Towards a new generation of participatory approach to integrated natural resource management: experience of the SAMBA role-play in Vietnam uplands

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Abstract

The SAMBA role-play is a participatory methodology that was developed to complement other participatory approaches to natural resources management. In the mountainous areas of Vietnam, traditional methods for land use system analysis and farmers' need assessment are challenged by (i) the high diversity of natural and human environments, (ii) the very rapid changes that happened in the recent years with the decollectivisation of agriculture, (iii) the difficulty to get access to the information on burning issues such as land tenure, livestock management, etc. through conventional surveys and participatory tools.

The focal point of the SAMBA methodology is a role-play board game in which local farmer households make decisions about land use and labor allocation. At the start of play, players are assigned families and paddy-land holdings of various sizes. Researchers record the outcome of the game, and facilitate discussions among the players about the outcome and its relation to real-life processes. A case study focusing on the interactions between agriculture, livestock and forest systems illustrates the participatory simulation process. It shows how distribution of production means to farmers via land entitlement can lead to farming system differentiation and the emergence of new local governance systems. This methodology could serve as a tool to facilitate interactions among local stakeholders about natural resource management, conflict resolution, and diffusion of technical innovations as alternatives to slash-and-burn cropping practices.

Key words: Participatory simulation, role-play, natural resource management, land use changes, Vietnam.

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1. Introduction

In Vietnam, agricultural decollectivization process spread over more than a decade, from the early 1980's to the mid-1990's. In the northern uplands this process led to dramatic changes in households' land endowment that modified the relations of production within the farming community (Rambo et al., 1995; Jamieson et al., 1998). A farming-systems study conducted in Bac Kan province has shown how these policy changes contributed to a rapid differentiation among households (Castella et al., 2000). Sadoulet et al. (2000) showed how family labor force composition influenced individual farm resource endowment under the successive land allocation reforms. Farmers' production strategies were driven by the changes in land and capital endowments relative to the family labor force and by the concomitant requirements for rice production needed to secure food self-sufficiency. Depending on the resource endowments of various villages (for example, quantity of lowlands, forest quality, soil types, and population) the combination of individual households' strategies led to a high diversity of local land use systems. In short, a diversity of farm strategies combined with a very heterogeneous environment led to multiple pathways for land-use change at the watershed level. As a consequence, no single policy can tackle the issues related to natural resource management that have arisen during the past decade (Castella et al., 1999a).

The extreme diversity of local situations resulting from these recent changes also is challenging for "classical" participatory research approaches. To overcome these problems, we have developed a new methodology that combines role-plays together with more classical methods. This new combined methodology will be illustrated in this paper by a case study conducted in Ngoc Phai commune, Cho Don district, Bac Kan province about the interactions among livestock, crops and forest systems in the uplands. This field experience raises new questions about how social scientists can adapt participatory research to such dynamic and diverse environments.

2. The limits of participatory and non-participatory land use analysis

2.1 Participatory Rural Appraisal

Prior to the beginning of our research program, several development projects had been conducted in Bac Kan Province. We reviewed their results and achievements in order to build our diagnosis upon existing experience. These development projects typically started with a one-week participatory rural

appraisal (PRA) intended to assess community needs and to identify development issues and intervention points, based on local knowledge (Le Ngoc Hung et al., 1996). The PRA exercise provided a very rapid overview of the history and geography of the commune based on local knowledge and available statistics. It led to a long list of recommendations. For those proposed activities that were both high-priority and feasible, a work plan was designed by the project team and then implemented under the supervision of a project steering committee. Because of the limited project period (i.e., two more years after PRA exercise) and the necessity to achieve measurable impact within the remaining time, emphasis was given to short-term activities. They were easier to monitor using objective indicators than activities aimed at building social capital. As a consequence, water tanks, and clean water supply were installed in all houses of the target villages in Ngoc Phai commune; livestock were vaccinated and new buffalo sheds were built close to the houses; new pig and poultry breeds were introduced; and credit was given to farmers without collateral. Alternative cropping systems were demonstrated on the slopes visible from the road, based on *Tephrosia* contour hedgerows and cinnamon trees on the tops of the hills.

The PRA conducted in Ngoc Phai commune raised the whole community's awareness about local development issues. Thereafter, it became easier to mobilize the villagers around activities that benefited the whole community. However, many issues involving coordination among households or community-based management were not tackled. Though ranked as priorities, the upgrading of the irrigation system, alternatives to animal free grazing, and the re-organization of forest protection regulations were not addressed by the project. There were three main reasons for this:

- The necessity for rapid, visible achievements that could be measured by the project impact monitoring system within the relatively short period remaining to implement planned activities,
- The PRA process led to new questions that would have required complementary research to be answered satisfactorily (e.g., sustainable cropping systems on the slopes, future market opportunities for different cash crops). Instead, the project gave priority to those problems that already had ready-to-use solutions. Further, the project simply followed farmers' desires, which often were influenced by the fashion of the moment relayed by agricultural extension services: new rice varieties or pig breeds, cinnamon, apricot, *Tephrosia* contour hedgerows, etc. Cash crop selection was not based on a preliminary market analysis, which resulted in a sharp fall in price due to saturation of a very small market, especially for apricots and cinnamon.
- Coordination among stakeholders requires complex processes of social learning and consensus building. These processes take a long time, and tend to bring to the surface latent tensions or conflicts that perturb the social peace. As a consequence, the most successful activities were those

that could be managed individually and that could rapidly improve households' well-being (sanitation and clean water supply systems, etc.). Credit schemes also worked very well because no collateral guaranty was requested. Loans could be managed individually. However, the poor social control over reimbursement led to a very low repayment rate.

Though interesting discussions on integrated management of natural resources took place among stakeholders during the PRA, they did not lead to collective action. This can be explained by the nature of PRA itself. Although this method is very relevant to the generation of agro-ecological and economic information in a very short time, it is not a good instrument for the analysis of social interactions (Mosse, 1998). Local configurations of power, relations of influence and dependence, and disputes cannot be captured through PRA even though understanding of these social interactions is essential for promoting community-based natural-resource management. Beside, a number of PRA conducted in the same province by diverse projects (e.g. Vietnam-Finland forestry sector, UNDP-PARC) have shown how difficult it is to "evade cooption by local politics" (Richards, 1995). It appeared that the whole PRA process was based on the assumption (shared by both sides) that local people know what is good for them and would manage for the common interest whatever the project would give them. However, regardless of the results of the PRA in a given commune, projects always provided the same concrete interventions as planned beforehand in the project document. As a consequence, the observation of the PRA process itself often delivered more interesting information than the concrete interventions it led to.

We thus felt that PRA outputs were not sufficient to respond satisfactorily to farmers' needs once they had been assessed. Informed collective actions should build upon refined knowledge of stakeholders' current strategies. This is why we decided to investigate agricultural dynamics more carefully.

2.2 Land-use systems analysis and modeling

We began with a fairly conventional land-use analysis phase that relied on a systems approach to land use changes, combined with a spatial approach to environmental dynamics (Castella et al., 2001). It was composed of four successive steps conducted by an interdisciplinary team.

1. Classification of the agro-ecological zones of the district based on available maps, statistics and stakeholders' meetings. Commune-level sites then were selected for more refined studies, based on their representativeness of the district's diversity.

2. Study of the agricultural systems dynamics over the last five decades through open interviews with key local informants (elderly, officials, etc.).
3. Spatial dynamics were studied through interpretation of aerial photographs (1983, 1989) and satellite images (SPOT 1990, Landsat TM 1994, SPOT 1995 and 1998).
4. Finally, on-farm surveys were conducted with 300 households representative of the diversity observed in the previous stages. Semi-structured interviews were used to investigate farming system strategies. The analysis resulted in (i) a typology of the current farming systems strategies and (ii) a trajectory tree displaying the differentiation process among households under the successive land policy reforms.

The monograph study resulting from this research shows that land use systems are driven by people's needs and strategies, which were affected by a rapidly evolving socioeconomic environment. One important outcome is related to the interactions among livestock – crops – forest systems at the watershed/village level and its impact on agricultural sustainability (Castella et al., 2001). Interactions between livestock management and cropping practices in the uplands illustrate the problems arising from poor coordination between groups of farmers pursuing different strategies. Many households could accumulate capital in the 1980's thanks to the rapid expansion of shifting cultivation systems. They invested in buffaloes, which were considered as living savings because private markets did not exist within the socialist economy. Livestock herd grew rapidly (Figure 1). Buffalo distribution to households that came together with the decollectivisation of production means led to dramatic changes in animal husbandry practices (Eguienta, 2000). For the *Tày* households, whose farming systems mainly relied on lowland rice cultivation, mobilizing a family member every day of the year to take care of a few buffalo became a real burden. Thus most *Tày* let their buffalo roam in the uplands to graze in pastures and forest during most of the year, when animals were not needed to plough. They would check the status of their herd once a week or every two weeks. In contrast, the *Dao* typically assigned buffalo surveillance to a child or an elderly year-round, except some period during the winter. Because their agricultural production relied mainly on slope cultivation, the *Dao* required surveillance to avoid animal damage to the upland crops. But the number of conflicts between *Tày* and *Dao* villagers has multiplied in recent years because of crop damages by roaming animals. Livestock owners usually have to compensate crop owners for production loss. But sometimes victims took justice into their own hands, and animals were found killed or injured.

In order to avoid losses caused by roaming animals, *Tày* farmers started protecting their upland plots: (i) they installed bamboo fences and dug

ditches around their fields, (ii) during the entire crop cycle, they lived in a temporary hut close to their field to keep an eye on their crop, (iii) they planted crops in areas not accessible to livestock. But *Dao* farmers could not protect their upland plots in those ways. Most upland fields cultivated by *Dao* farmers were scattered and of big size, because the traditional *Dao* farming system is based on four years of cultivation followed by three to ten years fallow. The time that would be spent to fence these fields would make their extensive system unprofitable.

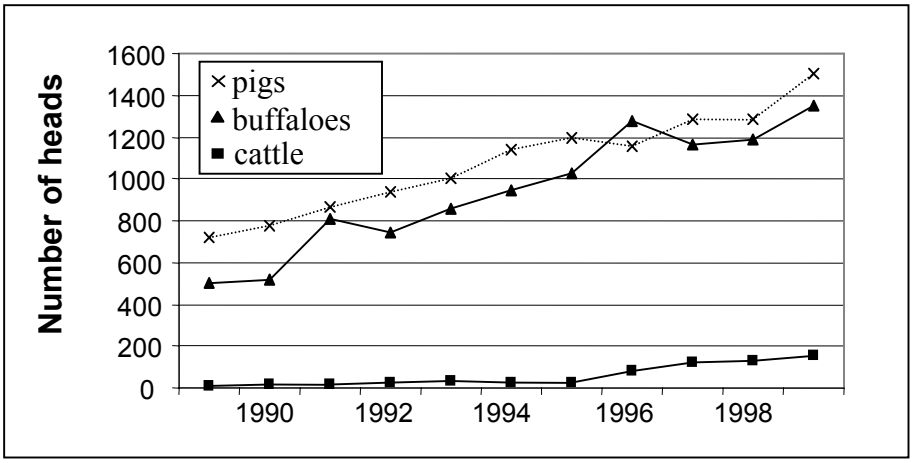

Figure 1. *Changes in abundance of livestock in Ngoc Phai commune, Bac Kan province*

Source : Statistical department of Cho Don district, Bac Kan

Fencing is now a necessity for those farmers, *Tày* or *Dao*, who build terraces or who establish intensive short-fallow upland fields close to the village. Beside directly damaging established upland crops or crop seedlings in regenerating forest, Husson et al. (2001) have shown that livestock shuffling degrades soil, reduces fertility regeneration during fallows, and reduces upland rice yields. The combined degradation of soil physical and chemical properties due to compaction strongly reduces root growth and thereby reduces drought resistance of the whole plant (Figure 2). Technical innovations have been proposed to restore heavily degraded soils and produce enduring increases in upland rice yield (Husson et al., 2000). The innovations include mulching, direct seeding (planting crop seeds directly into established cover crops), and no-tillage systems. Besides improving management of fallows and annual crop production, these innovative cropping systems can provide fodder for livestock and thus decrease the grazing pressure in the uplands. In the longer term, these new cropping systems could be associated with the introduction of perennial crops. But

social control is even looser on forest or tree-crop plantations than on upland crops. Therefore, roaming animals also can be considered a major obstacle to the development of agroforestry systems. When damage occurs on an upland rice field, the animal owner has to pay for the loss. But when animals destroy a tree plantation, the plantation owner is blamed for not having protected his or her plot. Nonetheless, upland fields need to be protected against roaming animals for the innovative cropping systems to succeed.

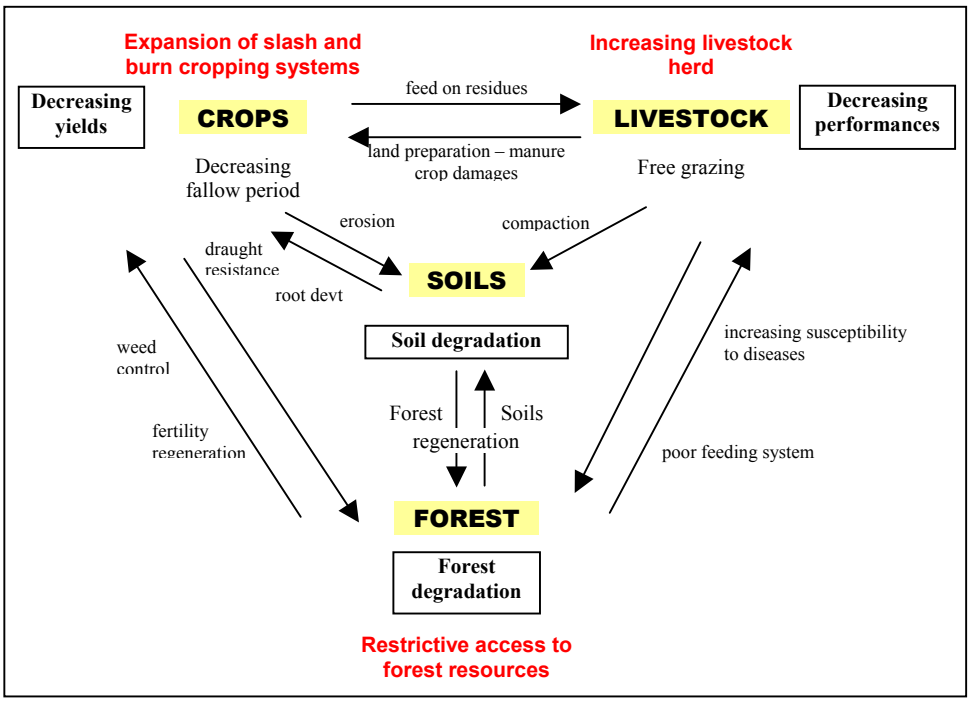

Figure 2. *Interactions among crop – livestock – forest systems*

Outside the uplands, crop production also is becoming difficult in the lowlands, because of the lack of community control over free grazing. Farmers have to fence their plots with bamboo to avoid crop damage during the winter. In some villages, roaming animals also hamper the development of spring rice.

Change in livestock management systems has thus become a prerequisite for agricultural intensification and diversification in the studied area. Observed at the watershed – community level, the current agricultural system seems to be merely the sum of the uncoordinated strategies of different household groups. Successive changes in the rules defining household access to natural resources profoundly transformed traditional community-based natural-resource management. Nowadays, the main strategy for managing natural resources seems to be restrictions imposed by individual landowners on

livestock access to specific land units. The success of such strategy depends on the capacity of each household to enforce their individually imposed regulations.

The land use analysis showed that the viability and productivity of the current agricultural system depend to a large extent on the spatial organization of the crop, livestock, and forest sub-systems at the watershed level. A computer model, called SAMBA and fully described elsewhere (Castella et al. 2000), was designed to mimic individual management of natural resources and the resulting impact at watershed – village level on land use and local institutions. This model was parameterized based on the data collected during the land use analysis stage. It has been used to test the main hypotheses derived from field studies. For example, it helped explaining the impact of rules for distributing lowland to households in the early 1980's on the land use in the uplands during the same decade (Castella et al. 2000). This simulation platform made it possible for a group of scientists from different disciplines and backgrounds to better understand past, poorly documented land use change.

Though it met researchers' expectations, this computer simulation tool had to be made accessible to local stakeholders to formulate their problems, to build scenarios themselves and to define pathways towards concrete action. From an exploration of the past, the tool had to evolve toward exploring future scenarios. It became clear that major changes in the local institutions and rules would be necessary to induce changes in land use patterns. A two-ways communication support between scientists and local stakeholders could facilitate this collective process towards more sustainable NRM practices. We converted the computer simulation model into a role-playing game.

3. Towards a new approach based on role-plays

3.1 Description of the game[1]

The **village environment** is made of a game board composed of 1600 wooden cubes. Each cube corresponded to an area of 1000 square meters. Each of the 6 cube faces was painted with a different color representing different land uses. Paddy fields were represented in red, upland rice fields in yellow, shrub-fallow in blue, poor-quality forest in light green, good-quality forest in dark green, and residential areas in black (Figure 3).

[1] In this document, we use the term "game" to designate the equipment used and the rules followed in the "role-play", which in turn designates the whole process including the players, observers, and facilitators.

Figure 3. *Photograph of the game board*

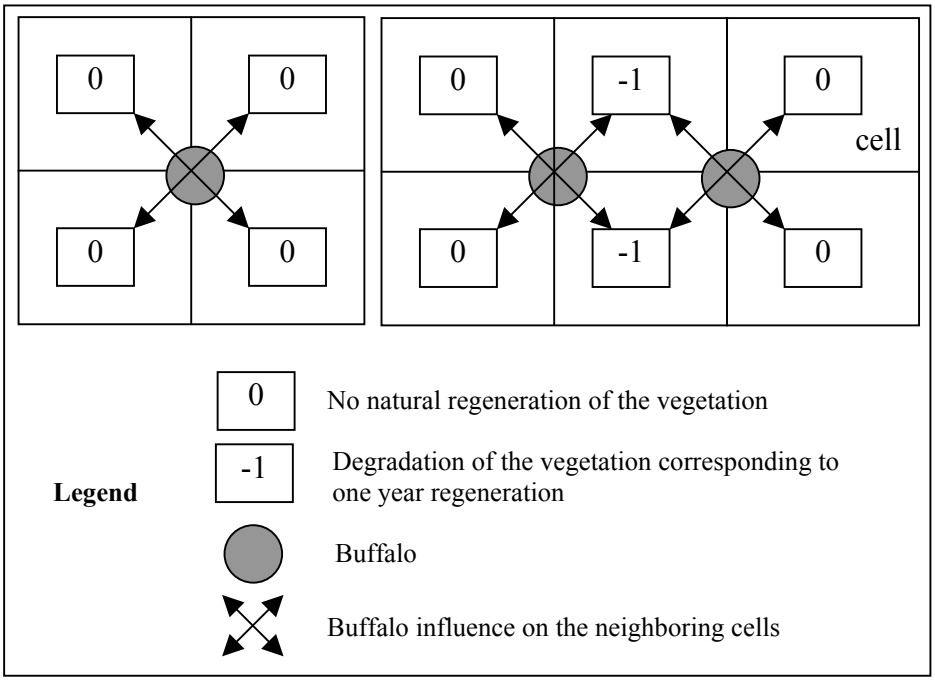

Figure 4. *Rules applying to buffalo impact on the land cover*

Wooden chips symbolizing buffaloes could be laid on the cubes to locate them in the village space. In the absence of buffalo, land cover regenerated each year according to the following rules: upland crops were followed by four years of shrub, then four successive years of poor-quality forest before reaching the status of good-quality forest. In real life, soil quality (and therefore potential crop yields) is directly proportional to the number of years of forest regeneration (Husson et al., 2001). Buffaloes, located at the intersection of four cubes (plots), inhibited the natural regeneration of their cover (Figure 4). If two buffaloes had an influence on the same cube, then the land use status was decreased by one point (Figure 4).

Households. Ten participants took part in the role-play, each representing a household. At the beginning of the role-play, each player drew cards defining the resources endowment of their virtual household:

– The "household" cards determined the composition of the family in terms of labor force and number of mouths to feed. Indirectly, the "household" cards also determined the family's food requirements, set at 300 kg paddy/year/person.
– The "paddy field" cards numbered from 1 to 3 were used to distribute from 1 to 3 lowland plots of 1000m^2 each.
– The "buffalo" cards numbered from 0 to 3 were used to distribute from 0 to 3 buffaloes to a player.

In addition to these cards, which characterized the different households, a "land card" was associated with each cube to monitor the status of each piece of land: its successive land uses and which of the players (if any) was using it. The facilitators were responsible for updating each "land card" at each time step.

Time steps. Each time step represented one year, divided into two seasons:

– During the summer season, the plots could be cultivated and buffaloes were necessary to plough lowland rice plots;
– Land was not cultivated during the winter and each household had to select grazing areas for any buffalo that they own.

At each time step, each player decided how to allocate his or her household's labor force to different tasks according to his or her lowland endowment, number of buffaloes, and food requirements. Following is a non-exhaustive list of possible tasks that players could decide to implement:

Tactical tasks (i.e. that could be implemented on a regular basis)

– Grow paddy rice in the lowland (required 1 buffalo and 1 labor unit per 1000m^2 plot)

– Buffalo surveillance during summer season within a one-day walk around the village. There was no limit on the number of buffalo that one person could take care of, but big herds (more than 5 heads) had to be managed by an adult person. During the winter, buffalo surveillance did not require labor input as livestock could be left grazing freely.

Strategic tasks (i.e. requiring land use conversion)

– Open new upland fields to grow upland rice. The player had to choose the number of plots to open as constrained by his or her available labor force (one unit of labor force could grow 4.000 m^2 of upland rice) and the location of his or her new fields on the board.
– Convert lowland paddy fields from 1 cycle (1 harvest/year) to 2 cycles. In that case, the required labor force for one plot shifted from 0.5 unit/year to 1 unit/year.
– Open new paddy fields and choose their location on the board.
– Grow fruit trees in the uplands. As for upland rice, the player had to select the location of fruit tree plantations on the board. Fruit trees were less labor-intensive than upland rice; for fruit trees, one unit of labor force could grow 5 plots (5.000 m^2) per year.
– Buy buffaloes from the facilitator at a price of 1000 kg paddy/buffalo, or from other players at a negotiated price.

The ability of the different household members to accomplish a given task depended on their age. Children and elderly accounted for half a labor unit each and therefore could be used most efficiently if assigned to livestock surveillance tasks.

Agricultural production. At the end of each turn, once each player had completed the previous steps, the facilitator distributed "equivalent rice coupons" to each player, representing the production of the player's various crops:

– For paddy fields, the production was fixed at 400 kg paddy/1000m^2/year for a 1-cycle field and 700 kg paddy/1000m^2/year for a 2-cycle field.
– For fruit trees, the production was fixed at the equivalent of 900 kg paddy/1000m^2/year from the fifth year of cultivation onwards.
– For upland rice, the production depended on the forest type and the number of cropping cycles (Table 1).

After each round, the facilitator also collected from each player the food consumed by the player's family (300 kg paddy / person/ year).

Buffalo herd reproductive performance and mortality depended on the kind of livestock management chosen by the player. For example, the facilitator

increased mortality rate when a child took care of a very big herd or when the animals were left grazing for a long time on a poor environment (shrub). Female buffaloes gave birth to one calf every two years.

Table 1. *Upland rice production (kg/1000m^2/year) according to the type of preceding land cover and number of cropping cycles. Based on data from Husson et al. (2001).*

Years of upland rice production	Preceding land cover		
	Good-quality forest	*Poor-quality forest*	*Shrub*
1	150	90	50
2	120	60	0
3	80	0	0

3.2 Organization of the role-play

Selection of the participants. Selection of players and observers was guided by a survey conducted in Ngoc Phai commune during the same year. Through this study, focused on livestock – agriculture interaction issues, a number of household strategies had been identified as well as farmers representative of each strategy (Eguienta, 2000). Seven persons of Phieng Lieng village were selected as "household" players, comprising six men and one woman. They all knew the commune well, from various perspectives: one was the commune doctor, and six were farmers of different ages and wealth levels. Several observers were also present, but were not allowed to intervene during the role-play. Among them was the commune forest warden, the chairman of the Peoples' Committee, and the persons in charge of agriculture and land administration services at the commune level. The role-play session presented in this paper was organized in the meeting room of the commune Peoples' Committee on August 23, 2000.

Sequence of play. At the beginning of the session, the team facilitating the role-play introduced itself. It was composed of (i) a facilitator, whose main role was to inform the players about possible choices without influencing them; (ii) a production accountant, who computed family production, made sure that player choices were permissible, and distributed the "equivalent rice coupons" to the players at the end of each time step; (iii) an environmental accountant, who monitored the changes in cell land use; and (iv) a reporter, who wrote down all interactions and internal discussions among players and with the facilitation team.

The facilitator explained to the players the game, its objectives, and basic rules. The players then drew cards to determine their family structure, paddy field and buffalo endowments. They introduced their virtual family and

resource endowments to other players. Then, the role-play started with players one by one deciding about their strategies with the help of the facilitator. After seven rounds (representing seven years), a debriefing discussion allowed all participants to share their thoughts about the experience.

3.3 Results of the role-play

Initial status. Households' resources endowments resulting from the random card draw are displayed in Table 2. The game board represented a village residential area, located at its center, and surrounded by an initial land cover resulting from a random combination of good-quality forest, poor-quality forest, shrub. Players first chose the location of their paddy fields near the residential areas.

Table 2. *Situation of the players at the beginning of the role-play*

Player	Number of household members	Number of labor force units	Ratio labor force / household members	Paddy field area ($1000m^2$)	Number of buffaloes
A	5	2	0.40	2	1
B	4	2	0.50	3	3
C	4	2	0.50	1	3
D	5	2	0.40	3	0
E	3	2	0.67	2	3
F	5	4	0.80	2	0
G	4	2	0.50	2	0

First round. Different players realized that they were constrained from growing two-cycle rice on their paddy fields by their shortage of family labor force (***B*** and ***D***) and/or buffalo (***A***, ***D***, ***F*** and ***G***). Labor force shortage was the main reason given by players to justify why they practiced one-cycle rice on their lowland plots. Interactions among players started even during the first round, when some players decided to borrow or to rent buffaloes from others. Player ***C*** wanted to sell one of his buffaloes to buy a paddy field. But none of the players had enough money to purchase a buffalo at this stage of the role-play. Players who could not cover their food needs from the lowland cultivation and had enough family labor force (***A***, ***C***, and ***F***) opened new fields in the upland. When choosing which upland areas to open, they selected mainly poor forest areas: 9 plots (of 1.000 m^2 each), against 2 plots in rich forest and 2 plots in shrubs. Players ***D*** and ***G***, who unlike the previous three players did not have enough labor force to open upland fields, had to

borrow rice from player ***E*** and from the "bank" (role-play facilitator) at the end of the first round to cover their food needs. Livestock management was quite homogeneous among players. During the summer, buffaloes were grazing close to the village under surveillance of a child. During the winter, they were roaming freely in the forest. An adult would look for them once every week to ten days to check their status and to prevent them from roaming too far from the village.

Second round. As yield decreased in the upland plots cropped for the second year, the players who did not open new upland fields during the second round could not cover their food needs at the end of the second round. Livestock management did not change. Mutual help developed between players ***B*** and ***F*** in that ***F*** borrowed a buffalo from ***B*** in exchange for working in ***B***'s paddy fields.

Third round. The facilitator announced that due to exceptionally favorable weather the paddy yield was increased by 100 kg per plot. This enabled all players to cover their food needs and some could generate a surplus. However, more than half of them still relied on upland crops and three of them had to open new plots from poor forest. The players decided that they wanted to elect a village head. Player ***A*** was selected because of "his widely recognized wisdom and technical skills".

Fourth round. The main changes that occurred concerned livestock. Player ***C*** wanted to sell a young buffalo, but the other players either already had their own buffalo, or could not afford the requested price (250 kg rice). Player ***F*** finally bought it by paying half the price in cash and promising to pay the other half after selling rice the following year. Player ***C*** exchanged one buffalo for one of ***D***'s paddy plots. Players ***B*** and ***C*** sent their buffaloes to graze in rich and poor forests because "there is more to eat" while ***E*** sent his buffalo to an old fallow because "grass had enough time to re-grow". ***A*** kept his male buffalo at home because "it is safer and easier to manage". He said he would cut some grass around the village to feed his buffalo.

The village head stated that "roaming animals are harmful for regenerating forest and, in addition, poor fodder resources in shrub / regenerating forest have a negative impact on animal health status". Everyone agreed to send the buffaloes alternately (in summer and winter) to two collective pasture areas designated by the village head. Further, the village head requested the villagers not to deforest anymore to increase upland crop areas, except in special cases. He also promoted the introduction of a new rice variety that would increase the lowland rice production to 800kg per year with two cycles.

Fifth round. The facilitator announced the death of three buffaloes from an epidemic. This epidemic motivated players to discontinue following the

rules established by the village head regarding the use of the officially designated pastures. The village head explained that the disease had had heavy consequences because of the poor nutritional status of the animals. Therefore, he advised players to (i) intensify paddy production through introduction of the new high-yielding variety, (ii) vaccinate their buffaloes, and (iii) temporarily stop bringing the herds to the summer pasture to let it recover from overgrazing.

But players did not follow the last part of his advice. Instead, the epidemic triggered the emergence of four different livestock management strategies:

1. As before, player ***A*** kept his buffalo at home all year long and grew fodder crops.
2. ***B*** brought his buffaloes to pasture no. 1 as instructed by the village head.
3. ***E*** let his buffaloes graze in pasture no. 2. Both ***B*** and ***E*** requested the village head to enlarge by 20.000m^2 each of the common pastures.
4. Player ***F*** took his animals to the same pasture as ***B*** during the summer but kept his herd at home during the winter.

Despite the livestock problems, most of the households could generate production surpluses thanks to increasing yields in the lowland and increasing labor force availability. Some of the children family members had reached the working age after five time steps. However, player ***F***, who could not cover the household food needs from the paddy fields, requested and obtained from the village head the authorization to open two upland crops plots from poor forest.

Sixth round. Player ***B*** proposed relocating the common pastures to other, larger areas. The village head requested and received authorization for this move from the community.

Seven round. Player ***G*** finally had enough rice surpluses to purchase a buffalo from ***C***. Player ***F*** again opened three upland crop plots from poor forest. Player ***E*** decided not to let his buffalo herd graze in the common pasture during winter because he feared diseases spread through the pasture. Players ***A***, ***D***, ***E***, ***F*** and ***G*** kept their animals at home during the winter and close to the village during the summer season. The players' situation after seven round is summarized in Table 3.

Debriefing session. This very important stage in the role-play sequence aimed at collecting the reactions of the players after a whole day session. Only the main points of the discussion are reported below.

Table 3. *Situation of the players after seven rounds of play*

Player	Number of labor force units	Paddy field area (1000m^2)	Number of buffaloes	Capital accumulated (equivalent rice)
A	4	2	1	700
B	2	3	7	3970
C	3	2	7	2600
D	2	2	2	360
E	2	2	9	4640
F	4	2	2	540
G	2	2	2	350

The first question asked to the players was: *Was the role-play similar to the reality of their own village*?
All players agreed that they found the game very consistent with their reality and that it helped them learn about the organization of crop – livestock – forest interactions at the village level.

What is missing in the game that would make it more closely resemble their reality?
Players replied that agricultural diversification options were missing, such as poultry, pigs, or fish on the animal husbandry side. Another missing option was to intercrop annual crops within a developing perennial cash crop. By selling the annual crop production, farmers could offset part of the cost of establishing a perennial cash crop. Players insisted that all components of the farming system are highly interwoven and to them it seemed a bit artificial to consider the components separately from each other.

In the game, players selected mainly poor forest when choosing where to open new upland fields. In reality, do villagers choose only poor forest to open upland fields?
Two players described their own practices on upland fields based on successions of upland rice, then maize intercropped within young fruit tree plantations. They stated that they do not have access to rich forests anymore as they are very remote, and the government forbids clearing them.

In reality, is there an exchange of labor force between households?
Players emphasized the similarities between what happened during the role-play and their real behavior in terms of mutual help and hiring labor for specific tasks such as land preparation, rice transplanting and harvest.

Then, the discussion came to the livestock management problems that the players faced during the role-play.

Players agreed that buffalo accumulation patterns during the game were similar to reality and that current livestock management systems are causing problems. Buffaloes and to a lesser extent cows are relying on shrinking fodder resources. This tends to limit livestock development and put pressure on the environment (direct damage to crops and forests, poor forest regeneration, etc.). On the other hand, players stated that livestock herds in the village are relatively small (from 5 to 10 head per household), and therefore do not yet cause extensive damage. Further, livestock herds serve as an essential money saving system for many households. They sell buffalo whenever they want to invest in house building, wedding, funeral ceremonies, or even to send their children to school.

In reality they also have two common pasture areas that were established in 1992, after the first round of forestland allocation. But with the increasing number of animals relying on the same resources, the mortality rate of young buffalo is increasing during the winter season. Thus, they explained, during the role-play they felt the need to have common regulations imposed by a higher management level. That is why they proposed to elect a village head. They felt that the village head plays a key role in designing and implementing new rules. A person who failed in this crucial aspect of his or her function would not be re-elected. They pointed out that the real problem lies in the coordination between households for livestock management.

They knew about on-going research on improved fodder and cover crop systems conducted by the SAM Program within their commune (Husson et al., 2000). But they wondered how they could coordinate among themselves to allocate their labor to common tasks, given that each family has a different number of buffaloes. At the end of the discussion, the "virtual village headman" said that they could gain good awareness about the problem through the role-play. But they would need more consultation among themselves and with the village advisory committee before reaching a consensus about the policy to be developed to adapt the technical innovations proposed by the program to the villagers' perspective.

3.4 Interpretation and discussion

Key role of lowland rice in farmers' strategies. Different strategies emerged among players depending on their initial resources endowment. The role-play clearly indicated that lowland rice production is central to farmers' strategies. Their first objective was to meet their food requirements through paddy field cultivation (Figure 5). Whenever buffalo availability limited the cropping intensity or the number of cropping cycles in the lowland, farmers would find a way to borrow a buffalo from a relative or to rent from a neighbor (e.g. ***D*** rented a buffalo from ***C*** until he could buy his own buffalo at the sixth round; ***F*** rented from ***B*** for the two first rounds and then

contributed labor to ***E*** in exchange for a buffalo ***E***. Farms lacking labor force started hiring workers from other households, as between ***E*** and ***D*** from the fourth round onwards.

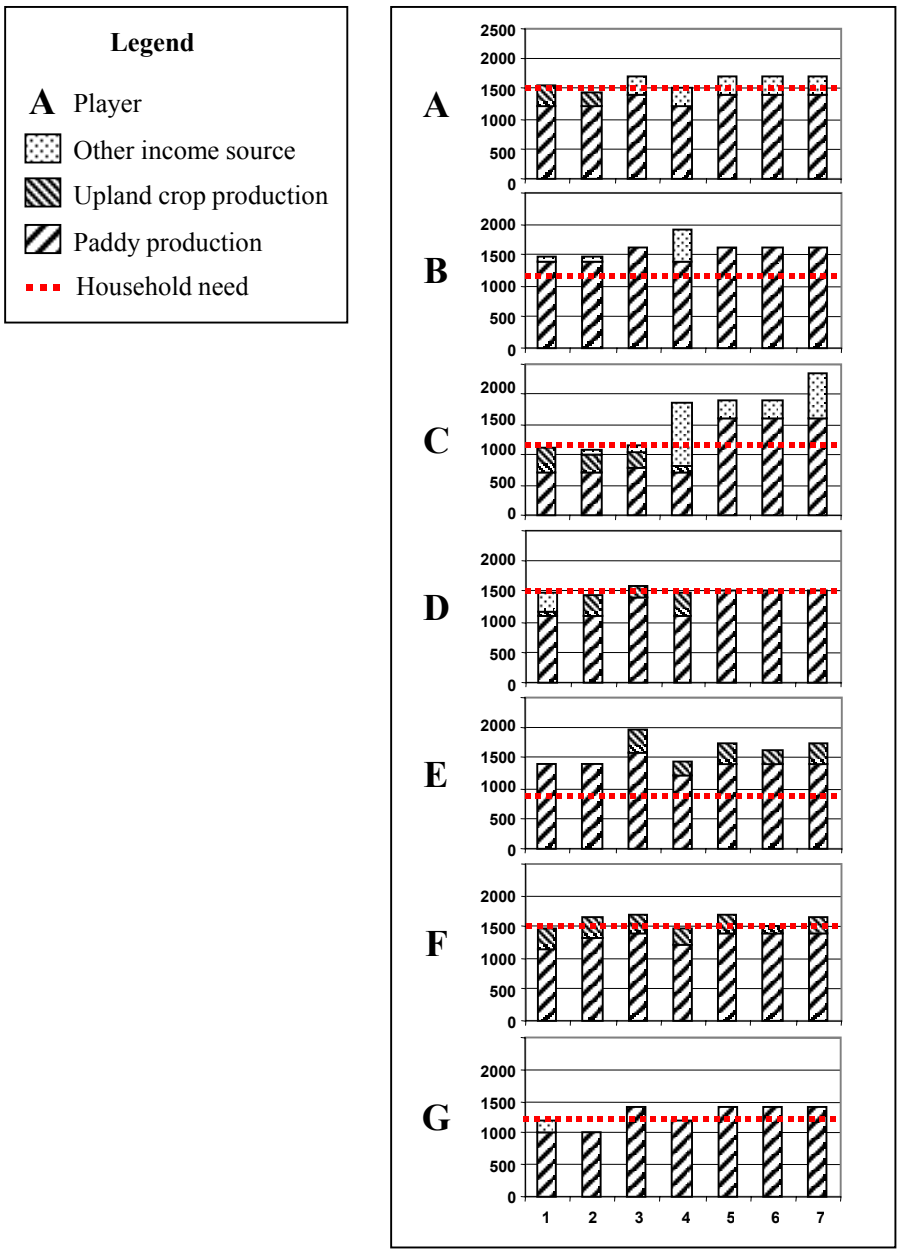

Figure 5. *Players' income and number of buffaloes during the course of the role-play session in Ngoc Phai commune, Cho Don district, Bac Kan province*

None of the farmers who had lowland surpluses relative to their cropping capacity were willing to rent their surplus land to farmers who lacked sufficient paddy land. Instead, farmers chose to keep their surplus land idle. For example, players ***B*** and ***D*** each kept one paddy plot idle, instead of renting the plots to other players with available labor force. At the fourth round, ***D*** traded his surplus plot to ***C*** for a buffalo, but ***B*** kept his surplus plot idle for all seven rounds. Such decisions reflect the very high status of lowland rice plots in farmers' consideration.

Upland crops. Only the players who could not meet their food needs from lowland rice cultivation opened upland fields (Players ***A***, ***C***, ***D*** and ***F***, Figure 5). All of them computed how much rice they needed to complement their lowland rice production. Then, this figure guided their choices in the number of plots to open and from which forest quality to exactly meet their food needs. But restrictions imposed by the authorities on the opening of new forest plots favored the development of off-farm activities (player ***A***'s said that "his son got a job in a small cottage industry in the neighboring commune") and the decrease in upland crop production as soon as intensification in the lowlands (through buffalo renting, mutual help and new rice varieties after the fifth round) allowed self-sufficiency (players ***C*** and ***D***). Player ***F*** had to rely on upland crops throughout the role-play to meet his family's food needs. On the other hand, player ***E***, whose lowland rice production sufficed to meet his family's food needs, started cultivating upland crops in the third round as a capital building strategy. Player ***G***, who was neither rice self-sufficient from the lowland nor had enough labor force to open upland fields, had to borrow rice from other players.

Interaction between upland crops and forest. With the exception of player E, most of the players were very respectful of forest regulations and usually opened the minimum area necessary to meet their production objectives. During the discussion, they confirmed that this was their strategy in their real life but also admitted that this had not always been the case. They stated that in the 1980's they relied heavily on the upland crops (rice and maize) to meet their food needs and also to accumulate capital. This led to rapid deforestation, which explains why the only remaining rich forests are very far from the village.

Livestock management strategies evolved throughout the role-play as the increasing number of buffaloes increased the pressure on the fodder resources. We first observed a quite homogeneous strategy similar to the one commonly practiced by *Tày* farmers in the area: buffaloes graze under the surveillance of a family child during the summer period and are allowed to roam freely during the winter with a visit from the owner once every 7-10 days (Eguienta, 2000). After player ***A*** became village head (round 3) he changed his buffalo management strategy and kept his buffalo at home during the winter to set an example. However, as households with big herds

could not change their management, the village head decided to establish new regulations: farmers had to confine their animals to the two official pasture areas. All households complied with the rules until an epidemic occurred that triggered the emergence of four different livestock management strategies. However, it was clear from the role-play that livestock management practices depended to a large extent on the role assigned to livestock in the production system. Small buffalo herds mainly devoted to land preparation could be kept close to the farmer's house during the winter whereas big herds mainly considered as "living capital" were allowed to graze freely at the periphery of the village.

Emergence of coordination among players. One very interesting feature of the role-play was the observation of informal exchanges and coordination, and then emergence of more-formal local institutions. Players constrained by their resource endowment sought help from other players. They started renting buffaloes (***D*** and ***F***), then hiring people from other families (***E***) or borrowing rice (***F***). As early as the second round, mutual help started with the son of player ***G*** taking care of the buffaloes of ***E,*** and ***F*** exchanging family labor with ***E*** for buffalo labor. Then a local institution emerged with the election of the village head and the regulations that he rapidly proposed to overcome collective issues related to livestock management.

About the process. We consider the role-play process itself to be a very important result. It was captured through video recording. By comparing different role-play sessions we expect to better understand (i) how people actually make decisions, (ii) the events that trigger changes in players strategies, (iii) the conjunction of factors that can steer a collective process toward one decision or another, and eventually (iv) how local institutions emerge.

4. Conclusions and perspectives

Having experienced the limitations of current development practice, including:

i The heavy atmosphere and the pre-cooked discourses of "official" stakeholder meetings,

ii The shopping list of PRA outputs in the form of "*we need this, we lack that*" that most of the time are beyond the scope of the R&D projects,

iii The limited relevance of standard tools for mobilizing local knowledge in an extremely diverse and rapidly changing environment, we thought there was need for a new kind of participatory tool. PRA builds upon local stakeholders' worldviews whereas land use analysis stresses scientists' perspectives. The SAMBA computer model provides a tool for interdisciplinary teams of researchers to integrate knowledge and to reach

a common representation of the systems they study. Besides, the SAMBA role-play provides a common platform for two-ways communication between scientists and stakeholders.

The role-play should be seen merely as one addition to the toolbox of useful participatory methodologies. It will not take the place of other methodologies but will complement them as part of a participatory diagnosis – intervention process. The role-play methodology is still at an initial phase of its development and its documentation. But beyond any specific methodology, we would like to draw attention to the importance of attitude. We call on researchers to change their attitude from one-way learning to two-way communication. And we believe that the role-play methodology can help bring about this transformation.

The SAMBA role-play, as presented above, has been developed to tackle broad natural management issues in a particular environment: the northern Vietnam uplands. It has been designed for use at the village level because ultimately, *it is communities that manage natural resources*. Indeed, the village level often coincides with a small watershed, which is an inherently useful scale for natural resources management (Castella et al., 1999b). When applied to many villages and player groups, the role-play will give different results with both local and regional relevance. The repetition of the exercise will help to differentiate between the two levels of knowledge. It will allow refining the diagnosis and defining its domain of validity. In this sense, the role-play can be considered as a **research tool**. Theories and hypotheses can be developed and tested in the virtual laboratory of the role-play (Barreteau et al., 2001). There is no risk to participants, as their decisions and actions do not have any impact on reality.

Nonetheless, participants in the role-play can change their perception of reality. Thus, the role-play can be used as a **training method** to help participants formalize their knowledge in a more structured, holistic way. At the same time, participants may become better able to communicate with other stakeholders because they all have "lived through" the same learning process. The role-play can also be useful as a training method (i) to sensitize local stakeholders about the impact of individual actions on the whole system, (ii) to facilitate the diffusion of technical and organizational innovations, and (iii) to help communities define their own pathways towards more sustainable natural-resource management.

Lastly, a role-play session provides a very powerful **communication platform** for exchange between scientists and local communities. Both groups build together a common story, a common outlook that they can then use as a basis for discussion. During the role-play process, scientists and local communities learn about each other, which is arguably the most important prerequisite for truly participatory development.

In summary, role-play can enable researchers to learn from local communities (research tool), enable local people to learn from researchers (training method), and enable both groups to learn from each other (communication platform).

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