

# MANUAL ON Watershed-based participatory land-use planning for NAGALAND



Empowered lives.  
Resilient nations.



MANUAL ON  
Watershed-based participatory  
land-use planning for  
NAGALAND



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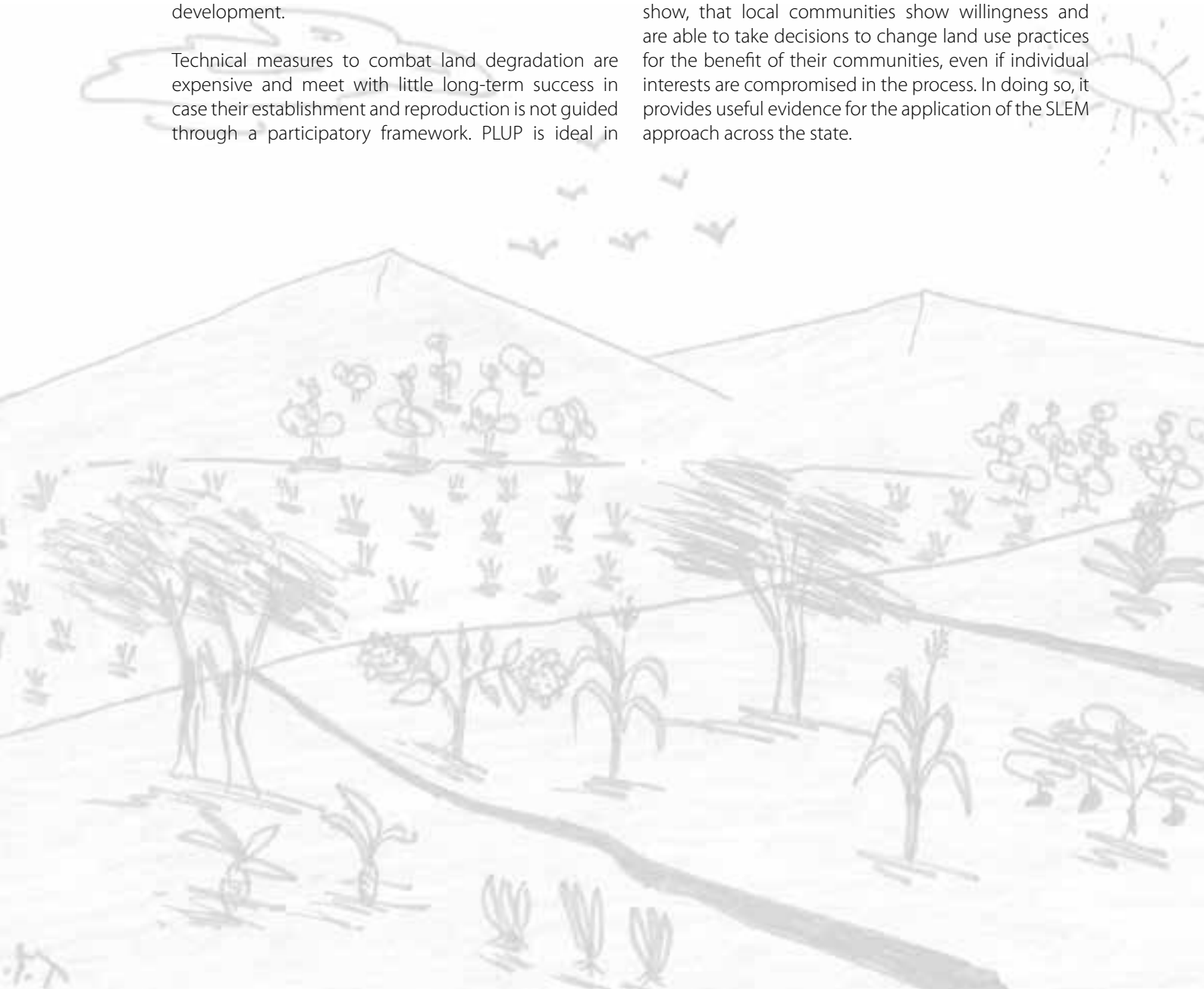
# Introduction

Human pressure results in loss of biodiversity and land degradation leading to poverty and conflicts over land resources. At the same time changes in livelihoods demand adjustments to current land use in many places. Participatory Land-Use Planning is considered to be an appropriate approach to halt or reverse land degradation, conserve biodiversity and maintain ecosystem services. PLUP identifies optimal solutions for alternative land-use, taking into account local socio-economic conditions and livelihood strategies. As participatory approach, it empowers communities through the process and thereby contributes to conflict prevention and balanced socio-economic development.

Technical measures to combat land degradation are expensive and meet with little long-term success in case their establishment and reproduction is not guided through a participatory framework. PLUP is ideal in

putting technical intervention measures into a socially appropriate context and thereby ensure their relevance, long-term application and thus their effectiveness.

PLUP can significantly contribute of sustainable land and ecosystem management in Nagaland, where most land is managed in relatively short shifting cultivation cycles, resulting in soil erosion and loss of productivity, degradation of vegetation and decline of water resources. Even though highly variable based on the tribe concerned, traditional community-based decision-making processes are well established, presenting an ideal platform for PLUP. Experiences show, that local communities show willingness and are able to take decisions to change land use practices for the benefit of their communities, even if individual interests are compromised in the process. In doing so, it provides useful evidence for the application of the SLEM approach across the state.



# Background and objectives

## What is land-use planning?

“Land use planning is the systematic assessment of land and water potential, alternatives for land use and economic and social conditions, in order to select and adopt the best land-use options. Its purpose is to select and put into practice those land uses that will best meet the ideas of the people while safeguarding resources for the future. The driving force in planning is the need for change, the need for improved management or the need for a quite different pattern of land use dictated by changing circumstances” (FAO, 1993).

## What is participatory land-use planning?

Participatory land-use planning (PLUP) is essentially bottom-up land-use planning; carried out with active participation of the concerned community. PLUP evaluates and proposes the best possible uses for land resources in a village in order to improve the livelihoods of the local population. Important land resources in a village include soil, water and plants, which are used for producing crops, livestock, timber, housing, drinking water, etc. Their optimal use depends on the biophysical conditions of the land, people’s ability to utilize the land, people’s socio-economic conditions and their expectations. PLUP serves improved land stewardship through systematically analyzing these conditions and proposing improved land-use options, taking into consideration all the above factors. The implementation of PLUP is ensured through ownership over the process by the community and through reliance on local institutions.

## Why participatory land-use planning?

Human pressure results in land degradation and leads to conflicts over land resources, while changes in livelihoods demand alternative utilization of land in many places. PLUP is considered an appropriate strategy to halt or reverse land degradation and to

identify optimal solutions for alternative land-use. At the same time, the process empowers communities and thereby contributes to a balanced socio-economic development.

Technical measures to combat land degradation are expensive and meet with little long-term success in case their establishment and reproduction is not guided through a participatory framework. PLUP is ideal in putting technical intervention measures into a socially relevant context and thereby ensure their relevance, long-term application and thus their effectiveness.

## Participation

Participation by the local community is the key to achieve ownership over the land-use planning process and thereby to ensure its development relevance and follow-up. In fact the need to enact land-use planning, along with the implementation of the process has to be driven by the community, once the proposal has been presented to them by the external facilitating team. Participation by various social-economic groups (incl. gender) is essential to ensure that the interests and expectations of all factions in the village are considered in the planning process. Mainstreaming gender in the PLUP process ensures that women’s very specific knowledge on land-use, along with their interests are reflected. PLUP strengthens local governance through empowerment, improved accountability and follow-up. PLUP is not a one-time exercise of drafting a land-use plan, but instead a continuous process of follow-up, ensured through inbuilt Monitoring and Evaluation procedures. All this makes PLUP a powerful social tool for sustainable land management, capacity building, empowerment, securing land tenure and conflict resolution over resources.

## Facilitation

The PLUP process initially requires external facilitation. The prerequisites for successful facilitation of ‘bottom up’ approaches are a good working relationship with the communities and a thorough understanding of local conditions. In the context of the GoI-UNDP-GEF project



these conditions are given, since the external facilitators on most instances have worked together with the concerned communities for years, have thus established a good relationship with them and are well aware of local conditions. The role of facilitators is to moderate the discussion, encourage people to contribute their knowledge and to respect this knowledge, which is very deep and essential for optimal decisions (Warner, 1991). While providing technical advice, it is essential to combine local knowledge contributed by the farmers with technical knowledge contributed by the facilitators. Final decision over land resources remains with the local community.

## Multi-disciplinary approach

External facilitators should ideally represent various technical subjects dealing with land-use, such as agriculture, livestock, horticulture, forestry, etc. Their role will be as much to facilitate the process, as it will be to provide advice on technical issues of land-use in the respective subject matters. Ideally, representatives of all line departments dealing with land issues (Departments of Soil and Water Conservation, Agriculture, Forestry, Land Resources, Horticulture, Fishery, Veterinary and Animal Husbandry, Sericulture) should participate in the planning process. This will ensure that a wide range of technical expertise is available to provide meaningful suggestions for alternative land-use options. At the same time representation of all departments will ensure optimal coordination of land-use interventions among the departments, possibly leading to synergies, avoiding duplication and uncoordinated interventions. The land-use action plan identified through the process can represent a starting point for concentrated interventions by various departments.

## Multi-level approach

Land-use planning is only meaningful, if carried out at various levels of administration. Village-level land-

use plans have to be coordinated and put into a regional context at the district level. There are several overarching and cross-boundary aspects of land-use planning, which need to be looked into at the district level, such as water(shed) issues, roads, protected areas, etc. Regional planning and coordination has to follow directives resulting from state-level land-use planning. At the state level, land-use planning consists of policies, laws, regulations and guidelines pertaining to land-use. At the same time the state has to ensure awareness creation and training opportunities and also to provision an enabling institutional and administrative structure regulating the use of land resources at all levels of administration. Particular land-use planning issues at the state level include e.g. the administrative division of the state and the protected area network.

## Advantages of PLUP

Land-use plan prevents and solves conflicts over land resource, secures rights and tenure, facilitates discussion among social groups, incorporates formal legal requirements of land-use, documents traditional land use rules and regulations, ensures that interests of entire community are reflected, excludes external interests, improves ecological condition of land resources, helps to develop new sources of income (e.g. ecotourism), secures the resource base, improves and empowers local governance, improves accountability of the local administration and compromises local, regional and national interests.

## Drawbacks of PLUP

PLUP is difficult in areas with private ownership and may raise false expectations in case its limitations are not fully clarified beforehand. Conflicts over land-use objectives between different (socio-economic) groups, as well as uncertainty over future plans and technologies further limit the scope of land-use planning.

# Methodology

## Role of the facilitators

The facilitator should try to establish a learning environment, enabling farmers to observe and interpret their own situation in a structured manner. The facilitator has to encourage farmers to take an active role in the land-use planning process. At the same time the facilitator has to act as a technical resource person providing expert advice on land-use issues in his own field of expertise. Facilitators have to respect local knowledge of farmers and find an appropriate way to combine it with their technical knowledge on land-use subjects. The facilitator is merely a moderator and a technical resource person providing expert advice, but he should not influence or dominate decisions and should try to act passively, focusing on keeping the process on track, once farmers started to take active initiative in the process.

## Semi-structured interviews

Semi-structured interviews have the main characteristic, that they do not have a fixed sequence, nor fixed questions or answers. The interviewer merely has a list of topics to be covered within the interview and s/he is free to choose the way s/he puts questions, as well as the sequence, which s/he follows to obtain the information. Do not restrict answers to a rigid list of questions/topics, but rather consider this list as a check-list of topics to be covered. Adjust the logical flow of topics to the particular discussion. Household surveys may best be completed in the evenings, after farmers have finished their activities in the field and are at home. Try to limit the time spent on each interview, but do not rush.

## Check list of data to be collected for land-use planning

Various exercises of land-use planning should yield information on the topics presented in Table 1. This list is a "wish list" and represents an ideal data basis for optimal land-use planning. It is the job of the facilitators to compromise between the value of certain information and the effort necessary to obtain them. See Table 1.

## Documentation

The output of various PRA exercises should be documented on white board, chart paper and should be photographed. Additionally, all exercises, documents, such as signature pages, 3D modeling, land-use zones, etc. have to be captured electronically.

**Table 1: Checklist of data to be collected for land-use planning**

**General information**

- Location
- Elevation
- Accessibility (roads, distances)
- Relevant infrastructure
- Administrative division

**Climate** (annual, distribution and extremes)

- Rainfall
- Temperature
- Wind velocity
- Potential evapotranspiration
- Growing period

**Soils**

- Relief (slopes)
- Erosion
- Soil fertility
- Other soil related limitations

**Hydrology**

- Rivers and minor streams
- Drainage
- Groundwater level and quality

**Land suitability**

- Suitability for different land uses
- Land capability
- Carrying capacity

**Actual land uses**

- Agriculture: major crops
- Livestock
- Forestry
- Natural vegetation
- Other uses

**Economy**

- Living standard
- Sources of income
- Expenditure pattern
- Agricultural & livestock production
- Farming systems
- Availability of (agricultural) inputs
- Labour availability
- Markets
- Farm size
- Land security and tenure systems

**Sociology/social services**

- Demographics
- Land pressure
- Presence of land-use conflicts
- Inter- and intra-regional migrations
- Settlement pattern
- Housing
- Status of & services for education & health
- Other (social) services: shops, water supply, etc.
- Presence & effectiveness of local institutions
- Effectiveness of village leadership

**Land management related policies, laws, etc.**

- Laws, policies, regulations, etc. concerning land
- By-laws for land management

**Projects active in the area**

- Sectoral projects
- Integrated projects

**Existing land-use plans and development plans**

- District
- Village
- National

# Preparation

## Coordination

### District Administration

Arrange a meeting with the Deputy Commissioner (DC) of your district and brief her/him about land-use planning. Obtaining her/his support is crucial for the success of the entire land-use planning process and therefore this point is very important. In the briefing, focus on the objectives and advantages of land-use planning and the necessity to conduct land-use planning at various levels of administration, highlighting the district level. Request the DC to delegate the line departments dealing with land issues (see below) to nominate representatives to participate in the land-use planning process.

In case you cannot get active support by the DC, at least aim at getting a passive approval of your plans and permission to involve line departments in land-use planning.

### Line Departments

Contact various government agencies (Line Departments) in your district dealing with land issues. These Departments include:

- Department of Soil and Water Conservation
- Department of Agriculture
- Department of Horticulture
- Department of Forests
- Department of Sericulture
- Department of Land Resources
- Department of Livestock

Discuss the issue of land-use planning in a joint meeting, highlighting its objectives, principles and procedures.

Focus specifically on the advantages and synergies of concentrated effort between the departments and highlight the negative sides on uncoordinated unilateral action frequently leading to failure. Request the line department representatives to nominate one member to be deputed for land-use planning.

Once representatives have been nominated, gather the facilitating team and brief them in detail on the procedures of land-use planning, specifically on:

- All components of the exercise, specifically PRA methods (see below)
- Briefing on principles of participatory research
- Division of work among facilitators

### Community representatives

The external group consisting of few key facilitators (government officials, UNDP, etc.) approaches representatives of the village community and briefs them about land-use planning and proposes them to facilitate the drafting of a land-use plan for the village. Principles, objectives and procedures of land-use planning, along with typical contents of a land-use plan are presented and discussed. The representatives of the village community discuss the proposal with the village community and respond to the facilitating team. It is very important that land-use planning is initiated with active interest expressed by the village community. In case the response is not positive, or at least not clearly positive, the facilitating team drops the village and approaches another village with the proposal of drafting a land-use plan. Consider conducting a one-day seminar on participatory SLEM in preparation for PLUP.

## Items to be procured

### Necessary items

- 1:10000 topographic map showing the surroundings of the village, with 40 m contour lines, geographic coordinate grid, river and road network (see Annex I: Preparation of the base map for the 3-dimensional terrain model).
- Cardboard (4-6mm\*1m\*1m, 25 pc)
- Fevicol glue 3 bottles
- Paint different colours
- Brushes different size
- Carbon paper (20 sheets)
- Stanley knives (small and large 3 pieces each)
- Flip chart paper (30 sheets)
- White board, felt pens of four colours
- Digital camera to document PRA exercises and land use types
- Tape
- Plaster-of-Paris bandage (5 rolls)
- Pens, pencils, marker pens of different colour
- Nails
- Bowl (2 pc)
- Thread of different colours
- Clips (10 pc)
- Pins of different sizes and colours (50 pc)
- Board
- Laptop computer

### Optional items

- GPS – in case available
- Satellite image showing vegetation cover of the same area – in case medium to high resolution images can be obtained
- Power generator
- LCD projector

## Planning

In consultation with all external facilitators and the community representatives, propose a schedule for the land-use planning exercises. Start ideally on a Sunday after Church devotional service is over in order to have a high proportion of the village community represented in the first general meeting. It is beneficial to follow up on the planning process without breaks, also to avoid your colleagues and the farmers getting weary of the process. Propose a duration of two weeks and clarify whether any important events during this period might disrupt your schedule. Plan to spend the first three to four days in the village, in case facilities exist, in order to establish better personal contacts with the villagers and to gain deeper insight into their situation.

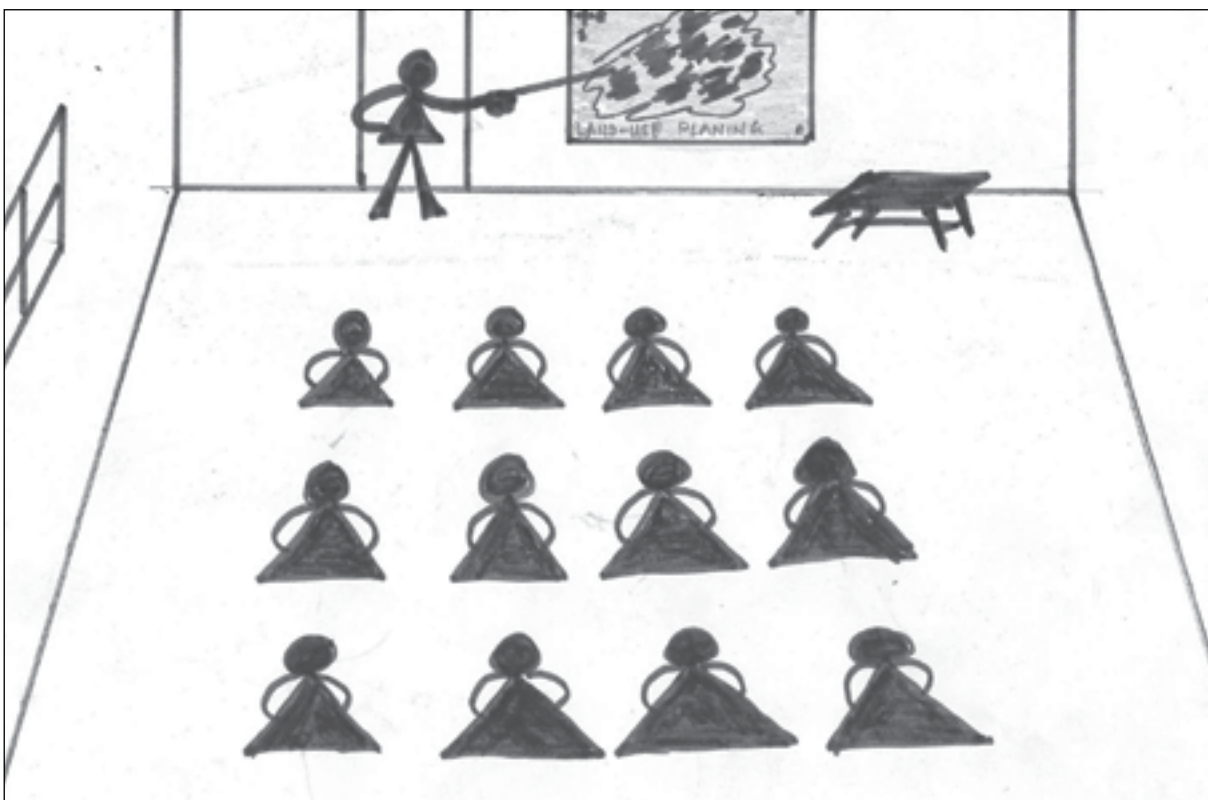
# Land-Use Planning Process

## Plenary village meeting

In case of a positive response, a plenary meeting of the village community is called, where the facilitators brief the entire community on participatory land-use planning and clarify unclear points (Figure 1, Figure 2). Specific attention should be paid on the objectives of land-use planning, its limitations, the prerequisite of participation and a bottom-up approach, the need to consider government guidelines, as well as the steps and methodology along with the expected duration of the process. Ideally, this meeting can be scheduled for a Sunday, after the Church service, in order to encounter as many community members as possible. This will also ensure wide female participation.

## Small group discussion on land-use planning

After the plenary presentation and a possible follow-up discussion, facilitators break the plenary group into smaller groups. One or two facilitators join each group and based on the information presented in the plenary presentation, they revise objectives, advantages and disadvantages and procedures of land-use planning. This revision will facilitate a better understanding of land-use planning by members of the village community.



**Figure 1:** The village community is informed about land-use planning in a plenary meeting



**Figure 2: The village community is informed about land-use planning in a plenary meeting**

## Forming the village Land-Use Committee

The village community is next asked to nominate a Land-Use Committee, consisting of approximately 15-20 members. These members should represent all the different socio-economic groups in the village (e.g. village council, angh, church, student body, *jhum* farmers, landless farmers, progressive farmers, land owners, self-help groups, women’s organizations etc.) and should include a high proportion of women, not only in representation of women’s groups and self-help groups. Minimal numbers should be defined for underprivileged groups, specifically women, landless farmers and farmers solely engaged in shifting cultivation and collection of NTFPs with minor additional sources of income, and their continuous representation throughout the planning process will be defined as a condition of conducting the exercise. This council should commit to serve also after the Land-Use Plan has been completed, since they would have to follow up on the implementation of the plan and be answerable to the community. Names of Land-Use Committee members are noted down and their nomination confirmed by their signatures and that of the Chairman of the Village Council.



**Figure 3: Small group discussion**

From this point in time, the facilitating team and the Land-Use Committee work together on the land-use planning process and are called Land-Use Team. The rest of the village community does not have to participate actively, but it is advisable for the Land-Use Committee to keep the village community continuously updated.



**Figure 4: Results of a small group discussion being reported back to the plenary group**

## Small group discussion on land-use problems and potentials

The Land-Use Committee is divided into smaller groups of four to five people each and each group is joined by two facilitators (Figure 3). Women should form a separate group and be joined by a female facilitator, in case there is one present. Groups independently list the land-uses practiced in the village (e.g. *jhum* farming, permanent crops, horticultural plantations, timber and bamboo plantations, natural forest, village area, kitchen gardens, etc.). Focus should be on detail at this stage and different horticultural plantations should be listed separately. If you find it makes sense to group them, you can do this later on. Group members are asked to estimate the proportion of the village area under each land-use type. The information is documented on chart paper in a list of land-use types, each with their respective percentage of the village land area. Do not forget about the village area, home and kitchen gardens, area for livestock, etc. This information is reported back to the plenary group by a representative from each small group (Figure 4). Information by different groups is triangulated, differences discussed and an agreement reached. Focus on preventing vocal group members to dominate the plenary discussion.

Subsequently, for each land-use type the groups list the problems they face. When asking them to list problems, facilitate them by asking what sometimes goes wrong, whether production is associated with any risks, what external influencing factors play important roles, etc. LUC members are also asked to list possible solutions, as well as opportunities for each land use type. Opportunities include possible innovations, improvements, beneficial alternative uses, changes to present practices, etc. Findings are once more reported back to the plenary group and discussed. Facilitators should aim at incorporating all ideas and reach an agreement between different groups on points, where their ideas differ. All information generated through the two stages of the group discussion is compiled into a common table (Table 2).

## Small group discussion on village demographics

**Resources needed:**  
**chart paper (4 pc),**  
**marker pen (4 pc)**

A focal group discussion gathers information on the number of births, deaths, immigrants and emigrants in the last five years. Information obtained in groups is reported back to the plenary group for discussion and verification. In case detailed written accounts exist, e.g. with the village pastor, this exercise will not be conducted.

## Village timeline

Resources needed: chart paper, marker pen (2 each)  
 Separate the Land-Use Committee into male and female groups. Discuss with both groups important events in the history of the village and record them along a line on chart paper. Start with the first event people remember in village history on the extreme left and mark subsequent events moving towards the right along the line with the present being on the extreme right. Do not identify too many events and keep periods rather long for periods further back in time and shorter for the recent past. In between these events document land-use types and associated problems, population and income for all periods (see Table 3).

## Seasonal calendar

Using gender-based focal groups (males can be separated into more than one group in case they are too many), discuss event in the village throughout the year, focusing on land-use and associated cultural events. Document them by month in as much detail as possible. Groups report the information back to the plenary group for discussion and verification.



**Table 2: Example of land-use types, associated problems, solutions and opportunities**

Land-use type	Problems	Solutions	Opportunities
<b>Jhum fields (40%)</b>	Decline in yield	Erosion and water conservation measures	
	Slashed and burned fields remain partially uncultivated due to labor shortage		Pool clan land and allocate uncultivated areas along hill tops, streams and gullies to protect them
<b>Areca nut plantations (10%)</b>	None		
<b>Terraced rice fields (5%)</b>	Unreliable water supply	Construct new irrigation channel	
<b>Bamboo plantations (5%)</b>	Steep terrain, difficult to harvest	-	
<b>Gmelina arborea plantations (10%)</b>	None		Establish sawmill in village to increase income
<b>Passion fruit plantations (3%)</b>	Marketing	Produce marketable volume	High income if marketable volume can be produced
<b>Reserve forest (18%)</b>	Decline of certain species of wild animals	Connect forest reserve with forest reserve of neighboring village using a biological corridor	Establish viewpoint for observing wild animals to promote ecotourism
<b>Village area (5%)</b>	Problems with water supply	Protect water source by planting bamboo and trees	

**Table 3: Example of village timeline**

	Village established 1948	Big landslide occurred 1970	Road constructed 1988	Present
<b>Land-use</b>	Jhum	Jhum, paddy fields	Jhum, paddy fields	Jhum, paddy fields, cash crops
<b>Problems</b>	Shortage of rice	Wild animals in paddy		Markets for cash crops
<b>Population</b>	60 HH	75 HH (new migrants)		90 HH
<b>Income/HH</b>	X IR	Y IR		Z IR

## Socio-economic household surveys

### Sampling of households

A proportion of households will be selected to obtain socio-economic information at the household level using semi-structured interviews. For selecting the households, external facilitators have to obtain a list of households from the Village Council. The list should contain all households residing in the village in a random or alphabetic sequence. Households residing outside the village will be ignored during this exercise. In case of larger villages 20%, and in case of small villages (fewer than 150 households), 25% of households will be sampled. Once the list is procured, one facilitator asks somebody to name a number between 1 and 4 (for the 25% sample), or 1 and 5 (for the 20% sample) and the household with this serial number on the list will be the first household to be included in the sample for the household interviews. Next, every fourth (for the 25% sample), or every fifth (for the 20% sample) household on the list will be earmarked for an interview.

### Conducting semi-structured interviews

Initially, facilitators form a core group of four and approach the first household to conduct an interview. One facilitator leads the group and moderate the discussion (Figure 5, Figure 6). Two facilitators take notes and one facilitator checks the list of topics to be covered to make sure all necessary information is covered within the interview. The first three interviews will be conducted together to make sure interviews are comparable and the information is obtained the same way, before the group of four splits into two groups of two facilitators. In case there are enough facilitators available, new members can join to “learn” the process from their colleagues. Three interviews should be conducted together before they can proceed to conduct independent interviews. In case household members are not present on two consecutive evenings, when facilitators approach to conduct the interview, the next household on the list will be selected.

### Topics of the semi-structured interviews

Topics covered by semi-structured interviews include social position, demographics, household economy, labor, land holdings (number of plots, area, location), land-use practices, NTFP collection, income and self subsistence from various land-use types. This information will be used to triangulate information obtained through the previous exercises, as well as to obtain data on the village workforce and population trends. The socio-economic interviews yield some of the most essential information for the land-use planning and should be taken very seriously!! Do not rush and obtain clarity before moving on to the next topic!

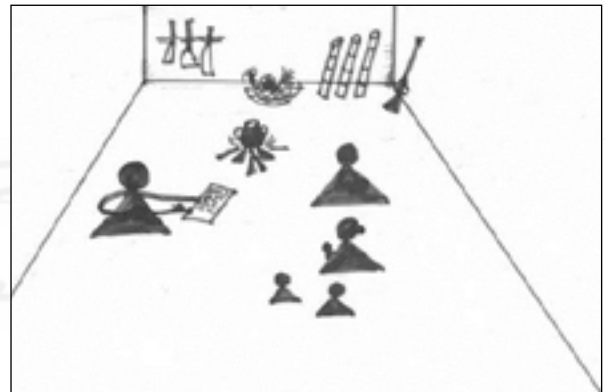
In particular, semi-structured interviews should yield the following information:

- Do members of your HH have any special function in the village (village council member, self-help group member, etc.). If yes, who is that and what function does s/he have?
- How many members does your HH have (by gender and age class)?

	Male	Female
Children ( $\leq 18$ yrs)		
Adults (18-50 yrs)		
Old people ( $\geq 50$ yrs)		

- How many children are in the household, who are of school-going age?
- How many of them actually go to school and where do they go to school?
- How many HH members reside elsewhere? Are they working/studying? Will they return to live in the village in the future or will they migrate for good?

- How many HH members are engaged in *jhum* farming?
- How many HH members work in other types of land use and how many have other work activities (daily wage, employment, etc.)?
- How much labour force do you have in your HH?
- How many plots of land does your HH own, what size are they and what type of land use do you follow on them (e.g. *jhum*, cash crops, plantations, timber, livestock, etc.)? In case of *jhum* fields what are the sizes of plots in various *jhum* areas you have? Include also minor fields, such as kitchen gardens, etc. (be very specific on this point – this is essential information and crucial for the entire land-use planning exercise!)



**Figure 5: Household socio-economic data collection using semi-structured interviews**



**Figure 6: External facilitators conducting semi-structured interviews**

- How much labour do you need every year for each of the different land-use types listed above? (in case the respondent does not assign time of labour to any land-use types listed above, prompt him and point out that he missed to provide the information)
- What percentage of the slashed and burnt *jhum* land is actually cultivated? If there is uncultivated area, what are the reasons for not cultivating it?
- What is the yield of each of the land-use types (name the crop and the yield per hectare)? What percentage of the yield do you consume and what percentage do you sell? How much income does the sale of produce bring you for each of the land-use types (specific by land-use type – very important!!)?
- How much financial input do you have to invest annually into the various land-use types (e.g. seedlings, fertilizer, pesticides, medicine for animals, etc.)?
- In case of *jhum*, is there variation in yield between years? If yes, what is the range?
- Does your HH face shortage of rice?
  - e.g. 40% from fallow *jhum* field, 60% for reserve forest)?
- Does your HH own livestock? How many heads each? How many heads of livestock (by species) do you consume yourself in a year and how many do you sell? If yes, how frequently and what price do they fetch? How much time do you spend working with your livestock and how much fodder do you provide them (try to quantify in terms of money)?
- Does anybody in your HH collect any NTFPs? Which ones and how much money do you earn from them? What percentage do you keep for your own consumption? Where do you collect the NTFPs from (assign them to the land-use types identified
  - Does anybody in your HH hunt? Which species and how many on an annual basis? What percentage do you consume yourself and what percentage do you sell? In case of sale, how much do you earn? How much time do you spend with hunting on an annual basis and in which land-use types do you hunt (be specific by providing percentages on where you shoot animals – e.g. 60% in fallow *jhum* land, 40% in forest reserve)?
  - Does your HH own anything else valuable than your land, house and your livestock? If yes, what?
  - Does your HH engage in off-farm activities (shop, daily wage, market, etc.)? How much do you earn from these activities and how much time do you spend on them (make sure to note the net profit with trade activities and NOT the income!)?

The essential information to be obtained from these socio-economic interviews besides demographics is the profitability of various land-use types. To be able to quantify this, it is essential that for EACH land-use type (including livestock rearing, kitchen gardens, etc.) the following information is available:

- **Input:** labor (mandays), investments if any (e.g. seedlings, fertilizers, pesticides, medicine, etc.)
- **Output:** Yield, proportion consumed, proportion sold, value (money) the sold proportion fetched
- **Size:** size of land holdings under the various land-use types, pay attention to rotational farming (*jhum*), where the size of area may vary between years and in some years no area may be available. Make sure the input and output information is collected together with the size of the *jhum* plot these figures refer to! Also make sure to clarify whether the information refers to the present year or the present and second year *jhum* field together!!

## Participatory transect walk

**Resources needed:** paper, pen, chart paper, marker pen

A reasonably short transect passing through as many land use types as possible is discussed and identified on a map. The Land-Use Planning Team walks along this transect, discussing land-use types they encounter along with associated problems, as well as specific features pertaining to the areas they pass through (Figure 7, Figure 8). This information is used to further corroborate information obtained through the previous exercises based on the principle of triangulation in social research.

The information is documented through a sketch profile: draw a horizontal altitudinal profile of the transect approximately showing slopes and draw a sketch map of the encountered vegetation indicative of the land-use. Under the sketch profile, in a table format, identify land-use, soil conditions, plants, animals, problems associated with land-use, opportunities for the particular areas, as well as activities needed (Figure 9).



**Figure 7: Land-Use Committee members and external facilitators discuss and verify land-use information in a participatory transect walk**

**Figure 8: Participatory transect walk**



## Participatory 3-dimensional modelling

Resources needed: cardboard 6mm\*1m\*1m 25 pc, glue 3 bottles, paint different colours, brushes different thickness, Stanley knives 4 pc, carbon paper 1 packet, 2 topographic maps (preferably 1:10000 showing contour lines, rivers, roads, administrative boundaries), pencils, pens, tape 6 rolls, clips 10 pc, pins of different shapes and colours 50 pc, thread of different colours, plaster bandage (4 rolls), nails, bowl 2 pc.

Participants: Land Use Planning Team, possibly local students as part of a geography class

### Building the 3D model

The Land-Use Team builds a Participatory 3-Dimensional Model of the village area (Rambaldi, 2010). This model allows easy visualization of topographic features within the entire village area. The Land-Use Committee locates places and carries out Participatory Resource Mapping on the 3D model. They also delineate present land use on the model using colored thread.

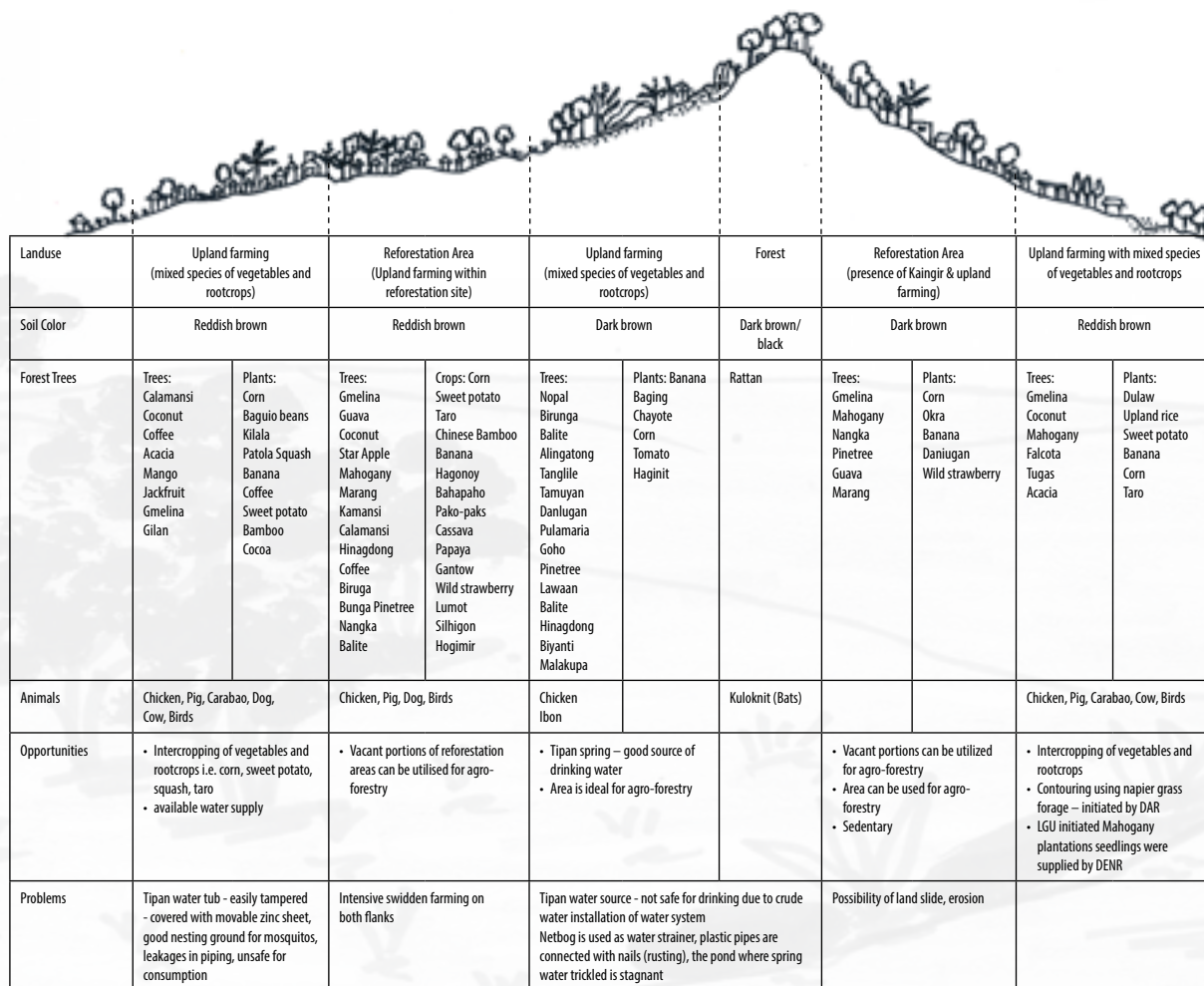


Figure 9: Sample output of participatory transect walk (source: www.iapad.org)

First a sheet of cardboard is laid out and covered with a layer consisting of several sheets of carbon paper taped together so that they cover the entire cardboard. Next, the topographic map is laid over the carbon paper and all three layers are clipped together so that they cannot move. Next, the lowest contour line is traced with pencil so that the carbon paper creates an impression of the contour line on the cardboard. Once the contour line has been traced, the shape is cut using a Stanley knife. Next, the next higher contour line is traced in a similar manner and cut out from cardboard and the process is followed through until the highest contour line. Layers of cardboard are glued on top of each other so that they depict the terrain model. Next, the model is covered with tape to smoothen out the steps resulting from different layers of cardboard. Finally, the model is covered with Plaster-of-Paris bandage and left to dry. Once the model has dried, rivers and roads are painted on the model based on the topographic map, applying a previously agreed colour code. For details on building the participatory three-dimensional model see Annex II: Preparation of the participatory three-dimensional model.

**Naming and participatory resource mapping**

Once the model is ready, LMC members are asked to locate places they know on the model. These places are marked using pins of different colour and place names are tagged on the pins (Figure 10). Next, LUC members are asked to locate important natural resources on the terrain model applying pins of different colours according to a previously agreed code (Figure 13).

**Village boundary verification**

Representatives of all neighboring villages are informed a few days in advance and invited to verify village boundaries. Boundaries are discussed, outlined with pins and thread connecting them and verified. In case boundaries do not run along easy to identify topographic features (rivers, ridges), they have to be verified in the field, for which the use of GPS is inevitable. Representatives of both villages together with a facilitator handling the GPS have to follow those parts of the village boundary, which run through unclear terrain. The GPS track has to be imported



Figure 10: Naming locations



Figure 11: Mapping present land-use



Figure 12: Mapped present land-use

into GIS and printed out on a map, before it can be transferred on the model. Alternately, GPS recordings of important points are noted in latitude/longitude format and directly transferred to the 3D model using a geographic grip marked on the 3D model. Solution of possible boundary disputes should be sought through active mediation. Once everybody agrees on the boundaries, they are painted in ink on the model and transferred to a 2-dimensional map. Representatives of both villages verify with their signature the correctness of the boundaries and this document is attached to the Land-Use Plan.

#### Mapping of present land-use

Current land-use types are delineated on the 3D-model using pins and coloured thread (Figure 11, Figure 12, Figure 13). Different jhum fields are delineated separately using the same colour code.



Figure 13: Participatory resource mapping

## Data analysis

The external team analyzes the information obtained (population, land-use, problems, etc.), summarizes it into a simple format and presents it to the Land-Use Committee. Analysis of socio-economic data is carried out quantitatively with help of MS Excel.



## Land zoning

The land-use zoning exercise will start with a general presentation of the findings of the previous exercises; especially focusing on results obtained on land use types and associated practices and problems, village and available work force demographics. Next innovative land-use techniques are presented, which may be particularly suitable for the conditions in the model village (improved farming techniques, land zoning techniques – stream buffers, protection forests, biological corridors, etc.). The problems of discrepancy between available labour force and labour force necessary to farm all shifting cultivation areas is discussed. Based on this discrepancy, as well as problems associated with various land-use types in particular locations, alternative uses for certain problem areas will be suggested to villagers (protection of water sources and water courses with a forest buffer; setting aside underutilized shifting cultivation areas in critical (steep, erosion-prone) areas; intensification of farming applying SLM techniques in suitable areas). Committee and provide their suggestions also in writing. The facilitators leave the village to let the Land-Use Committee discuss the suggestions with involvement of the entire village community and to take free decisions. The Land-Use Committee agrees on which suggestions to accept and on possible further interventions. They respond to the facilitators in a separate meeting and communicate the community's decisions. Land-use zones reflecting accepted spatial suggestions are delineated on the model using colour thread. Where there is no change, the present land-use zones (jhum field, plantations, reserve forest, etc.) are marked on the model (Figure 16). Suggestions are once more discussed, especially if they have not been taken up. The result may or may not differ from present land-use depending on villagers' interest in embracing new ideas, their conceptions about the suitability of their present land use, as well as their willingness to submit themselves to a common plan. In case there are no more changes, the final decision on land zones is permanently painted on the model, reflecting the land-use plan of the community (Figure 14, Figure 15). A legend is prepared for the 3-dimensional model explaining colour codes in the local language, Nagamese and English (Figure 17, Figure 18).



Figure 14: Painting of model



Figure 15: Painting land-use plan on model

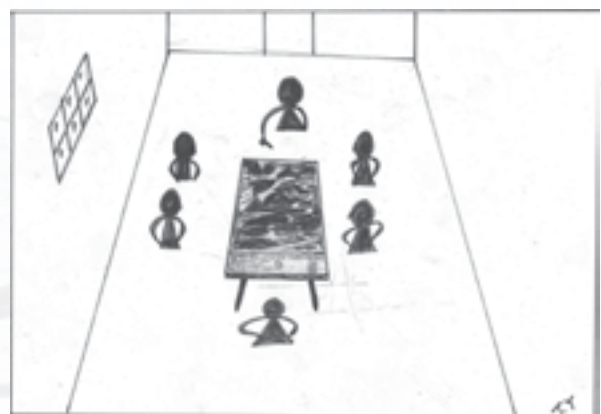


Figure 16: The Land-Use Committee with support of facilitators delineates land-use zones on the 3-dimensional model of the village

## Land-use action plan

**Resources needed: chart paper, marker pen**

The Land-Use Team discusses and identifies the Land-Use Action Plan necessary to implement the Land-Use Plan. The Action Plan includes the actions, the responsible person/agency to carry them out, necessary external support and a time frame of implementation (Table 4).

## By-laws

Existing land-use by-laws (rules) are listed and expanded by newly resolved by-laws.

## Monitoring and evaluation procedures

The importance of M&E will along with suggested participatory monitoring and evaluation procedures will be outlined to village community representatives. The Land-Use Committee decides on Monitoring and Evaluation procedures to follow up on the plan. Annual consultation meetings on the implementation of the land-use plan, along with a proposed structure and content will be proposed. It will be important to document the changes or any decision/revision taken



**Figure 17: Completed participatory 3D modeling with delineated land-use zones**

in relation to the land-use. The local committee may be given this responsibility of monitoring changes, with support of the local youth/students. Suggested M&E procedures:

- The LUC will hold meetings three times a year (more if necessary)
- The LUC meetings will discuss village land-use issues
- The implementation of Land-use Action Plan will be reviewed and adherence to rules (especially maintenance of buffer) will be verified also in the field
- The LUC will identify gaps in implementation

**Table 4: Sample of a land-use action plan**

Land-use type	Problems	Action	Responsible	Time line
Jhum	Erosion	Contour bunding on 50 ha	LUC together with DSWC/UNDP	April 2014
Cash crops	Marketing	Construct marketing shed along road	VDB	July 2014
Plantation	Disease	Identify control measures	LUC with Dept. Of Agriculture	December 2013
Forest reserve	Grazing	Exclude cattle	LUC	January 2014
Village area	Drinking water	Establish new cistern above village	VDB	October 2013

- The LUC will review adherence to by-laws and take action if necessary
- The LUC will adjust the Land-Use Action Plan and by-laws if necessary

## Documentation

All the generated information (socio-economic information, land-use zones – perpendicular photograph of the land-use zones on the 3D model, Land-Use Action Plan, by laws, monitoring end evaluation procedures) are compiled into a common document and signed by the village Land-Use Committee.

## Final presentation and handing-over ceremony

With a member of public administration as chief guest (preferably the Deputy Commissioner of the district, Figure 19), the 3-D model along with the plan document translated into the local tribal language and Nagamese is handed over to the Village Council Chairman / Angh in a plenary meeting of the village. The model and plan will once more be briefly presented and the need for regular monitoring and evaluation highlighted (Figure 20).



Figure 18: Tuimei village land-use plan



Figure 19: District governor arriving for ceremony



Figure 20: Handing over ceremony

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# Annex I

## Preparation of the base map for the 3-dimensional terrain model

Install Quantum GIS on your computer. The software is licensed under a general public licence and is therefore freely available at <http://qgis.org>. As the installation file is very large, the file has been circulated among UNDP District Project Support Officers (DPSOs). Next, obtain the Digital Elevation Model data for your area. 90m resolution DEM data are freely available at <http://srtm.csi.cgiar.org> and the tiles for Nagaland are sheet srtm 55-07 for most of Nagaland srtm 56-07 for the eastern part of Mon district. These files have also been circulated among UNDP DPSOs.

Verify the boundaries of the village in the field with the help of knowledgeable village representatives. Locate the village you are conducting the land-use plan for

on Google Earth or on a topographic map and identify its geographic extremes of aerial extent (Figure 21). Note the coordinates you see for extreme points of the boundary towards N, E, S, and W. To do this in Google Earth, first you have to change the way coordinates are displayed. Under "Tools – Options – 3Dview", select "Decimal degrees" under the options for "Show lat/long" and click on "Apply". Next, you have to move the cursor to extreme points and read the geographic coordinates for latitude and longitude provided at the bottom right of your Google Earth window (red circle). Once you have identified extremes in all directions, you should have four values: the minimum and maximum value for latitude and the minimum and maximum value for longitude.

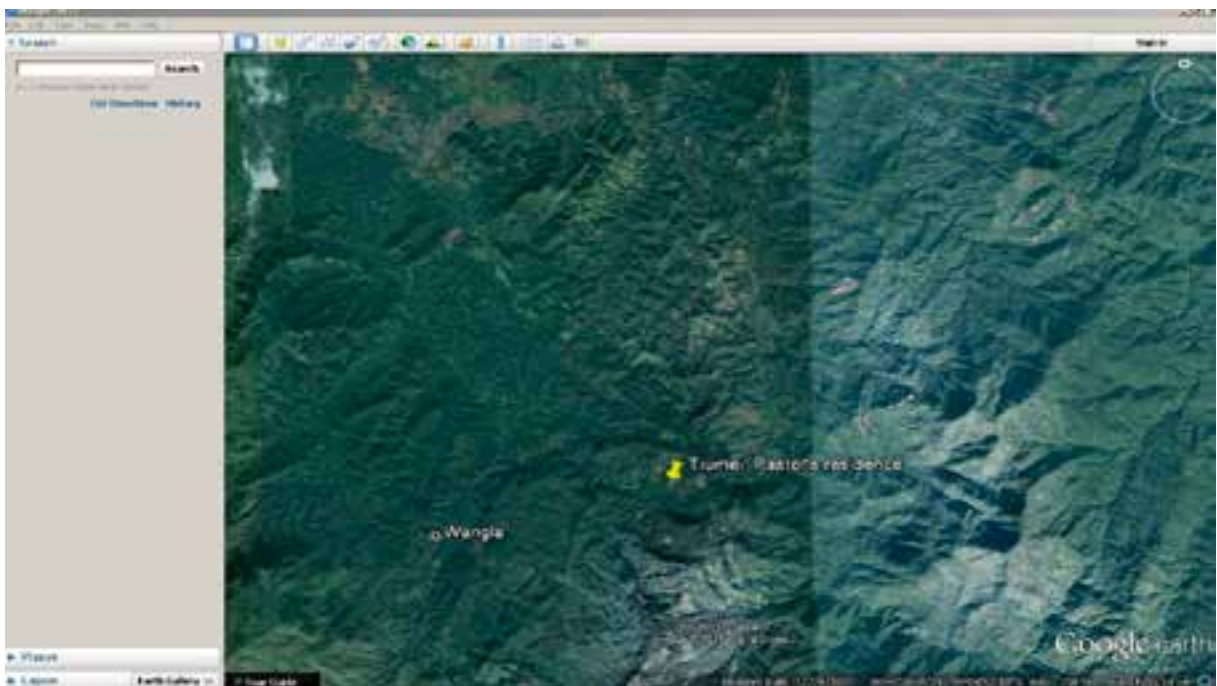


Figure 21: Google Earth image showing the geographic extremes of Tuimei village

Install Quantum GIS on your computer. The software is licensed under a general public licence and is therefore freely available at <http://qgis.org>. As the installation file is very large, the file has been circulated among UNDP District Project Support Officers (DPSOs). Next, obtain the Digital Elevation Model data for your area. 90m resolution DEM data are freely available at <http://srtm.csi.cgiar.org> and the tiles for Nagaland are sheet srtm 55-07 for most of Nagaland srtm 56-07 for the eastern part of Mon district. These files have also been circulated among UNDP DPSOs.



Figure 22: Quantum GIS software with Add Raster Layer button

Verify the boundaries of the village in the field with the help of knowledgeable village representatives. Locate the village you are conducting the land-use plan for on Google Earth or on a topographic map and identify its geographic extremes of aerial extent (Figure 21). Note the coordinates you see for extreme points of the boundary towards N, E, S, and W. To do this in Google Earth, first you have to change the way coordinates are displayed. Under “Tools – Options – 3Dview”, select “Decimal degrees” under the options for “Show lat/long” and click on “Apply”. Next, you have to move the cursor to extreme points and read the geographic coordinates for latitude and longitude provided at the bottom right of your Google Earth window (red circle). Once you have identified extremes in all directions, you should have four values: the minimum and maximum value for latitude and the minimum and maximum value for longitude.



Figure 23: Adding the Digital Elevation Model data as raster layer in QGIS

In the example of Tuimei, these values were latitude between 26.795°N and 26.859°N and longitude between

Table 5: Conversion of geographic coordinates from degree/minute/second to decimal format

Geographic coordinates in degree/minute/second format	Geographic coordinates in decimal format
26°47'42"N	26.795°N
26°51'32.4"N	26.859°N
95°01'30"E	95.025°E
95°06'3.96"E	95.101°E

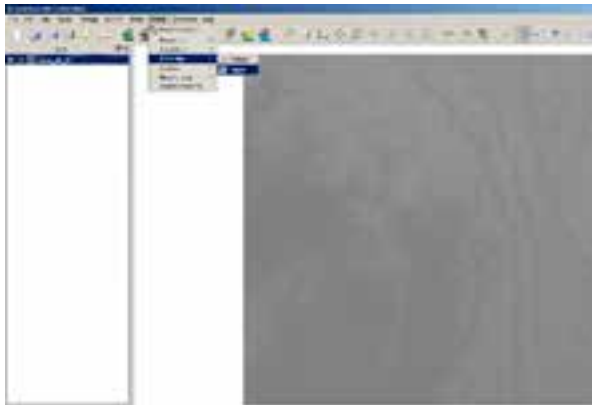


Figure 24: Clipping the raster in QGIS

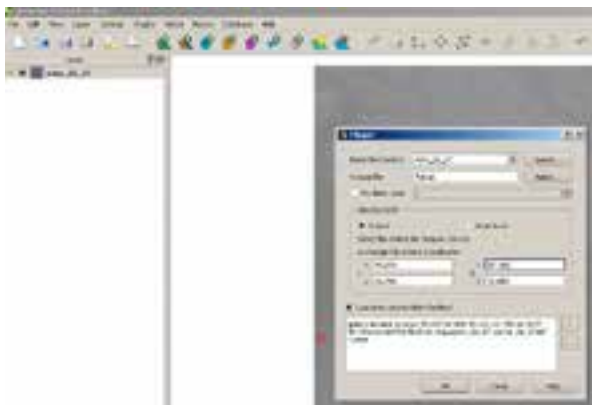


Figure 25: QGIS clipper window

95.025°E and 95.101°E. Topographic maps provide geographic coordinates in degree, minute, second format, which has to be first converted to decimal format. For the same values above, you would obtain 26°47'42"N, 26°51'32.4"N, 95°01'30"E, and 95°06'3.96"E. The conversion of e.g. 26°51'32.4" into decimal format works the following way:

1. Divide the seconds by 60:  $32.4/60=0.54'$
2. Add the value obtained to the value you have for minutes to obtain the minutes in decimal format:  $51'+0.54'=51.54'$

3. Divide the minutes in decimal format by 60:  $51.54'/60=0.859^\circ$
4. Add the value obtained to the value you have for full degrees to obtain the coordinate in degree decimal format:  $26^\circ+0.859^\circ=26.859^\circ$

Convert all four values in a similar way to obtain your geographic extremes in degree decimal format (Table 5).

Once you have obtained/converted all coordinates in degree decimal format, open Quantum GIS and click on "Add Raster Layer" (Figure 22). Select the SRTM Digital Elevation Model (DEM) data for your area (most of Nagaland is on sheet srtm 55-07, the eastern part of Mon district is on srtm 56-07) and click "Open" (Figure 23).

The DEM will appear as an image with grey shades. Lower lying areas are darker, higher lying areas are lighter. Next, click on "Raster - Extraction - Clipper" (Figure 24). Write the geographic coordinates in decimal format (see Table 5) into the window which opens up (Figure 25). As output file, write the village name (e.g. Tuimei) and check "Load into canvas when finished" before clicking "ok". Note the small red box appearing to the left of the clipper window - this is the village area you have delineated. After clicking "ok" for all windows, which open up subsequently, click "close".

Next load the clipped area into your window by right clicking on the newly appearing layer "Tuimei" on the left of your QGIS window. Select "Zoom to layer extent" and click the left button, also click off the check mark to the left of the srtm\_56\_07 layer. The village area will appear in the window. Next, select "Raster - Extraction - Contour" (Figure 27) to open a new window (Figure 28).

For the input file define the layer of your village (e.g. "Tuimei") and for the output file give a name (e.g. "Tuimei\_cont"). Define the altitude interval between contour lines and check the boxes "Attribute name" and "Load into canvas" before clicking "ok" and "close". The contour map of Tuimei village will appear in the window (Figure 29). You would need to print out this map in the scale of 1:10000 and use it for the participatory 3-dimensional modeling exercise.

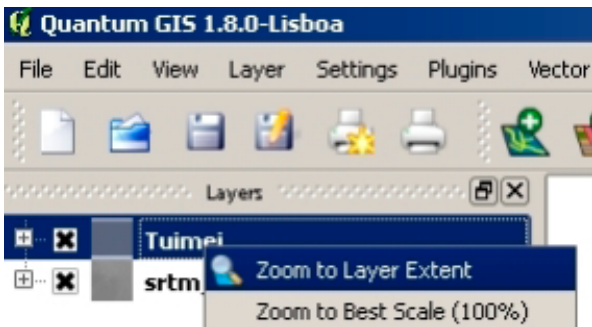


Figure 26: Zoom to layer in QGIS

You may have to change the colour of the contour lines in case they are not well visible. For this, select the layer containing the contour lines (1 - Figure 30) and change the line properties (2 - Figure 30). In order to add labels, select the "Labels" tab in the layer properties window (3 - Figure 30, Figure 31). Next, select "ELEV" in the "Field containing label" (1 - Figure 31). Define "Auto" for the label angle (2- Figure 31).

In order to print the map, click on "File – New Print Composer". A new window called "Composer 1" will open up (Figure 32). Here, click on "Add new map" (1 - Figure 32) and place the cursor in the top left corner

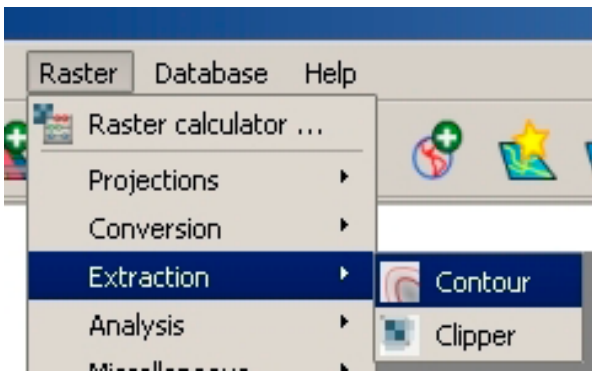


Figure 27: Extraction of contours from DEM in QGIS

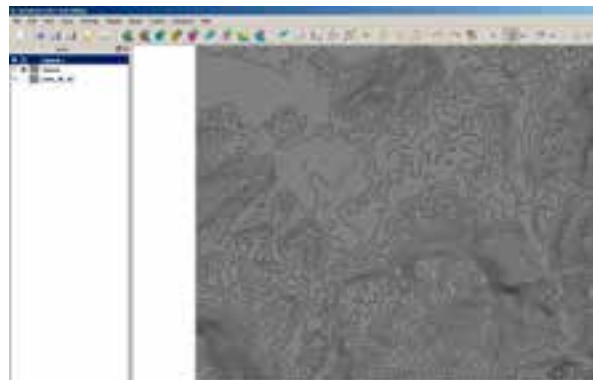


Figure 29: Extraction of contours from DEM in QGIS



Figure 28: Defining contour lines in QGIS

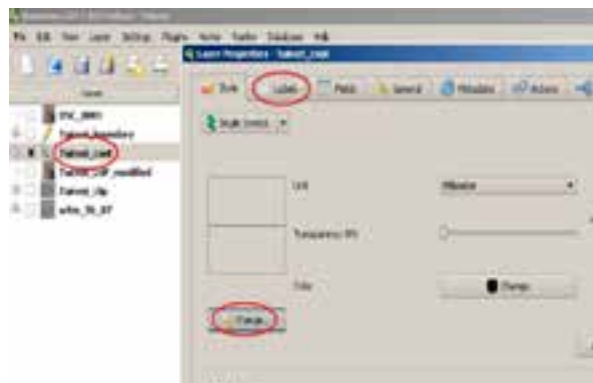


Figure 30: Setting of line under layer properties in QGIS



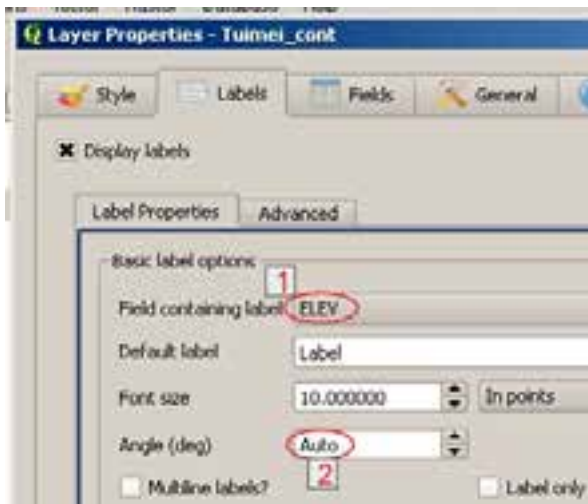


Figure 31: Setting of labels under layer properties in QGIS

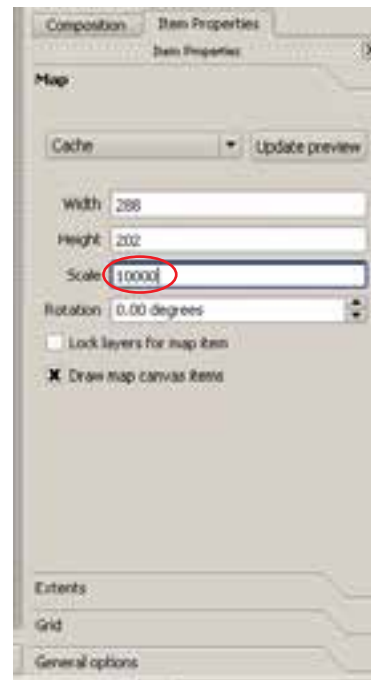


Figure 33: Item properties – map of the QGIS print composer

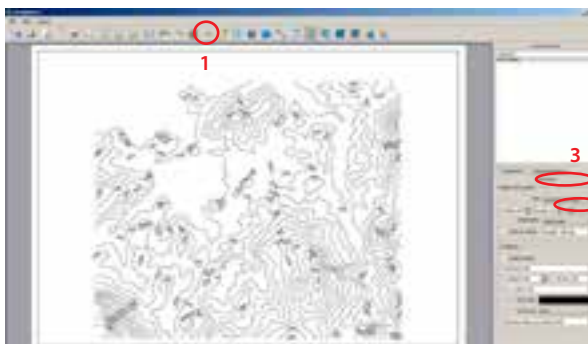


Figure 32: Print composer with loaded contour map

of the blank white page. While keeping the left button of your mouse pressed, open up a rectangle keeping a narrow margin within the blank white page. When you have completed the rectangle, release the mouse button and your contour map will appear within the rectangle. Set the paper size to A4 (2 - Figure 32), in case you do not have an A0 plotter at your disposal. Next, define the map properties under the “Item properties” tab (3 - Figure 32). Set the scale to 10000 (Figure 33). Under grid, select “Show grid” and define 0.01 both for the X and Y intervals. Select also the “Draw annotation” option (Figure 34).

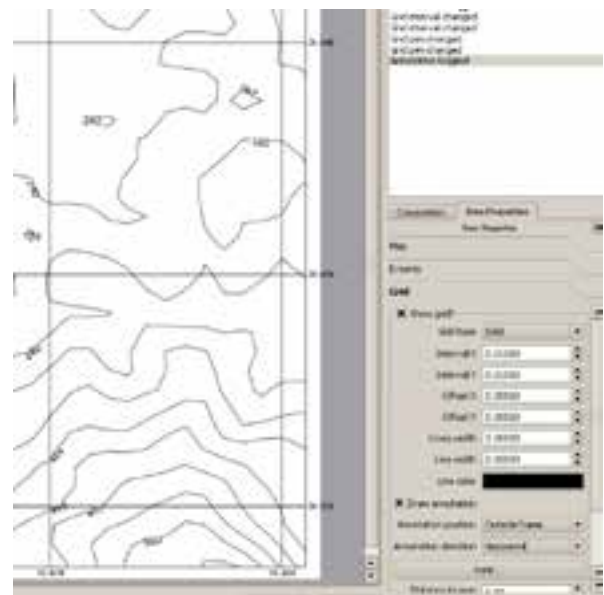
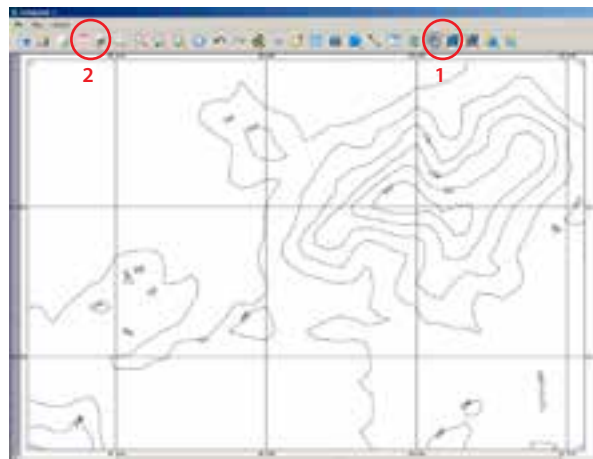


Figure 34: QGIS print composer item properties for grid

Since the map will not fit onto one single A4 page, you will have to print various pages. For moving the map to display various parts of it in the print window, change to "Move item content" (1 - Figure 35). If you click inside the map and hold the left mouse button pressed, you can move the map within the window. Move your map in a way that its top left corner coincides with the top left corner of the print composer window. Next, click on the pdf icon to create a printable file of the part of the map displayed in your print composer window (2 - Figure 35). Next, move your map to the right making sure that the last gridline is visible in your new map window. Create a pdf and move on towards the right, until you have the entire map area covered. Next, move down, making sure that the lowest gridline is still included in your next lower row. Proceed in this manner, until you have created pdfs of the entire map area. When assembling the printouts and taping them together, you can orient yourself on the gridlines.



**Figure 35: QGIS print composer with grid ready for printing**

# Annex II

## Preparation of the participatory three-dimensional model

P3DM is carried out after a set of other PRA methods forming part of the PLUP process have been completed (NAFRI et al., 2012). Initially, the village Land-Use Committee is divided into three groups. The first group is responsible for tracing contour lines on sheets of cardboard, the second group cuts the cardboard along contour lines and the third glues and places the layers on top of each, resulting in the three-dimensional terrain model.

Initially, the first group joins the various A4 printouts of the contour base map by tape to form a 1m<sup>2</sup> size map (Figure 36). Next, they prepare 1m<sup>2</sup> large sheets of 4 mm thick cardboard (Figure 37, Figure 38). Afterwards, they join sheets of carbon paper by tape so that the resulting surface forms a large sheet of carbon paper of 1m<sup>2</sup> size. Finally, the carbon paper is laid over the cardboard and the 1m<sup>2</sup> base map is placed on top of the other two layers. The three layers are fixed by clips, preventing the slip of layers. Next, group members are asked to trace the contour line representing the lowest altitude above sea level with pencil so that the impression creates a line on the cardboard (Figure 39, Figure 40).

They are also asked to trace the margin line (edge) of the map on the cardboard. Once they completed the task, they hand over the cardboard to the next group. They then place a fresh sheet of cardboard under the carbon paper and the base map and start tracing the next higher contour line along with map margins onto the second cardboard. They follow up the process until the contour line representing the highest altitude had been traced.

The second group cuts the margins and the contour lines (Figure 41), while the third group glues (Figure 42, Figure 43) and places the layers on the top each other (Figure 44, Figure 45). Once all layers have been glued on top of each other, the raw model is ready for being covered in plaster. First, however, the raw model is covered in cellular tape (Figure 49) to prevent it from getting moist while covering it with Plaster-of-Paris (Figure 50, Figure 51, Figure 52). After seeing their land emerging with the model, villagers eagerly discuss village topography (Figure 46, Figure 48, Figure 53). The model is now ready for further use in participatory resource mapping or land zoning exercises.



Figure 36: Assembly of contour base map



Figure 37: Preparation of 1m<sup>2</sup> cardboard sheets



Figure 38: Preparation of 1m<sup>2</sup> cardboard sheets



Figure 41: Cutting cardboard along contour lines



Figure 39: Tracing contour lines



Figure 42: Gluing of plywood model base



Figure 40: Tracing contour lines



Figure 43: Gluing of contour layers



Figure 44: Assembling contour layers



Figure 47: The raw model



Figure 45: Assembly of contour layers



Figure 48: Farmers discussing village topography



Figure 46: Farmers with half-completed model



Figure 49: Application of cellular tape on model



Figure 50: Covering model with POP plaster



Figure 52: Completed model covered in plaster



Figure 51: Covering model with POP plaster



Figure 53: Villagers discussing topography





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