For the weak point in the catchment:

- Bamboo hedgerows prevent erosion better than *Acacia mangium* and *Tephrosia candida* hedgerows.
- Improved fallow of *T. candida* (2 years) in rotation with cassava (2 years) prevents erosion better than bamboo hedgerows intercropped with Cassava

For the strong point in the catchment:

- Trees conserve water for the whole catchment.
- Acacia and bamboo species are better than weeds/short natural fallow and monocropping at water conservation.

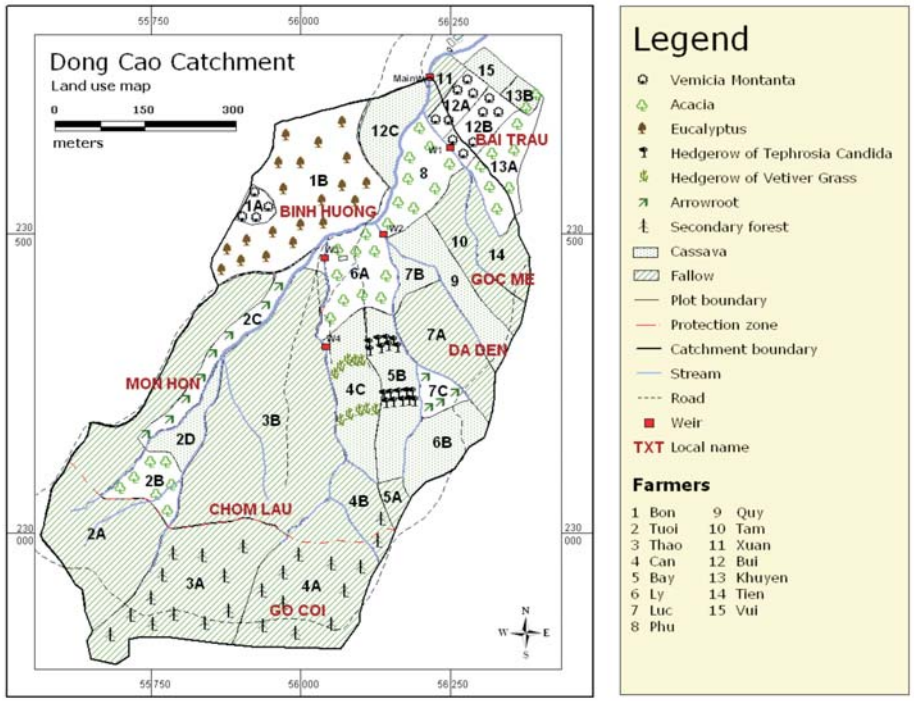

Figure 4. Simple GIS map of Dong Cao catchment with local names of the fields and list of owners.

References

(http://www.worldagroforestrycentre.org/sea/Publications/index.asp)

Fagerstrom MH, van Noordwijk M and Nyberg Y. 2005. Development of sustainable land use practices in the uplands for food security: An array of field methods developed in Vietnam. Hanoi, Vietnam. Science and Technics Publishing House. 58 p.

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PARTICIPATORY LANDSCAPE ANALYSIS (PaLA)

The multifunctional landscape and its stakeholders

Landscapes change in response to what people do to make a living and to live their lives as best they can, constrained by economic opportunities, knowledge and lack of collective action and joint decision making about, and implementation of, spatial planning. Global population growth, local migration and increasing wealth exert pressure to convert forests to agricultural, industrial or residential land. The diversity in physical and socio-economic conditions in the uplands requires new sustainable land use options for obtaining food security and for environmental protection. Involving multiple stakeholders in the analysis of the tradeoffs between short and long-term benefits and drawing upon their perspectives and knowledge are considered essential in the development of sustainable land use. Furthermore, farmers' knowledge of landscape relationships and their perceptions of an underlying logic play an important role in their management decisions. Development of sustainable land use practices at farm and landscape levels depends on bridging the various perception and communication gaps.

Landscapes and livelihood issues as the focus of debate

Land use at plot level is linked to land ownership or tenure, and is the primary source of harvested goods and income. What happens in one plot, however, also influences the flows of water, moist air, sediment, organisms (beneficial, detrimental and 'neutral'), fire and smoke/haze. The spatial pattern of land use and its relation to the underlying structure of the landscape determine the overall outcome for 'goods and services'. Land use planning is normally the basis for local regulation of who is allowed to do what where, but implementation usually falls short of expectations and the plans may not sufficiently reflect local concerns and knowledge.

Objectives of PaLA

PaLA was designed through packaging some appropriate Rapid Rural Appraisal/Participatory Rural Appraisal (RRA/PRA) tools/methods in combination with an approach of Agro-ecological analysis in order to capture local knowledge at relevant temporal and spatial scales. PaLA can be used in scoping studies and for awareness raising among community members on problems and issues connected with ecological and administrative boundaries. This is in order

(i) to articulate and study farmers' perception on the relationship between land use and landscape[1] functioning,

(ii) to understand farmer's management options and the actual choices made;

(iii) to understand the flows of water, sediment, nutrients and organisms and internal filter functions that determine landscape functioning[1] on the basis of the mosaic of land use practices and interactions between landscape units.

Following PALA as early diagnostic tool, further appraisals can follow up on issues of local concerns in, for example water flows, soil erosion, slope stability or agrobiodiversity, defined in a participatory manner.

[1] A landscape is a defined area of specific interest, with clear administrative and ecological boundaries

Steps in PaLA

PaLA consits of 8 steps, balanced between in-door and out-door activities:

1. Identification of ecological and administrative domains with clear boundaries (in-door and observation activities). This includes reviewing existing reports (bio-physical, ecological socio-economics, prevailing and future policies) and maps. The maps of concerns are topographical maps, land use maps, soil maps, administration maps. An internet search can yield hidden gems of information
2. Sampling of stakeholders to be interviewed, using questionnaire and/or ranking methods (in-door and observation activities). The selected stakeholders should be representative in terms of several criteria. They can be spatial location of their fields (for example in the upper slope, in the middle slope or in down slope areas), and wealth, and/or gender, and/or social, and/or ages, and/or experience, and/or education. The criteria of representativeness are selected on the basis of specific project purposes.
3. Formulation of the survey interdisciplinary group, planning and designing checklist and matching PRA tools (in-door and observation activities). Concepts and steps of PaLA are agreed upon by the team by using brainstorming technique.
4. Making village sketch/model (fieldwork activities) in order to identify the land use patterns and focus points in the landscape. The method used is semi-structured interviews with male and female groups. The expected output is a village sketch/model, showing local names of different areas, distribution of land use plots, and main features such as rivers, streams, mountains, roads, etc.
5. Transect walk (fieldwork activities) in order to get an understanding the soil-plant-water interactions along a landscape. The selected transect/s should have most of the land use types of the study area/s. The methods used are simultaneous transect walks and semi-structured interviews. The expected output are representative transects and sketches of the areas, locations of transects entered on map
6. Making timeline (fieldwork activities) for each land use type along transects or/and the fields situated in the representative areas of the study catchment or village, in order to study land use changes over time. The methods used are semi-structured interviews and timeline drawing.
7. Feedback meeting (in-door activities) in order to report findings to the farmers/stakeholders involved to get their feedback. The methods used are poster using visualised tools and group meeting.
8. Data analysis (in-door activities) using team work. Qualitative data of each PRA tool such as sketch transect, timeline, and secondary data is analyzed separately by different team members. After that, all findings are compared and cross-checked in order to get landscape patterns and issues.

Case study: Dong Cao catchment (Hoa Binh province, Vietnam)

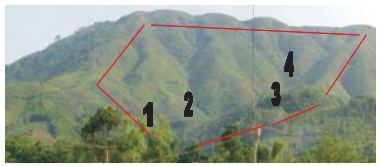

Figure 1. Location of Dong cao catchment, Hoa Binh province (Photo: Tran Duct Toan,

Dong Cao catchment (20^0 58' N, 105^0 29' E) is located in Tien Xuan commune, Luong Son district, Hoa Binh province, Vietnam. The site lies 60 km south of Hanoi. The area receives mean annual rainfall of 1500 mm, which falls mainly between April and September. Ferralsols and Acrisols soils consisting of clay loam to clay dominate the area. Most of the area has been converted to agricultural uses. Patches of secondary forest exist, mainly at higher altitudes. Cassava, corn, arrowroot and soybean form the major annual crops in the uplands and rice cultivation dominates the low lands. The slope gradient in the area is 15-60 percent. At an elevation of 200 and 600 m, the area is representative of the areas where 39% of upland ethnic minorities live in the low mountain zone of the Vietnam´s Northern Mountain Region. Two ethnic groups, Muong and Kinh are living in the study area.

PaLA was applied at Dong Cao catchment as a scoping study. During the PaLA survey, farmers' perceptions concerning current land use both in time and space, and visions for landuse change were investigated using a 3D village model, a village sketch with local names, transects and timelines. The issues found were used to develop hypotheses for the Local Ecological Knowledge (LEK) survey and simulation work. We started with the current land use and plot level (village sketch/model). Then we continued at landscape level (transect). For each plot, we looked back in history and forward to find farmers' visions for changes. Starting with simple questions such as What, Why, When and How, in-depth exploration followed in the open-ended interviews.

The research team consisting of three Vietnamese and three Swedish researchers and students worked in parallel in the field during nine days. Of those days, five were spent in the field together with 14 selected local farmers and four were used for indoor work (Figures 2 and 3). Brainstorming was the main tool for the team dynamics and interactions during the whole survey. All concepts, definitions and methods were discussed and agreed upon by the team members. Rapid Report, where all information obtained during the day was written in a structured form, was completed after each fieldwork day, to make sure that the information gathered was properly documented. The method and checklist to be used for the next day was also agreed upon. The open-ended interviews used were aimed at an equal partnership between the team members and the farmers involved. Feedback from the local farmers was asked for during the whole research process.

Figure 2. Team dynamics during the indoor sessions (*Photo: Dan Olsson, 2002*)

Figure 3. Transect walk (Photo La Nguyen, 2004) and village model (*Photo: Dan Olsson, 2002*)

The focus points in the landscape including the weak point, i.e. the sensitivity to erosion, and the filter, i.e. the strategic water supply area in the catchment were identified, both in the field and on maps. The characteristics of the filter and the weak point were described in the simple GIS map (Figure 4) and the timeline. We believe that land use scenarios developed for these two focus points in the catchment can make large on-site and off-site impacts. This was reflected in the farmers' knowledge gained during the PaLA: 'More trees in the sub-catchment (the filter place) cause higher amounts of water in stream'. Therefore the focus points were then subjected to a more in-depth study on Local Ecological Knowledge (LEK), which later helped to formulate hypotheses and explanations for the outputs of the modeling work.

Hypotheses were formulated, based mainly on the farmers' perspective and knowledge collected, and used for the simulation work. This was done in order to predict long-term soil and water conservation effects of tree-based land use options associated with a low cost, i.e. no need for long-term erosion measurements. Some examples of such hypotheses are:

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