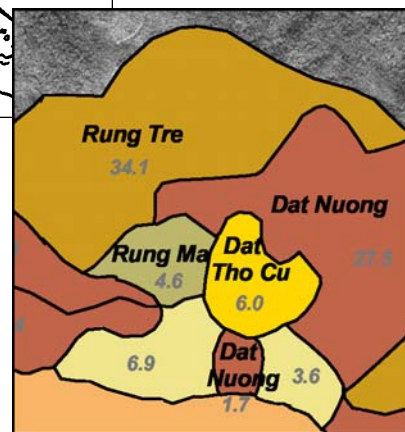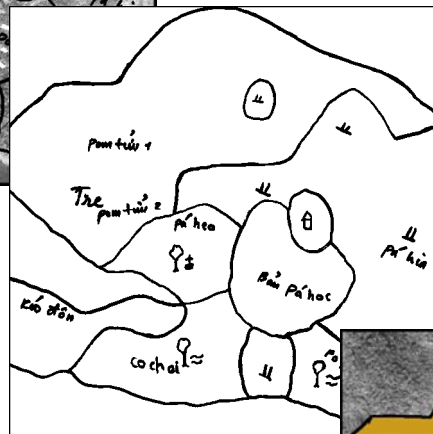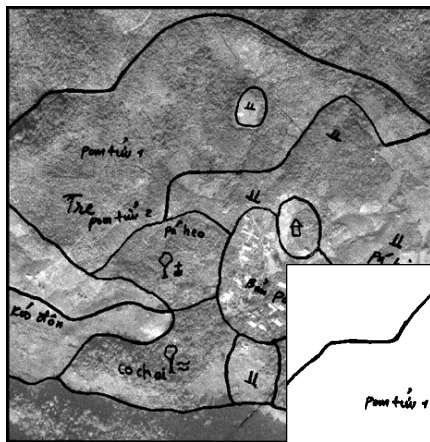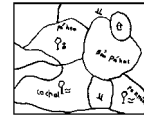# MANUAL ON PARTICIPATORY VILLAGE MAPPING USING PHOTOMAPS

TRAINER GUIDE

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Second draft, 30/06/2003 Son La

INTRODUCTION

What are Orthophoto-maps?

Photomaps are printouts of geometrically corrected (rectified) aerial photographs placed in a map coordinate system. The corrected aerial photos are called Orthophotos. Plotted Orthophoto-maps are the most accurate and economical remote sensing data for mapping purposes with large scale maps.They are easy to use and a non-literate tool to effectively engage farmers in discussions on natural resource use, planning and management.
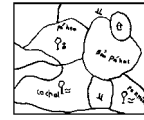
What is participatory photo-mapping?

Conventional approaches to obtain land use maps are usually conducted by outsiders who interpret remote sensing data without profound knowledge of local resource conditions. Limited field experience possibly results in inaccurate delineation and misinterpretation of land use classes.

The objective of participatory photo-mapping is to enable villagers to carry out the interpretation of aspects of their land resources, which are of significant importance to them. In this process villagers delineate their land use on transparencies laid over an Orthophotograph. The information on the transparencies will later be scanned or digitised and geo-referenced. Involving local stakeholders with their extensive field experience is expected to improve the accuracy and precision of obtained data.

Why participatory photo-mapping?

Orhtophoto-maps are an effective participatory communication tool on village level to:

- **visualize resource use** to facilitate discussions without communication barriers and to motivate participants to reflect and discuss about land issues;

- allow a **rapid identification of social, economic, and environmental problems** of the village by determining and debating issues related to natural resource use with active participation of the community;

- create a **common understanding** among local land users and administrative authorities on spatial distribution and status of resources and resource use;

- provide a basis for **joint and demand-driven decision-making** between different villages and between villages and state entities;

- acquire **accurate spatial data** on large scale on the basis of local knowledge;

- provide options for **participatory impact monitoring** for rural development investments from government and other donors;

- mediate and solve prevailing **boundary conflicts**;

- generate accurately scaled information on land use, that can be **officially approved** for management purposes.

PROCESS

Participatory photo-mapping is a process, which can be used to generate a series of outputs to be transferred into a Geographic Information System (GIS). Transeferred information permits for various ways of processing, analyses, and presentation and can be easily updated according to the specific objective. The process of conducting participatory photo-mapping contains the following steps:

1. Preparatory work

2. Field work

3. Data processing

4. Feedback to and from stakeholder

Each step is described in the following sections.

I. Preparatory work

❑ Collection of secondary information on natural resources and socio-economic data

❑ Village selection according to identified objectives

❑ Selection of participants, which should represent the whole village population in terms of gender, age and social status. Group size may range from six to 10 persons

❑ Orthophoto-map print-out, preferably in A0; scales depending on the desired level of detail and on local conditions, but ideally should be 1:5,000. Currently available orthophotos are from 1999/2000. They are referenced to UTM coordinates and the Vietnamese Date 2000 (VN 2000). A coordinate system, small crosses at the intersections of the map grid and a northarrow need to be printed on the orthophoto-map and the projection and map date should be indicated, as well as the the name of the village, the scale of the map and the date of the photo . Additionally, selected elements of the topographic maps such as main roads or rivers can be added, but only in areas with limited visibility like vegetation covered regions. For better orientation of technicians it is recommended to add main contourlines with very thin line symbols and elevation points. It is important to include the houses of users whenever possible, because this helps users to interpret photomaps and also gives them confidence that they are part of the community land to be discussed. Each aerial photo should be printed with an overlapping area with the neighbouring photos to facilitate correct merging of the photos on village basis.

❑ Transparency to place on top of the orthophoto-map print-out. . For present and planned land use different transparencies should be used, but the transparency for the planned land use should be fixed on top of the other one and the orthophoto-map. The outer boundaries of the orthophoto-map coordinate system have to be transferred to the transparencies for consistent future data processing

❑ Stationary: double clips (to temporarily fix the transparencies securely on top of the aerial photomap), permanent and white board marker in different colours
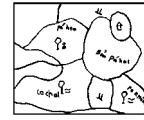
❑ GPS receiver can complement data collection of non-visible boundaries (e.g. future plans, ownership) and allows instant verifications of mapping results in the field as well as additional transect walks within an accuracy of 3-5 meter, thus is only recommended for measurements of plots > 10 ha

II. Village meeting

The village meeting can be scheduled from ½ a day to one day according to the motivation and specific interests of local participants. Participants should be clearly informed in advance about the topic to be discussed and the place and date of the meeting. The meeting point should be on an even surface with good overview of surrounding land resources. The facilitator has to ensure that all users have equal opportunities to participate in discussions and express their real expectations.

A short introduction should provide (i) sufficient information about the approach of participatory photo-mapping, (ii) a brief explanation of the techniques of aerial photography, (iii) the year and month of origin of the aerial photograph used and (vi) ensure enough opportunities to clarify remaining questions.

Whenever possible the facilitator should allow users to direct their own discussions. At the beginning participants should have sufficient time to get familiar with the photomaps. Orientation could be facilitated through the identification of the present location and the recognition of easily identifiable landmarks such as rivers, roads and residential areas. Mapping activities could start with important classes like paddy fields and ghost forests and with land types close to the village and on relatively flat terrain. The facilitator should inform villagers about the date (month and year), in which the aerial photos have been taken. They have to evaluate if land use changes occurred since than. Seasonal land use changes needs to be discussed as well.

Forest users are generally very skilled at interpreting photomaps and facilitators should be patient and allow users to conduct their own interpretation.

Users like to position photomaps in relation to a clearly visible landmark (like a road, a river, the edge of the forest). If such landmarks are difficult to find it is sometimes helpful if the facilitator correctly positions the photomap with the aid of a compass.

Often boundaries need to be re-adjusted during discussion. Therefore, villagers are supported with white-board markers, which can easily be wiped off in case of non-satisfying delineation. Villagers should be asked to draw slowly and carefully. After common agreement is reached correct boundaries can be fixed with permanent, waterproof markers. On the first transparency boundaries of the present land use situation should be drawn, while on the second transparency the planned land use should be sketched. The title should indicate the respective theme.

Land use classifications have to be discussed and explained carefully before land use types are being marked with agreed symbols. If non-standardised symbols are used, an accurate legend has to be attached for further data processing. Local names have to be used to identify localities such as hills and rivers. They should be written on the transparencies.
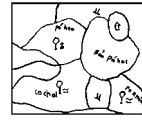
As the boundary map is part of a legal agreement it is important that the positions of boundaries are marked carefully and with agreement from all participants. Field checks should be carried out in the afternoon to check the information.

Note: The facilitator should spend more time listening than talking

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III. Data processing

To process village information with GIS software for future use in planning and management, the following steps have to be accomplished.

1. Preparation of transparencies :

After field work, data can be enterd into a GIS program. Therefore, the orthophoto-maps have to be handed over together with the transparencies to the responsible institutions. There are different options to transfer the data to the GIS. One option consists in on-screen digitizing of the information on basis of the orthophotos. This option does'nt require any special preparation of the transparencies. The second option is to scan the transparencies for data transfer. To enable a later spatial referencing of the scanned information, small crosses should be drawn (with a thin permanent pen) on the transparency at the intersections of the coordinate system gridlines of the photomap. These crosses will be used to align the scanned transparency to other reference information.

Further preparatory steps include the cleaning of the polygons on the transparency by removing breaks in the lines and erasing mistakes and unnecessary drawings. Polygons could also be closed on the outer boundary of the photomap to ease later digitising.

2. On-Screen Digitizing/ Scanning

A) On-Screen Digitizing

On-screen digitizing is carried out on basis of the digital orthophotos. The interpreter has to manually draw the boundaries on-screen by following the lines and shapes of the orthophoto on the screen. The advantages of this method are, that no scanner is required and that the results from on-screen digitizing are data in vector format. Since this is the finally required data format, no further conversion between vector and raster data (resulting format from scanning process) is necessary. As the data are digitized on basis of the orthophotos, the same geographical reference system (UTM, VN 2000) has to be defined for the GIS layer (information files).
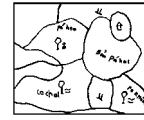
B) Scanning

The transparencies have to be scanned in separate tiles as input to GIS software. The number of tiles depend on the size of the scanner. With an A4 scanner it would result in approximately 15 tiles to be referenced. To reduce time requirements preferably an A0 scanner, or at least A3 scanner should be used.

The transparencies can be scanned in black and white with an output resolution of 150 PPI, because scanning quality is not of major importance since only the outline of the polygons are needed from the transparencies. Black and white scans decrease file size and therefore reduce subsequent processing time. To store the scans filenames should be used, which can be associated with their position on the transparency. We suggest to give sequential numbers to the scans indicating the position on the transparency. The scan in the upper left corner could be named "11", the next one to the right "12", and so on. The second row of scans would then start with number "21" for the left tile in the second row. In addition, the scans for different villages should be placed in separate directories on the computer to avoid later confusion.

3. *Data input into GIS*

The projection which needs to be specified for LUP/LA data in the GIS needs to be the same like the projection of the orthophotos and the topographic maps (UTM, VN 2000). Since the VN 2000 is not an international geographic date, its parameter have to be entered, or GIS Software has to be used for dada conversion.
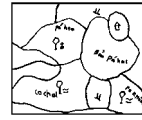
A) On-Screen Digitized Data

Since on-screen digitizing is carried out with GIS Software, the data are already entered into the GIS.

B) Scanned Data

E.g.: ArcView

In ArcView the Image Analysis Extension is used and the scans have to be added as 'Image Analysis Data Source'. Then the 'Align Tool' can be used to geo-reference the image to the coordinate system of the reference map. Exact coordinates are known for the small crosses, which were drawn on the transparency at the intersections of the map grid. The crosses can be entered as control points with the 'enter coordinates tool'. That procedure has to be repeated for four points in the corners of the scan. If coordinates are properly entered a root mean square error can be displayed, which should be below 1,0 . The referenced and saved image can then be added as 'Image Data Source'. All referenced scans merged together should reflect the whole village map as it was drawn on the transparency. After geo-referencing the data have to be digitized to achieve vector data.

E.g. MicroStation/ MapInfo

Microstation can be used for digitizing of the scanned data. Therefore the lines and polygons of the scanned transparency are followed on-screen. The information can than be exported to the GIS software ArcView or MapInfo. After data import into the GIS software, the information is available in the required vector format.

After the present land use information has been transferred to the GIS, the layer should be copied and renamed ("planned land use"). The copied data on the new layer should be modified according to the planned land use transparency.

4. Entering Attribute Data

Every polygon of the resulting GIS datafile (e.g. shapefile) need to have an identity code (ID) for the land use class and one identity code for the local names. Additional attributes which can be entered comprise e.g. the implementing year. Before additional data processing the shapefile has to be clipped with the boundaries of the photomaps and cleaned from gaps (undershoots) and overshoots. When editing work is finished, land use statistics for the respective villages can be calculated.

5. Design of Map Layout

Finally the map layout has to be designed. Standard regulations should be used for the colours and symbols, as well as for the information, which has to be added also to the map, like titel, scale, geographic reference syste, coordinate grid, year for data collection, etc. The scale of the maps is normally 1:10.000.

Features like contourlines, elevation points, main roads and rivers are available already in digital format from topographic maps, thus these elements can be added to the present and planned land use maps.

IV. Feedback to and from stakeholder

After the data processing is finalised a print-out of the developed map is brought back to the village and further details are verified or re-adjusted if necessary until a final agreement has been reached among all parties involved. The original orthophoto-map should be handed over to the villagers after data processing is finalised.

The final mapping information has to be presented in a way that meets the local capacities and demand. Information to be provided on the map should be the year and month of the aerial photograph, the identified land boundaries, date of data collection, land use classifications, local names, viallge name, scale and geographic references.

One copy of the developed map remains in the village to be used as a decision-making tool for villagers during their further village meetings.

GENERAL REMARKS ON PARTICIPATORY PHOTOMAPPING

Strengths and Weaknesses

| *Strengths*	*Weaknesses*	*Solutions*
Easy to understand	Missing topography on 2D photomaps and distorted land use polygons on 3D photomaps	Add basic contourlines to the orthomap; Villagers know their environment
Higher mobility than 3D model		
No limited durability like 3D model		
Outdoor work is less time-consuming		
Enables data integration into GIS, so that information can be easily processed, assembled, analyzed and returned to stakeholders	Limited capacity for data input and processing at district and even higher levels	Continued data processing at provincial level; Data collection at district and communal level
Greater spatial accuracy than "opposite sloping"	When using old photomaps villagers may tend to follow old plot boundaries	Discuss land use changes; Field checks
Greater clarity and reduced likelihood of arising boundary conflicts	Availability of up-to-date photomaps limited at present	Use photos from 1999/2000
Increased official acceptance of results		
Possibility for digital storing enables low-cost re-prints of plots and of generated information	Technical equipment required	Integrate investments into budget calculation
Enhanced possibilities for information sharing	Specific skills are required	Training (1-2 weeks)
Improved planning potential.		
Combines local knowledge with a clear scalable geographic reference	Land use situation shown in the photomaps refers to one season of the year	Discuss climatic impact with villagers
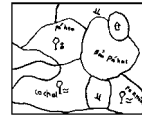
Enables automated monitoring of land use changes and quantitative analysis	Aerial photos need to be available in fixed intervals of e.g. 5 years	

Conclusion

Participatory mapping based on orthophoto-maps is a precise, cost-effective and participatory tool for land use planning, resource assessment, impact monitoring and conflict mediation . Participants in mapping exercises typically show high level of participation and engagement, most likely due to the authentic nature of the data. In addition, data input into a GIS program enables post-processing, permits enhanced cadastral activities, better land use statistics and computer-based monitoring of land use changes.
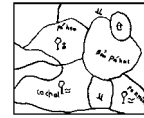
ANNEXES

ANNEX 1:   Orthophoto-map with sketched present land use , Pa Hoc
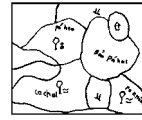
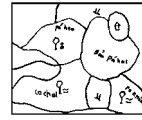ANNEX 2:   Present land use transparency, Pa Hoc
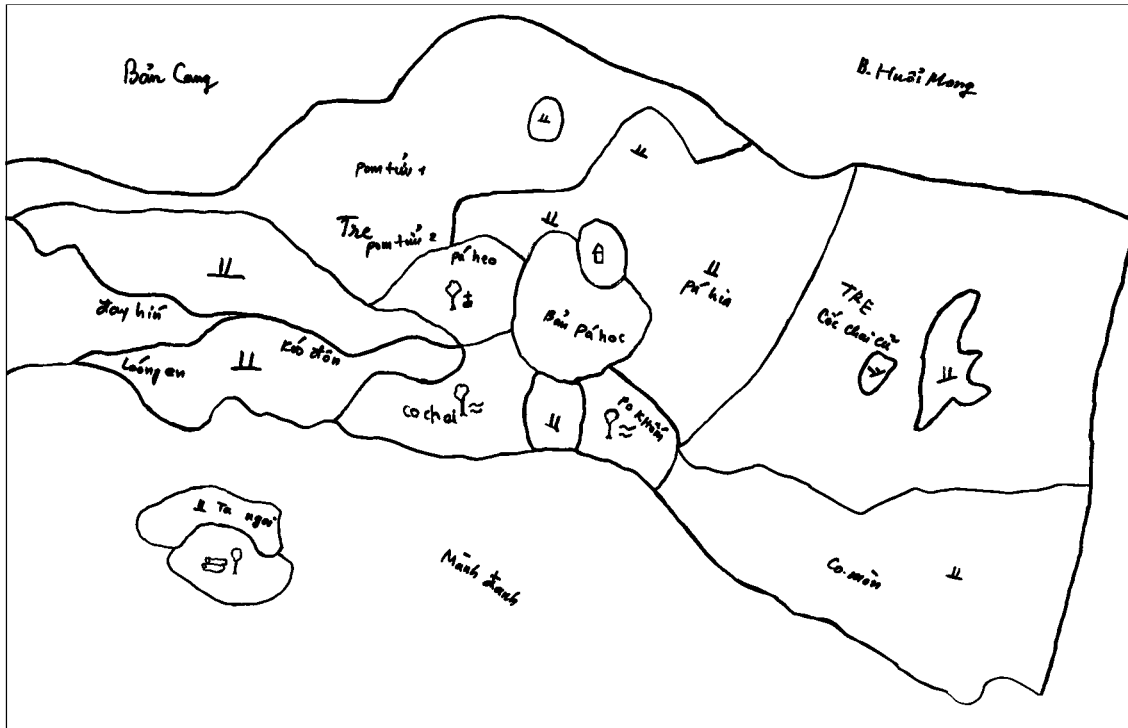
ANNEX 3:   Present land use map, Pa Hoc

ANNEX 1:   Orthophoto-map with sketched present land use , Pa Hoc

Figure 1:   Aerial photomap of Pa Hoc village, Chieng Hac commune with landuse boundaries, land use classification and local names added by villagers

ANNEX 2:   Present land use transparency, Pa Hoc

Figure 2:   Extracted transparency after village meeting in Pa Hoc village as basis for further data processing and digitalising of land use map database
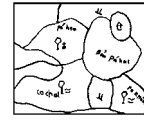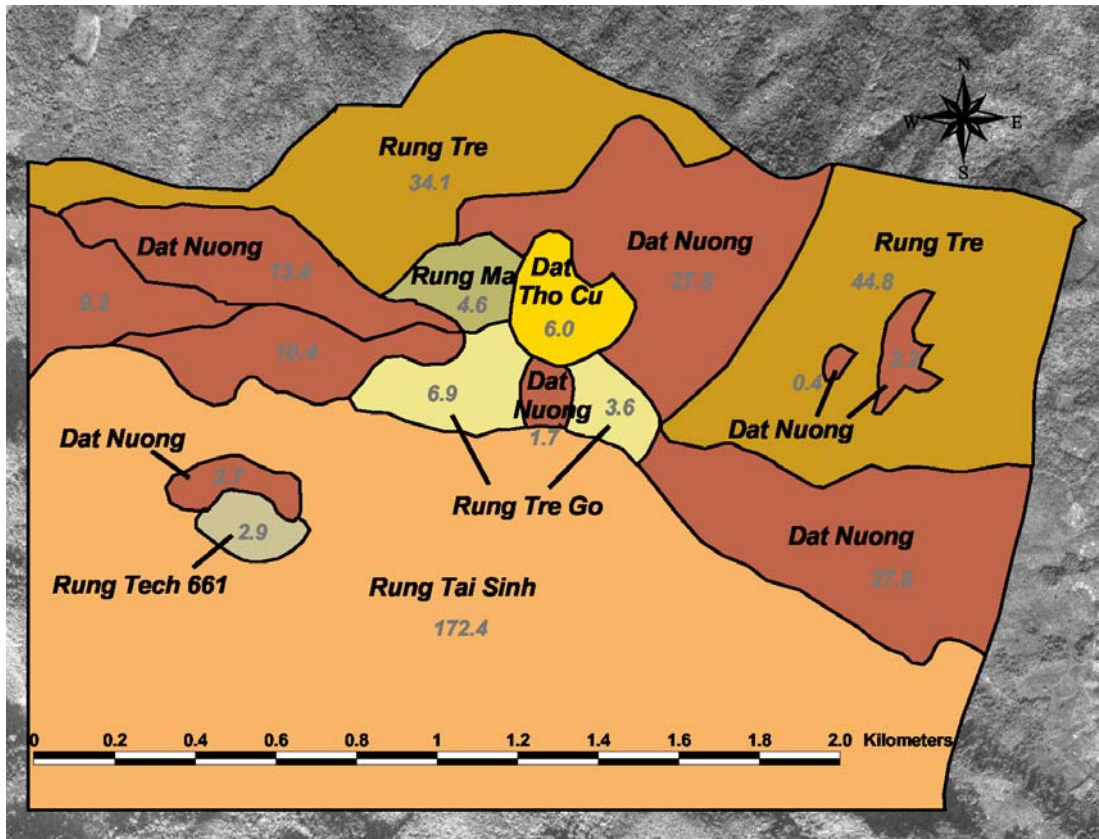
ANNEX 3:   Present land use map, Pa Hoc

Figure 3:   Finalised present land use map of Pa Hoc village