

Companion modeling to facilitate adaptive forest management in Nam Haen sub-watershed, Nan Province, northern Thailand

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Abstract

Forest management through the establishment of headwater management units and the new Nantaburi National Park in Nan Province, northern Thailand, deals with many stakeholders. They have different points of view and interests on forest resource use, different kinds of knowledge, and different opportunity to participate in setting up a management plan. This creates conflicts on forest resource use and management, particularly about the rules for collecting non-timber forest products in the National Park area. This kind of problem is complex not only because it involves many stakeholders, but also because it deals with several interacting ecological and social dynamics. The Companion Modeling (ComMod) approach adopted in this case study seems adapted to facilitate participatory and adaptive management in such complex situations. Role-playing games, multi-agent systems, and a geographic information system will be used to build a communication platform integrating various points of view, knowledge (scientific and indigenous), and disciplines (social and ecological ones). There are four main iterative phases to be implemented with the stakeholders i.e. i) diagnosis and problem identification, ii) sharing, adjustment, and improvement of knowledge and perceptions on the problem with gaming simulations, iii) collective discussions to generate acceptable scenarios to be tested and agreed-upon indicators for their evaluation, iv) computer simulations to support the collective assessment of these scenarios and decision-making on further action to be taken. The expected outcome of this action-research process is an improved collective planning and management of forest resources and the construction of a generic model that could be adapted to similar situations at other sites. Following a presentation of the forest management problem at the study site, the first implemented steps of the ComMod process are described. The initial diagnosis and the first set of participatory gaming simulations provided the research team with a better understanding of local stakeholders' needs and perceptions. These preliminary results allow us to precise the subsequent steps based on key resource management problems identified with the stakeholders. In particular models integrating ecological and socio-economic aspects of cattle grazing in the forest and the gathering of non timber forest products will be constructed to facilitate adaptive forest management by various stakeholders, in particular villagers and national park officers.

KEY WORDS: Companion modeling, forest management, watershed, Nan Province

Introduction

Forest degradation is a major problem due to many causes such as logging concession policy and agricultural area expansion (Lakanavichian, 2001; Delang, 2005), especially in highland areas. Traditionally, the Royal Thai Government (RTG) policies regarding forest management have been enforced through a top-down approach. Many strictly controlled reserved forest areas were established by the Royal Forest Department (RFD). Thereafter, tens of thousands of upland farmers and hill people are occupying these areas illegally and are blamed to be forest encroachers (Roth, 2004). This

expansion of conservation areas has become a major cause of conflict between the RFD and local communities. In recent years, the RTG has taken steps towards more local people rights to manage their natural resources. However, conflicts between government agencies and local people are still common, as in the case of the establishment of the Nam Haen headwater management unit (NHU) and the Nantaburi National Park (NNP) in this sub-watershed located in north-western Nan Province, northern Thailand.

Nowadays, the modeling approach is widely used in the field of participatory watershed management in Thailand (Bouquet *et al.*, 2005). In this study, we are using the Companion Modeling (ComMod) approach to facilitate participatory and adaptive management of forest resources by providing the concerned stakeholders with a communication platform to share information, knowledge, perceptions, and concerns about their common resource management problem to identify acceptable ways to mitigate it. The expected outcome of this research is an improved collective planning and management of forest resources, and the construction of a generic model that could be adapted to similar situations at other sites.

Following a brief definition of the ComMod approach, the aim of this paper is to present preliminary results on the context analysis and problem identification phase implemented with key stakeholders. Gaming simulation was used to validate the researchers' information and to improve our understanding of the situation.

Forest management context

The Nam Haen sub-watershed is part of the Nam Yao-Nam Suad Natural Forest Reserve. This sub-watershed covers 190 square kilometers and consists of 11 villages populated by two minority ethnic groups (the Mien or Yao and the Khamu) living in highland areas, and northern Thai people living in lower areas. Most of forest management activities in this area have been done by the NHU since 1979, such as reforestation. During 1996-2003, the Danish Cooperation for Environment and Development (DANCED) supported a natural resource management project in the Upper Nan watershed (RFD, 2004). By the project, the community coordinator system has been set up for the better cooperation between RFD and villagers. Moreover, income generation and natural resources protection activities have been implemented in the participatory way such as the revolving fund for agriculture, forest fire breaks, and the communities' network with the rules and regulations. Another forest management institute in this area is the NNP which was established in 1996 by not yet well-defined boundary. However, the park has been implementing the national park law to control human activities inside the NNP (Figure 1). Regarding these government policies, the forest ecosystem is seemed to be recovered but the socio-economic and agricultural system of villagers were potentially impacted. Nowadays, the villagers have the problem on the limitation of agricultural area while the population is increasing. Moreover, the villagers trend to work off-farm to gain more income.

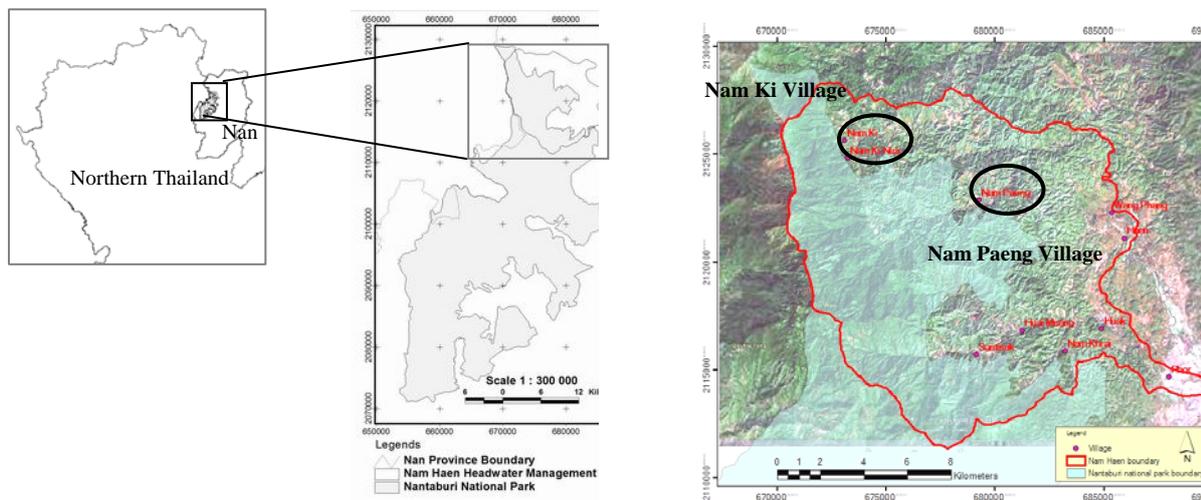


Figure 1: The map showing the Nantaburi National Park and the Nam Haen Headwater management Unit (left) and the location of the 2 Mien villages in this study (right).

Sources: RFD National Park GIS database and www.googleearth.com

Materials and methods

The Companion Modeling (ComMod) approach

The ComMod approach is useful for such situations because it is an iterative and evolving approach alternating field work and modeling in a continuous process. This approach can be used for two objectives: to understand a complex system or to support collective decision-making processes regarding its management (Barreteau *et al.*, 2003).

There are four main iterative phases to be implemented with the stakeholders: i) diagnosis and problem identification, ii) sharing, adjustment and improvement of knowledge and perceptions on the problem with gaming simulations, iii) collective discussions to generate acceptable scenarios to be tested and agreed-upon indicators for their evaluation, iv) computer simulations to support the collective assessment of these scenarios and decision-making on further action to be taken (Bousquet and Trébuil, 2005). During the ComMod process, several complementary tools are implemented. In this study, multi-agent systems (MAS), role-playing games (RPG), and geographic information system (GIS) will be used to build a visual communication platform integrating various stakeholders' points of view based on different kind of knowledge (scientific and indigenous), and contributions from different disciplines (social and ecological ones).

Preliminary field diagnosis

To better understand the forest management context and perception on forest resources, individual in-depth interviews of key stakeholders such as the NHU officers and some villagers or village headmen in Nam Haen sub-watershed were carried out. During these interviews, not only new information but also new interesting problem or type of stakeholder were raised. Subsequently, those people were interviewed as well.

First role-playing game

Based on knowledge acquired from a review of the existing literature and the individual interviews, a first role-playing game (RPG) was constructed and used to i) to test the idea that the establishment of the NNP is an important issue for the villagers, and ii) to observe the villager's behavior related to the forest resource management.

The 2 gaming sessions were played in two Mien villages. Two gaming boards were used to represent the simplified land covers. Detailed charts showing the input costs of the various crops, possible off-farm activities, and value of non-timber forest products (NTFPs) were displayed to remind the players (Figure 2). A simple regeneration rule for Arenga fruits and NTFPs was applied (e.g., for Arenga fruits: if they over harvest in a round, then the production for next round will become the same as previous round because there are a lot of Arenga trees in forest, and for NTFPs: if they over harvest, the production for next round will decrease). In each village, ten players representing three main types of farms depending on their access to resources and socio-economic status were selected to participate in the gaming sessions and subsequent discussions. Individual interviews were carried out the day after. At the beginning of the game, each player received a role card representing the number of his/her agriculture plot(s) and labour(s) as well as some money for investment. At each gaming round (corresponding to one cropping year), the main activities of the players were as follows 1) deciding to send their labour(s) to work off-farm, 2) deciding the crop choices and planting, 3) harvesting Arenga palm for selling, 4) harvesting NTFPs for household consumption, 5) harvesting the crop productions and going to the market table to calculate how much cash they had left. Two scenarios; without and with a National Park, were played during the gaming sessions. In a scenario with National Park, a rule stipulating that the villagers could not access the land controlled by the National Park area was created. As a consequence, the villagers could not harvest NTFPs for consumption and could not harvest Arenga fruits for sale. Graphs of cash, off-farm income, and forest-product income of each player type were constructed to illustrate the impact of the establishment of the park.



Figure 2: Gaming board represents the land use/land cover and detailed charts of investments.

Results and discussions

Stakeholders perceptions and problems on forest resource use and management

Based on the interviews, three main types of stakeholders were identified. The first type is the NHU of RFD which has a strategy for participatory management the forest resources and has carried out many activities with the villagers (such as making fire breaks, small weirs, fire monitoring, and reforestation) by using its financial resources. There is no serious problem between the NHU and villagers.

The second type of stakeholder is the NNP which has an important role on forest conservation. The park's manager has an attitude that the villagers are a cause of forest degradation through the expansion of agricultural area and cattle raising inside the park. The Park's manager requested the researcher study the impact of these cattle on forest ecosystem. The park's manager did not believe that the villagers have the capacity to manage their resources. Recently, because the park is not yet declared by law, therefore many villagers' activities are still allowing, such as collecting NTFPs for household consumption, collecting Arenga Palm fruits for selling, practicing agriculture in the park area. But after the park has declared by law, the park manager stated "the rules have to be discussed with villagers again." He need the real Nation Park which "no human activities." So, we can infer that this government agency has lower level to apply the participatory management than the NHU. Particular integrated ecological dynamics and socio-economic dynamics model related to the park interest is needed to use to involve the park into a participatory management strategy.

The last kinds of stakeholders are the local villagers who are using and managing the forest resources. They defended that they have set up village rules to manage their forest resources for a long time, such as the rule to collect Arenga Palm fruits. Therefore, they could have the right to manage their resource themselves. They also address their problem of the NPP declaration that makes them confusing about the park's law and boundary as well as make them to be afraid of agriculture land loss. This problem is caused by the NPP did not explain the rules and the exceptions directly to the villagers but the NNp explain through the village headmen.

The results reveal that these 3 types of stakeholders have their own perception, although two of them are government institutions. This local conflict deals with diverse stakeholders using forest resources and intervening in its management. These diverse actors have different points of view, knowledge, interests, and strategies on forest resources, and different opportunities to participate in setting up a truly collective forest management plan.

Regarding this information about the conflict between villagers and the NNP, the first RPG was setup with aiming as described above. Three main types of farmers were classified depending on their access to resources and socio-economic status. Type A is the farmer who is occupying small land area and earning income from the forest product and low wage off-farm activity. Type B is the farmer who

is occupying enough land area and earning income from agricultural activities and forest product. Type C is the farmer who is occupying enough land area and earning income from the high profitable off-farm activities, such as selling soymilk in town. This classification aiming at providing the representatives of farmers to played the game because it is difficult to control many players.

The first gaming simulation

During the gaming sessions in the two villages, most of the players understood rapidly the features and the rules. The results from interviews revealed that they played the game with the feeling of the real life. Some of them practiced the real life activities, however, some of them used this floor to try the new activities that they never practice in reality. Many feedbacks from players, such as they plant the crops in the game like they do in the reality but they get lower/higher income than in than reality, are useful to adjust the researchers' information as well as calibrate the game.

The results from the second scenario "with the National Park already established" supported that the establishment of the National Park is an important issue for the villagers. The Park will impact the villagers by reducing their income and by changing their way of life (Figure 3). In Ban Nam Ki village, the players did not break the new rule during 2 rounds. Regarding this, the cash and forest product income were decreased (Figure 3a, 3b) where as the off-farm income was increased (Figure 3c) because some players decided to go for off-farm employment to raise cash to replace their previous income from selling Arenga fruits gathered in the forest. In Ban Nam Paeng village, the players did not break the rule in the first year of the scenario with National Park. In the second year, the players especially the type A and B farmers decided to break the rule due to the indebtedness in the game (Figure 3d-3f).

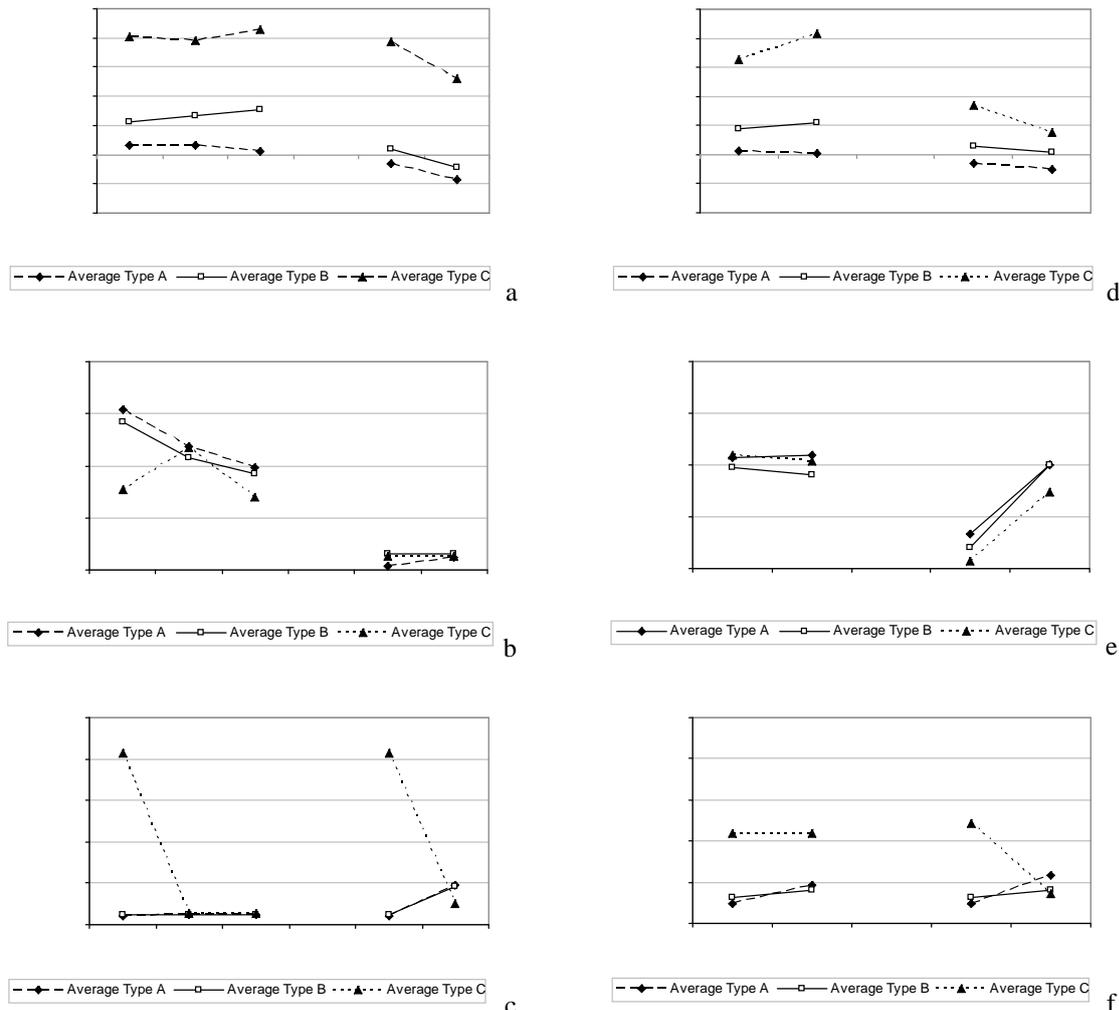


Figure 3: Cash, forest income and off-farm income from the gaming simulation in 2 Mien villages, Ban Nam Ki (a-c) and Ban Nam Paeng (d-f).

For the management behavior of players in both villages, we observed that when forest products become scarce, some players discussed with each other to find the appropriate way to collect. Although not all of players discussed together, this behavior can implied that they feel concerned and needed to manage their resources. After group discussion separated by farmer types, we found that in both villages, the players have different opinions on the important of resources. Some players who depending their real life on NTFPs for consumption thought that the NTFPs for consumption are more important than Arenga Palm fruits for selling because they can harvest NTFPs for consumption all year round while the Arenga is not. On the other hand, some other players who are collecting the Arenga fruits thought that the NTFPs for consumption can be replaced by vegetable from a market.

Moreover, the result from the interviews showed that they knew more about the other players' behavior and decision. They also concerned more about the future situation if the NNP apply the law. Regarding these results, the common agreement among villagers is needed before negotiating with the NNP. Moreover, the facilitating of the players' lesson learned about their problems and situations to the non-players is important because the transferring of information could increase the motivation on management (Lambin, 2005).

Conclusions and future perspectives

The first step of the ComMod approach, problem diagnosis through the interview and gaming simulation, is useful to diagnosis the important problem in study area as well as the stakeholders' perceptions and needs on their forest resource. The results of the gaming sessions confirm that the establishment of NNP will impact the villagers. Moreover, among villager themselves, they have different opinions and concerning on the forest resources use and management. From this simple RPG by gaming board, we will adapt the complex gaming simulation in a computer in order to use as a tool to facilitate the decision platform for the collective forest management planning.

Next step of the study, the first RPG will convert to the MAS model under the CORMAS platform (<http://cormas.cirad.fr>) because it is useful to re-play many times. Then, this model will be used to present to the NNP and NHU officers with aiming at i) to show the villagers decision-makings and results/impacts in such a management condition, ii) to see their awareness on the villagers' problems in case of "if the park set up", and iii) to share the NNP and the NHU officers perspectives and interests of the gaming simulation in the field and MAS simulation in the computer. These aims can refer to the second step of the ComMod approach (i.e., sharing, adjusting, and improving of knowledge and perceptions on the problem with gaming simulations).

Furthermore, to encourage an interesting of the NNP officers and involve them in the participatory management strategy, particular models integrating ecological and socio-economic aspects of cattle raising in the forest and the gathering of non timber forest products will be constructed by MAS. A classified satellite image or a GIS land use data will be introduced as the environment of the CORMAS for more realistic than the simplified one. Many researches support that the visualization encouraged more in-depth and lively discussion, and seemed to assist stakeholders articulate more clearly their preferences for landscape conditions (Hoare *et al.*, 2002; Lewis and Sheppard, 2006). This integrated model could be useful to adjust the perception of NNP officers on the villager's situation and knowledge to manage their resources. It also could be useful for the villagers to learn more about the National Park roles through the gaming simulation as well as increase their motivation to manage their resources sustainably. Finally, after stakeholders have adjusted their perception, this integrated model could facilitate the emergence of a collective forest management policy through the assessment of possible scenarios agreed by stakeholders.

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