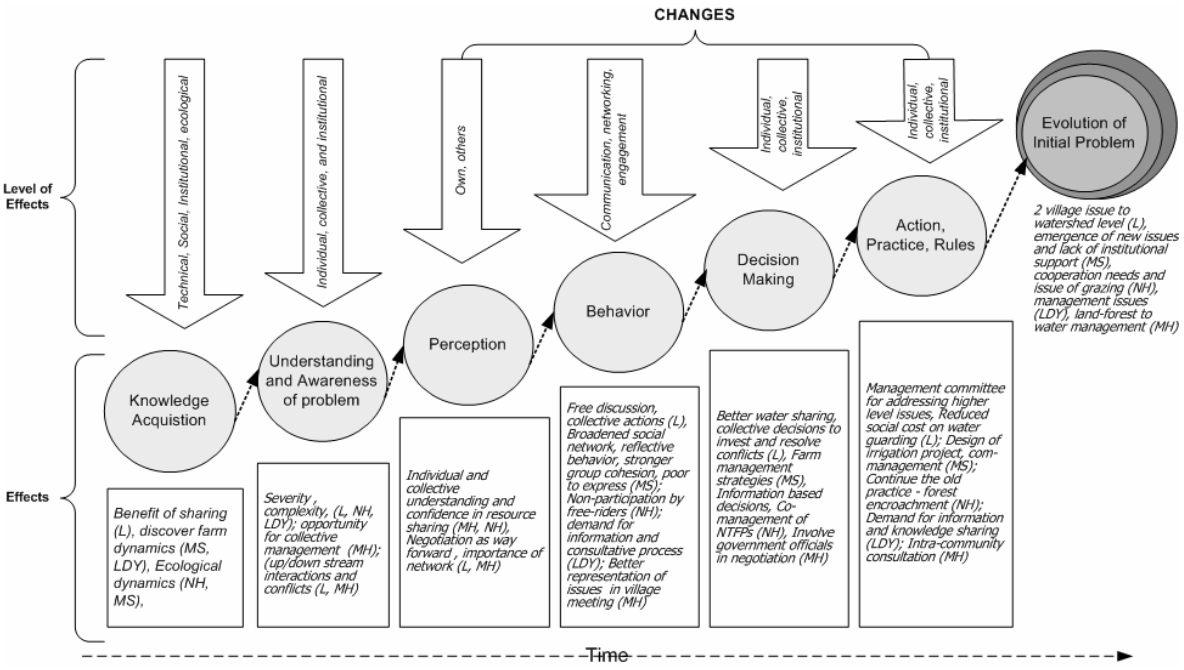

Figure 3. Diversity of effects and impacts generated by ComMod process

Discussion

The 5 case studies in diverse socio-economic and agro-ecological situations offer a wealth of experiences in using companion modeling approach. Some of the potentials and limitations of the approach are illustrated below:

Potentials

- In a situation where communities lack knowledge to appreciate effects of their actions ComMod process provide a suitable methodological approach to support knowledge acquisition at individual, collective and institutional. It also facilitates behavioral changes leading to adaptive mechanism a principal strategy to adjust in a dynamic ecosystem. The model and scenarios allowed people to step out of their real setting thereby enabling stakeholders to realize the problems. While it takes time (multiple cycles in case studies) ComMod creates space for integrating knowledge and viewpoints leading to trust in relationship between stakeholders.
- RPG in all 5 cases has confirmed to be a neutral communication platform which allows heterogeneous groups of stakeholders to participate in the process without comprehending their social status. RPG in conjunction with MAS modeling open up pathways to networks of reciprocity and collective management, thus leading to construction of social capital.
- The use of different tools, agrarian system analysis (Trébuil et al., 1993), RPG and MAS Modeling (Bousquet et al. 2002), GIS (Trébuil et al., 2005), RPG (Gurung, 2005) in different case studies with no definitive structure shows its flexibility to apply. Particularly the use of RPG and Agent Based Models alternatively displays the adaptability of approach depending on the context.

Limitations

Whilst ComMod promotes neutral platform for knowledge integration, communication, and exploration of adaptive mechanisms, there are some weakness which can be improved during the process.

- The effects of ComMod process are sequential, as it opens areas of understanding and or intervention from small to bugger. Further the indifferences (social inequities, exclusion, sanctions) which may be induced by opening up the hidden rules of society and experiential learning, a mechanism to closely monitor the change process will help in explaining the dynamics of change. Use of Most Significant Change (MSC) technique and logbook in many sites prove to be useful tool to monitor.
- As ComMod process empowers people with information and knowledge, people (small proportion of population) who involve in the process think and act collectively, which do not correspond to the bigger group who did not participate in the process. This fragmentation undermines the strength of ComMod process. Thus a method to up/out-scale the effects is a prerequisite.
- ComMod as any participatory process generates ideas and plans to improve, however without a commensurate policy and institutional environment to implement the action plans, aspirations quickly die and further breaks down the social trust and fabrics. Lingmuteychu case is a good example where policy and institutional environment supported the outcome of process,

making difference to people's livelihood, while this did not occur in Thailand. Thus local groups need support from legal structures for entitlements and legitimating the change.

- In all cases, there is no demonstration of how institutions at different levels can be linked for dialogue. The inability to link grassroot to higher level institutions often has become a critical hurdle in 4 sites in Thailand.

Conclusion

In five diverse case studies representing a complex social-ecological-political domain where natural resource is highly contested, an iterative process supporting integration of stakeholder perspectives for collective learning and exploration of future strategies become pragmatic methodological approach. The iterative process with flexibility in application facilitated collective learning and negotiation for resource sharing and management. With the ability to integrate view points of heterogeneous stakeholders, ComMod opens several windows for interventions. Rather than conceiving it as a temporary and merely exploratory process, the principle challenge is how to enhance the ownership of the development process and legitimacy by local stakeholders. Further, the involvement of stakeholders having greater influence on the issue from initial stage still remains a challenge. While the process can empower voices less or less influential, the outcome has minimum impact on the governance system and institutions. A challenge remains on how the process can motivate people and institutions to partake in the process and legitimatize the outcome. The approach working with small group of RPG players heighten the understanding and expectation of small group leaving them as privileged few in a majority of those who do not believe in the predictions of those who participated in the process. Thus the use of hybrid gaming ABM of Nam Haen promotes involvement of more stakeholders and communication higher social hierarchy. At the same time, it is imperative to institute monitoring procedures that can keep track of evolutions at different levels.

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