ZEF Bonn

Community Resource Mapping for Regional Land Quality Assessment in Uganda

A Methodology Documentation Paper

by

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for the

Policies for Improved Land Management in Uganda Project

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1 Introduction

This paper documents the methodology of Community Resource Mapping (CRM), which was applied to a survey covering 108 communities in Uganda between March and October 2000 under the research project "Policies for Improved Land Management in Uganda". The main collaborating institutes of that project were International Food Policy Research Institute (IFPRI), Center for Development Research (ZEF), Makerere University Faculty of Agriculture (MAFU), National Agricultural Research Organization (NARO), and Agricultural Policy Secretariat (APSEC). The objective of this survey was to acquire a regional level resource data set that will be used to identify and characterize natural resources and changes in land use and land management of communities within that region between 1990 and 1999.

The structure of this paper comprises of three main sections: 1) the spatial sampling framework to select 108 communities that are representative for 18 different development domains covering two third of Uganda's area (chapter 2), 2) the community resource mapping procedure that describes a) the methodology of boundary delineation, natural resource and land management feature collection, b) the questionnaire to record those features characteristics and c) the soil sampling strategy (chapter 3), and 3) survey management guidelines that were applied to coordinate the activities of four teams who simultaneously carried out community resource mapping in spatially distributed communities (chapter 4).

2 Spatial Sampling Framework

The spatial sampling framework for this regional community resource mapping survey relies on methodological and conceptual discussions with policy makers, planners, and agricultural researchers in Uganda. Based on those discussions we developed a model-based stratification algorithm to reduce total variability of natural and socio-economic factors related to agricultural development over the whole territory of Uganda. The model for the proposed stratification procedure is the 'development pathway" concept (Pender et al., 1999)". A "development pathway" is defined as a common pattern of change in farmers´ livelihood strategies, associated with its causal and conditioning factors (Pender et al., 1999).

Many natural and socio-economic factors may determine development pathways depending on the specific study location. Based on previous research on agricultural development, some natural resource and socio-economic factors were found to be of particular importance. Pender et al. (1998) suggests four main factors that are particularly important in African conditions, including population density, access to markets, agricultural potential and elevation (cited by Wood et al., 1998). Those four factors were developed by spatial analysis and combined by stratification using Geographic Information Systems (GIS) to demarcate "development domains" for the whole area of Uganda (Figure 1). More details on that stratification are reported elsewhere (Ruecker et al. 2003).

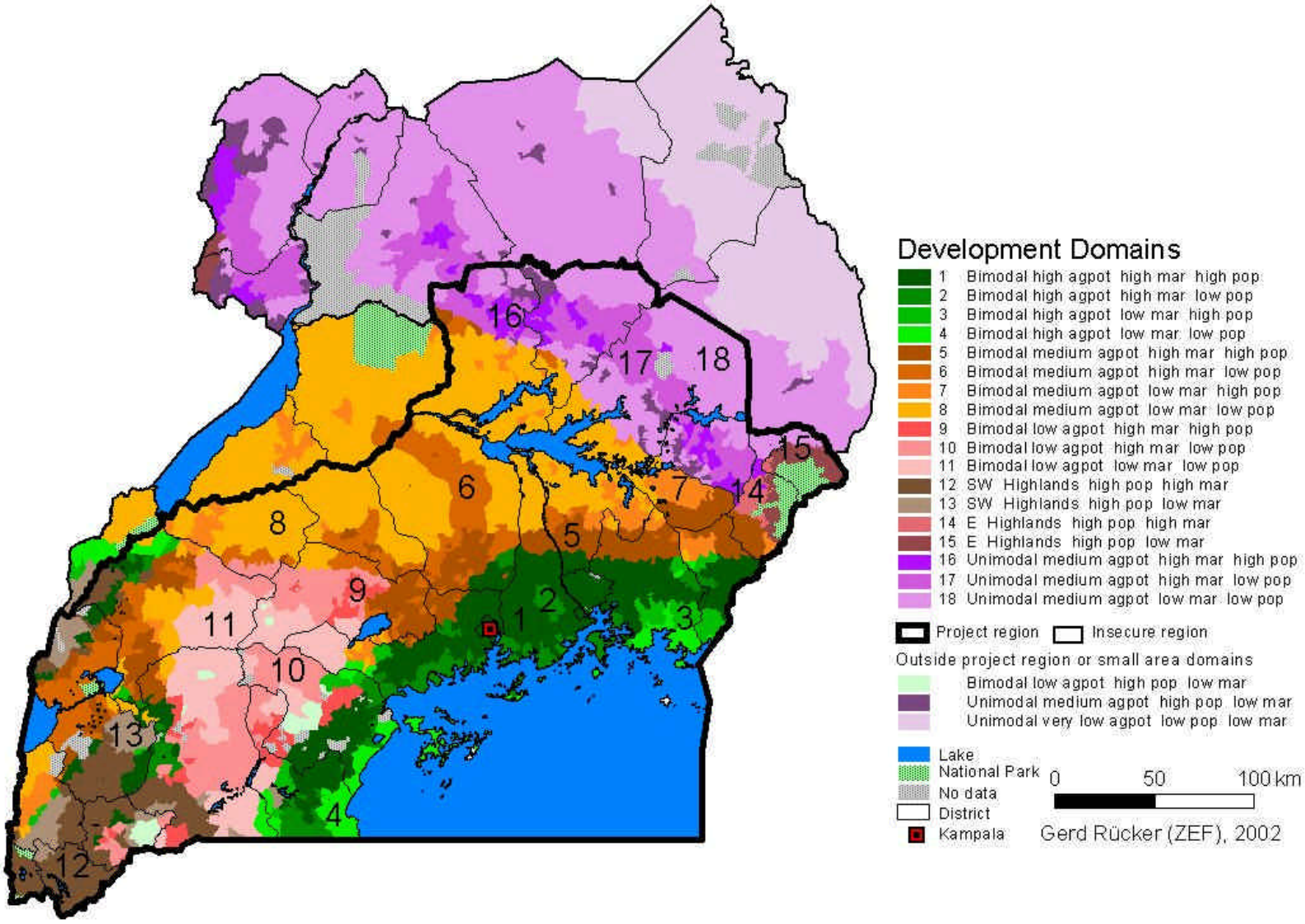


Figure 1: Development domains of Uganda

The survey region was narrowed down to southern and central parts of Uganda due to rebel activities in major areas of northern and western Uganda. That remaining survey region consisted of 18 development domains and was approximately the area south of Lake Kyoga, but included also the northern districts Lira and Apac where important annual based farming systems are located. The total survey region covered 63% of the total area of Uganda.

Parishes were the smallest administrative units in Uganda for which digital geographic information for our defined survey region was available. The administrative level ´Local Council 1´ (LC1), which is one level below parish, can be addressed as the community. The primary sampling unit was "enumeration area", a technical boundary definition that has been used during population census. Enumeration area can be smaller than LC1, but in some areas in Uganda it could be also on a higher level (Guillaume and Lambotte, 1998). If the enumeration area was smaller than LC1 and entirely within one LC1, the LC1 was considered. If the enumeration area included more than one LC1, one of them was chosen. The number of enumeration areas for development domains was based upon the total population of each domain, but a minimum of 4 samples was used for each strata (Table 1).

Table 1: Number of survey communities within development domains

#	Elevation	Population Density	Market Access	Agricultural Potential	Number of Survey Communities
1	Lowland	Low	Low	Unimodal	4
2	Lowland	Low	Low	Bimodal low	4
3	Lowland	Low	Low	Bimodal medium	7
4	Lowland	Low	Low	Bimodal high	4
5	Lowland	Low	High	Unimodal	4
6	Lowland	Low	High	Bimodal low	4
7	Lowland	Low	High	Bimodal med	4
8	Lowland	Low	High	Bimodal high	4
9	Lowland	High	Low	Bimodal med	6
10	Lowland	High	Low	Bimodal high	4
1	Lowland	High	High	Unimodal	6
12	Lowland	High	High	Bimodal low	4
13	Lowland	High	High	Bimodal med	11
14	Lowland	High	High	Bimodal high	18
15	Southwest highlands	High	Low	-	4
16	Southwest highlands	High	High	-	12
17	Eastern highlands	High	Low	-	4
18	Eastern highlands	High	High	-	4

From the selected parish, one enumeration area was randomly selected. If a selected LC1 belonged to an urban municipality or was located on an island, it was dropped and a replacement was drawn. Research communities of collaborating institutions were included in that selection. This expansion of the sampling units served to compare natural resources and land management conditions of communities where agricultural research and extension has been or will be very active for many years with communities that experienced little or no research and extension impact. Those additional communities comprise 1) three communities in Iganga District from the International Center for Tropical Agriculture (CIAT), 2) two communities in Kabale District from the African Highlands Initiative (AHI) and 3) two communities in Mbale District and one community in Pallisa district from National Agricultural Research Organization. The final sample population amounted to 108 LC1s. The spatial location of those communities within Uganda is presented in Figure 2.

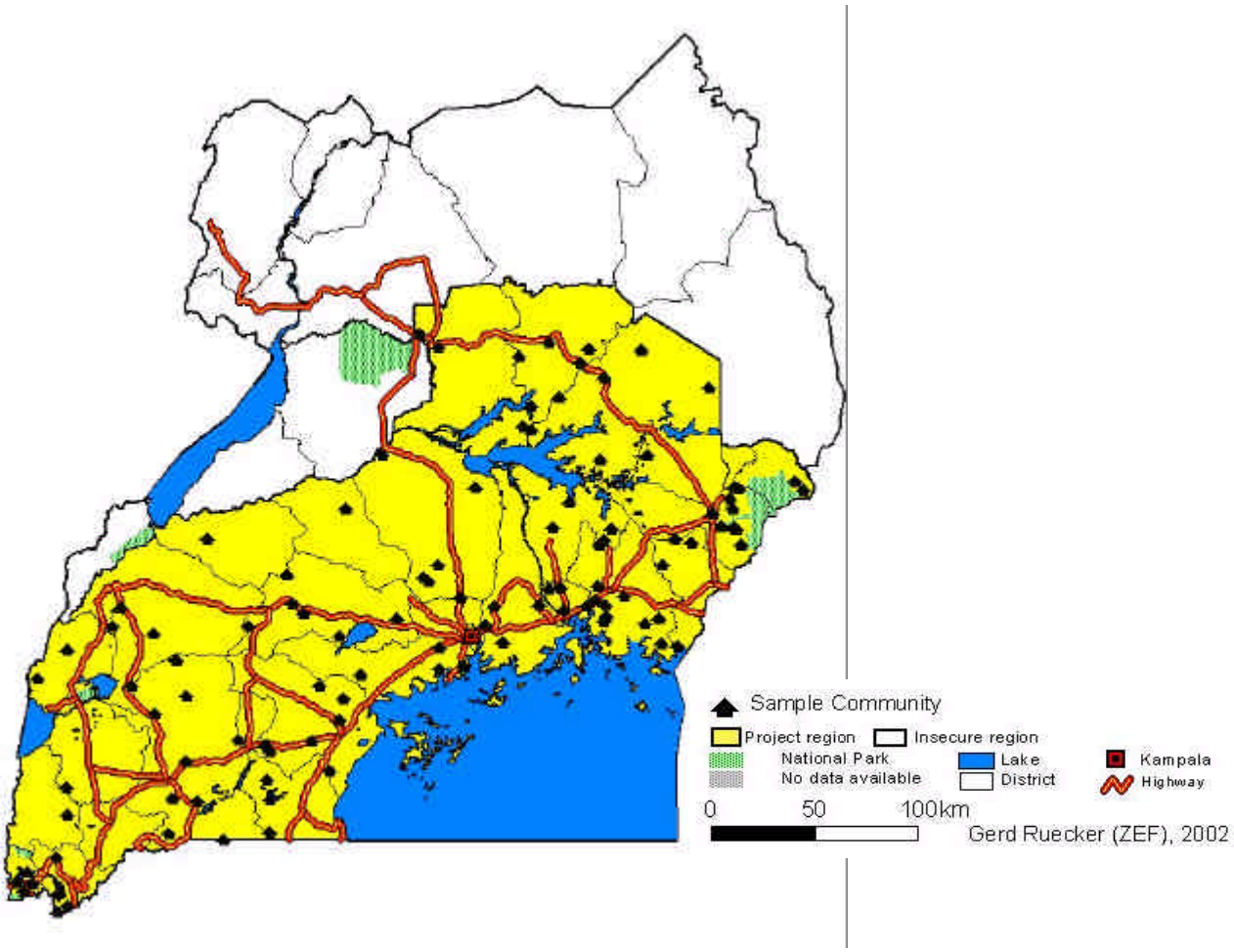


Figure 2: Location of sample communities within survey region

3 Community Resource Mapping

The community resource mapping procedure was developed to identify and characterize natural resources and changes in land use and land management of communities within that survey region between 1990 and 1999. The suggested procedure employed participatory methods to collect resource information together with farmers who shared with us their indigenous knowledge, spatial perception and long-term experience on land quality and land management. During the survey the provided information was organized in a "Field GIS" by using a set of transparencies on which the boundaries of different resource objects (e.g. land use types, soil types) were drawn. Since that "Field GIS" was georeferenced, all survey maps could be transferred into digital GIS maps. Those GIS maps were integrated together with the previous stratification data in the "Uganda Regional Resource GIS" (URRGIS). All descriptive information from those survey resource objects as well as analytical results from soil surveys were recorded in a questionnaire. That information from the questionnaire was entered in a database, which in turn was linked to the resource objects of the URRGIS.

3.1 Mapping strategy

For each selected community, the administrative boundary that was demarcated on topographic maps (scale 1:50.000) of the Ministry of Lands and Survey, Uganda, was enlarged on A1-size paper, while the georeference of the paper map was maintained. North direction, striking topographical features such as roads, rivers or rock exposures, and names of neighboring communities were added on this map to facilitate farmers´ orientation. This composed map was titled 'administrative boundary map'.

In each community the LC1 chairperson was asked to selected six representative farmers, men and women equally, who were knowledgeable about the conditions of the land resources in the their community over the time period 1990 until 1999. Farmers and LC1 chairperson were guided in map orientation and reading the 'administrative boundary map'. During joint reconnaissance walks through the community, the prepared administrative map was corrected if it was necessary. The coordinates of one geographical feature were recorded as a community reference point by using hand-held GPS.

For detailed identification of community resources and land management the spatial unit of major landscape units within a community was identified as upper slope, middle slope, lower slope and flat area. The spatial dimension of these features was demarcated on a series of transparencies overlaying the administrative map in a kind of ´Field-GIS´ similar to layers of GIS themes. Farmers identified in group discussions major land use types in those landscape units in the second season of 1990 and 1999. Land use types were classified as areas with cultivation, settlement or natural vegetation. The latter land use type includes fallow, grazing area, forest / woodland, bare land, swamp, wetland and bush. Farmers were also asked about a wide range of questions on their land management, including soil and water conservation (SWC) and soil fertility management (SFM) technologies, which they have applied in different landscape units of the communities. Farmers´ perception about causes of changes in land use, land management and soil quality in landscape units was also investigated. Farmers´ answers were coded after modified guidelines from Romig et al. (1996). Detailed step-by-step description of that procedure is presented in chapter 6.

About ten composite top-soil samples (0-20cm depth) were collected at an equal surface distance along a slope transect which traverses the dominant landscape units of each community. The detailed soil sampling strategy is described in chapter 5. Previously compiled ´Field GIS´ layers were cross-checked and modified if necessary during the transect walk. The collected soil samples were analyzed in the laboratory of the Kawanda Agricultural Research Institute, Kampala, Uganda. After drying at 30 °C and soil was gently ground to pass a 2mm sieve. Texture was analyzed by hydrometer method (Hartge and Horn, 1989). Organic matter content was measured by modified Walkley and Black method (Nelson and Sommers, 1975) and pH in 1:2.5 H_2O solution by pH meter (Hesse, 1971; Dewis and Freitas, 1970). Concentrations of available bases were determined by flame photometry for K and Na, and by atomic absorption spectrophotometer (AAS) for Ca and Mg, after Anderson and Ingram (1993). Phosphorus was determined calorimetrically by the molybdate blue method (Olsen and Dean, 1965).

All information obtained from the farmers, or acquired by own investigation was recorded in a questionnaire, while spatial information was demarcated on maps. All maps were scanned, digitized, geo-referenced and together with the data from the questionnaires, the soil analysis and the stratification integrated in a GIS and Microsoft Windows Access® database.

3.2 Questionnaire

All information that was collected from farmers as well as assessed in the field was recorded in a questionnaire that was structured by topics and landscape units. The questionnaire was organized in three main thematic parts with a total of seventeen specific thematic sections:

Part 1: General Information

Section A: Administration

Section B: Respondents

Section C: Geographical Information

Part 2: Community Resource Mapping

Section D: Landscape

Section E: Land use type – Crops/ Cropping systems - Soil Fertility Management - Soil and Water Conservation Management - Livestock

Section F: Change detection (1999 - 1990): Land use type, – Crops/ Cropping systems – Soil Fertility Management - Soil and Water Conservation Management – Livestock

Section G: Soils and Soil Quality

Section H: Climate and Climate Change

Part 3: Transect Walk

Section I: Sociological and Economical Status

Section J: Crops / Cropping Systems and Management

Section K: Farners´ Soil Quality Criteria and Assessment

Section L: Landscape

Section M: Soil Physical Characteristics

Section N: Soil Biological Characteristics

Section O: Crop Quality

Section P: Overall assessment

Community Resource Mapping (CRM) Questionnaire

Policies for Improved Land Management in Uganda

Gerd Robert Ruecker
Center for Development Research (ZEF)

Community No: _____ Day: ____ Month: _____ Year: _____

Names CRM assistants: _____

Part 1: General Information

Section A: Administration

District: _____ DISTCODE: _____
County: _____ CNTCODE: _____
Sub-County: _____ SCOCODE: _____
Parish: _____ PARCODE: _____
LC1: _____ LC1CODE: _____
Community (selected): _____ COMCODE: _____
Communities (not selected):_____
within LC1): _____

Section B: Respondents

No.	Full Name of Farmer	Sex	Age	Farming in Community since	Location of Farm Land	Dominant Soil Condition of Farm	
						Initially	Current
				at least since 1985	upper, middle, lower slope, flat land	(4) very good, (3) good, (2) moderate ,(1) bad	
1							
2							
3							
4							
5							
6							

Section C: Geographical Information

1 GPS point in **LC1** (e.g. LC1 office), **3 GPS** points in **community** (e.g. road junction) and **10 GPS** points along the **transect**

#	Name / Description of Location for Striking Feature / Soil Sample	GPSCODE		North	East
		LMK-0x	LC1 name – 01/ Community name – 01/- 02...	Deg / Min / Sec	
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					

Part 2: Community Resource Mapping

Feature	Time Period	Coding	Community Cross – Section
Section D: Landscape			
Landscape Unit	-	Upper, middle, lower slope, flat land	
Section E: Land use type (LUT) - Crops / Cropping Systems (C/CS) - Soil Fertility (SF) - Soil–Water Conservation (SWC) Management - Livestock (L)			
Land Use Type (LUT)	1999	**Rank 5 dominant** LUT within landscape unit **by area** ***Codes:*** - cultivated land - fallow - grazing area - forest/woodland - land not used - swamp / wetland - natural land - settlement - bush / scrub - lake ***Example:*** 1. cultivated land (90%) 2. grazing area (5%) 3. settlement (5%)	
	1990		
Farmers` LUT criteria	-	**Ask farmer for <u>their specific</u> LUT criteria.** ***Example:*** Soil texture, soil color, vegetation, fertility	

LUT name	-	Copy LUT from above	
Crops / Cropping Systems – Soil Fertility Manage-ment	1999	**1. List 5 dominant crops** grown **2. Estimate area size** of crops covering the landscape **2.** Add **crop usage** c cash - f food cf cash & food **3.** Add **crop specific SF- management** **Check and describe** in farmers´s words: - mulching - fallowing - **crop rotation** - crop diversification - **fertilizer** (org., inorg., org+inorg-> which?) - terracing - herbicides - pesticides - other **practices (which?)** ***Example:*** 1) coffee$_{c}$ (**30%**, ferrtilizer) 2) banana$_{cf}$ (**20%**, mulching) 3) cassava $_{f}$ (**50%**, -)	
	1990		
Soil – Water Conservation Manage-ment (SWC)	1999	How do farmers **conserve / control** Soil and Water? **Rank list** of SWC practices **according to importance** for farmer. ***Example:*** 1. terracing 2. fanya juu **3. indigenous practices (which ?)** 4. water harvesting 5. bunds 6. mulching 7. minimum tillage 8. cover crops 9. contour cropping 10. zero grazing	
	1990		
Livestock	1999	**Which livestock** do farmers have? **1. Rank** list of livestock **according to importance** **2.** Add **usage** of livestock ***Example:*** 1. cow (meat, milk, cow dung) 2. goat (meat) 3. chicken (food, dung)	
	1990		

Section F: Change detection (1990 => 1999): LUT - C/CS - SF - SWC Management – L			
LUT name	-	Copy LUT from above	
Change in size of area	1990 ↓	**Specify (%) change** of area size (increase / decrease) **within landscape units** for: **1. Land use type** **2. crops / cropping system** **3. soil fertility management** **4. soil – water conservation** **5. livestock** ***Example:*** 1. cultivation area (+50%), fallow area (-50%) 2. banana (-20%), maize (+50%) 3. mulching (+20%) no SFM (-20%) 4. terracing (+30%) not SWC (-30%)	
Causes of changes	1999	**1. List** main causes of change **2. Rank** main causes according to farmers´ priority (max. 5) ***Example:*** 1. soil fertility decline 2. heavy soil loss 4. population increase 5. new road for better market access	
Results of changes		**1. List** main results / outcomes of changes **2. Rank** main results according to farmers´ priority (max. 5) ***Example:*** 1) increased yield 2) reduced pests 3) reduced erosion 4) more different crops 5) more deep soils	

Section G: Soil Types / Variability - Soil Fertility			
LUT name	-	Copy LUT from above	
Local name of soil type	-	-	
English name	-	-	
Soil Fertility **Present Status**		(0) **Poor** soil fertility, potential very low (2) **Moderate**, fertility not balanced (4) **Good**, fertility balanced, high pot.	
Change **Trend** **Degree**		**1. Trend** of soil fertility change (1990-99) **Stable** / **Decline** / **Incline** in soil fert. **2. Degree** of soil fertility change (1990-99) **small** / **moderate** **great** changes	
Symptoms of change		Ask farmers **how they recognize soil fertility de-/incline** ***Examples:*** - Yield decline - Pest pressure increase - Diseases increase - Plant leaves yellowish	
Reasons of change		**1. List** causes of soil fertility de-/incline **2. Rank** causes according to farmers´ priority (max. 5) ***Example***: 1. continuous cultivation 2. lack of inputs	
LUT name	-	Copy LUT from above	
Crucial years of soil fertility change **trend / degree**	1990 ↓ 1999	**1.** Note chronologically **crucial years** which mark significant changes in soil fertility since cultivation began **2.** Specify **trend** of (decline / incline) **3.** Specify **degree** of de-/incline **(great, mod. little)** **4.** Make notes of **why there was decline / incline** ***Example:*** 1980 great banana decline (nemat.) 1987 mod. cassava decline (->cassava mosaic)	
Strategies **against soil fertility decline /** **for soil fertility**		**1. List strategies farmers <u>already</u> apply** against soil fertility decline / for soil fertility incline **2. Rank** strategies according to farmers´ priority (max. 5)	

Section H: Climate and Climate Change			
Climate Change		Have you observed any climate change? Yes / No	
		If yes, which type ?	
Rainy Seasons	1990	Note all facts for **1. first** rainy season **2. second** r. s. (not planting season!)	
Reliability	↓	**Did the rains come / end to the expected time?** **Time period between actual start/end of rainy season (1990/99) and expected dates** **1.** first rainy season **2.** second rainy season ***Example:*** 2 weeks deviation of start of first rainy season (1999)	
Efficiency	1999	Was **rainfall less, more or exactly what was expected**? **1.** first rainy season **2.** second rainy season	

Part 3: Transect Walk

Section I: Farmers´ Sociological and Economical Status in 1999			
LUT name	-	**Copy LUT** from above	
Name		First name, second name	
Age			
Sex		Male / female	
Ethnic group			
Household (HH) size		**1. Number** of people in HH of **respondent** **2. Average number** of people per HH	
Potential labor force		**1.** Number and sex of between 10 and 65 years of HH actively working on the farm **2.** Number and sex of hired laborer	
Education		Level of school education of respondent	
Sources of income		**1. List sources** of income including on/off farm activities **2.** Assess **relative %** of income sources	
<u>Area size</u> **Total land**	1990 ↓ 1999	**Total size of land** of farmer (acre) in land-scape unit including fallow land (1990-1999)	
Plots under cultivation		**Number** and **size** of **plots** (acre) comprising total **cultivated land** (1990-1999)	
Non Cultivated land		Farmers´ **kind and area size** of **non cultivated land** (acre) (e.g. grazing land, forest) (1990-1999)	
Land sufficiency		Do you consider the land you own sufficient to make a living? If not **why**?	
Land title		What kind of land title do you hold?	
Access to capital		1. Sources of credit 2. Average amount 3. Interest rate (%/month) 4. Mode of repayment (cash/in kind)	

LU/LF name	-	**Copy LU/LF** from above	
Expenditures for agricultural purposes		**1.** Kind of **agricultural inputs** needed for agricultural production (e.g. tools, fertilizer, labor) **2. Rank** from highest to lowest **amount spent annually**	
Expenditures for <u>non-</u> agricultural purposes		**1.** Kind **of non-agricultural production items** purchases (e.g. stable food, education, health) **2. Rank** from highest to lowest **amount spent annually**	
Section J: Crops / Croppings Systems and Management			
<u>Crops / Cropping system</u> **in plots** **crop / crop rotation** **Area size** **Yield** **Food / Cash**	1990 ↓ 1999	**<u>Acquire data for all plots</u>** the farmer owns and which were under his cultivation from **<u>1990-1999.</u>** **<u>Indicate assessment for the actual plot</u>** from which you take the soil sample. **1. kind** of **<u>crop & crop rotation</u>** (1990-1999) e.g. maize ->beans ->cassava -> maize... **2. area size** occupied by each crop / cropping system (% of farmer´s total cultivated land) **3. yield** (local unit + conversion factor) **perennial crops**: yield / specific period e.g. banana bunch size peak/off season **annual crops**: yield/ 1st, 2nd season **4. food / cash** / food & cash crop	
<u>Soil Fertililty</u> / **<u>Management</u>** **Problem Awareness** **Observation of problems** **Present status**		**1.** Do you as a **farmer consider nutrient depletion as a problem?** A serious B medium C not serious **2.** How do you **observe** and **measure** soil fertility? **3.** Which of **farmers´ plot/s (in which landscape position)** has/have presently (0) **Poor** soil fertility, potential very low (2) **Moderate**, fertility not balanced (4) **Good**, fertility balanced, high pot.	

LU1 name	-	**Copy LU1** from above	
Plot specific assessment		The following questions are for the **specific plot from where you take the soil sample !**	
Soil sample number	-	**Note soil sample number** from that plot	
Soil Fertililty / Management **Present status**		(0) **Poor** soil fertility, potential very low (2) **Moderate**, fertility not balanced (4) **Good**, fertility balanced, high potential	
Change **Trend**		Did you observe any **Change in soil fertility over the last 10 years?** **Stable** soil fertility **Decline** in soil fert. **Incline** in soil fert.	
Degree	1990	**Degree** of soil fertility Change (1990-99) **Small** changes **Moderate** changes **Great** changes	
Symptoms of change	↓	**How do you recognize soil fertility de-/incline** ***Examples:*** - Yield decline - Pest pressure increas. - Diseases increased - Plant leaves yellowish	
Reasons of change	1999	**1. List** causes of soil fertility de-/incline **2. Rank** causes according to farmers´ priority (max. 5) ***Example***: 1. continuous cultivation 2. lack of inputs	
Prevention / Improvement Measures		If soil fertility has changed, **what kind of Measures** did you Apply on this plot: ***Example:*** - mulching - fallowing - **crop rotation** - crop diversification - **fertilizer** (org., inorg., org+inorg-> which? e.g cow dung, urine - herbi/pesticides - **other practices**	

LU1 name	-	**Copy LU1** from above	
Fallow **Management**		**1.** Do you have **fallow land YN**	
Duration		**2. How long** is your fallow period?	
Treatment		**3.** Do you apply any **treatment / techniques during your fallow** period?	
Crop residue **Management**		**1. How do you treat crop residues**? ***Example***: Burning, mulching	
Proportion		**2.** What **proportion of crop residues** are **returned** to the plot (%) <20, 20-50, 50-80, >80	
Timing		**3. When do you return crop residues?** - Immediately after Harvest - After ploughing - After sowing - Other	
Proportion 10 years ago	1990	**4.** Was this **proportion similar 10 years ago**? **If not, why?**	
	↓		
Livestock	1999	Livestock of farmer (1990-1999) **1. Species** **2. Number** **3. Purpose direct** (e.g. meet) **4. Purpose indirect** (e.g. cow dung, urine for fertilizer)	
Soil-Water Problems / Conservation **Erosion / Crusting / Compaction**		**1. Do you consider** a) **erosion** b) **crusting** c) **compaction** **as a problem**? -> Y/N, 2 of list, all? **2.** If so, which **reasons** do you consider to cause a) **erosion ?** b) **crusting ?** c) **compaction ?** **3.** How do you **monitor** a) **erosion ?** b) **crusting ?** c) **compaction ?** **4.** What kind of **prevention measures** do you apply for a) **erosion ?** b) **crusting ?** c) **compaction ?**	

LU1 name	-	**Copy LU1** from above	
Drought / Water-logging	1990	**1.** Do you have a **serious problem with recurrent** a) **drought** ? b) **water logging** ? -> Both, none **2.** Was it **the same 10 years ago**? **3.** If not, what are the **main reasons for changes in** a) drought ? b) water logging ? ***Example->specify* !** - climate - poor soil quality - poor management - poor crop varieties - other **4.** If there are problems which strategies do you have to minimize the impact of a) **Drought**? b) **Water logging** ?	
<u>Land preparation</u> **Method**	↓ 1999	**1. Method of land preparation** (1990 – 1999) **- zero tillage** - slash - burn - slash and burn - herbicide use - weeds not removed - handhoe - tractor - oxen - other (specify)	
Change in method **Reasons**		**Did you change the method of land preparation in the last 10 years?** **What are the reasons for change?** - new technology / knowledge introduced - changing climatic conditions - changing soil conditions - cost of machinery / equipment - other (specifiy)	

LUT name	-	Copy LUT from above	
Wealth/ Poverty Ranking **LC1 & Farmer´s judgement**	1990	**1.** Ask **LC1 & farmer** for the different **wealth ranking criteria** in this community **2.** Ask **LC1 & farmer** for the **rank of the farmer** you interview in the landscape unit A **well-to-do** farmer B **less well-to-do** Farmer C **poor** farmer	
Researchers´ judgement	↓ 1999	**1.** List **your criteria** for farmers wealth. Observe: Dress, language, land size, capital, previous answers **2. Rank wealth of specific farmer** within wealth classes A **well-to-do** farmer B **less well-to-do** Farmer C **poor** farmer D **very poor** farmer **3. Indicate reasons for possible differ-ences** between your ranking and farmer´s ranking	

Section K: Farmers´ Soil Quality – Criteria and Assessment

LUT name	-	Copy LUT from above	
Farmers´ Criteria / Boundary of Land Quality	1990 ↓ 1999	**1.** Ask **which criteria** farmers use **to assess the quality of their land** After farmers have given their criteria, you ask whether the following criteria are important for them to assess quality of land: a) **Productivity factors** - soils/nutrients - rainfall - terrain - land size b) **Environmental factors** - pest/disease - stability of slopes against erosion - biodiversity c) **Human / animal health** - drinking water - infrastructure - land use diversity **2**. **Rank these criteria** according to farmers´ priority **3.** Note **farmers´ assessment of these criteria** for the soil in the specific landscape unit	

Section L: Landscape

LUT name	-	Copy LUT from above	
Topography	1990	F Flat A Almost flat G Gently undulating U Undulating R Rolling H Hilly S Steeply dissected M Mountainous	
Landform		MO Mountain HI Hill UP Upland PL Plain PT Plateau BA Basin VA Valley	
Land Element	↓	Classify **landscape element:** Su summit Sh shoulder Bs backslope Fs footslope Ts toeslope Ch channel	
Position	1999	**Relative position in** undulating or **mountainous terrain**: CR Crest UP Upper slope MS Middle slope LS Lower slope BO Bottom Relative position in **flat / almost flat terrain**: HI Higher part IN Intermediate part LO Lower part BO Bottom (drain. line)	
Aspect		Note the compass bearing looking downslope (in degrees)	
Rock outcrops per area		N None 0% V Very few 0-2% F Few 2-5% C Common 5-15% M Many 15-40% A Abundant 40-80% D Dominant > 80%	

Surface coarse fragments per area	1990 ↓	N None 0% V Very few 0-2% F Few 2-5% C Common 5-15% M Many 15-40% A Abundant 40-80% D Dominant > 80%	
Effective Soil depth	1999	(1) Extremely shallow < 10cm (2) Very shallow <30cm (3) Shallow 30-50cm (4) Moderately deep 50-100cm (5) Deep 100-150cm (6) Very deep > 150cm	
Section M: Soil Physical Characteristics			
Horizon of Top-soil **Depth**	1990	Use the ruler to measure the **depth of top soil horizon (cm)** from the surface down into the auger hole. Due to irregular boundary of the top-soil to the subsoil you might not determine the exact depth of the top soil, but a narrow range (e.g. 15-18 cm)	
Structure	↓	(0) cloddy with big chunks (2) lumpy or does not hold together (4) crumbly, granular e.g. 0 <- 2 or 0<->0	
Texture		(0) extremely sandy, clayey or rocky (2) too heavy or light (4) loamy	
Color (moist)	1999	(0) tan, light yellow, orange, or light gray (2) brown, gray, or reddish (4) black, dark brown, or dark grey	

Moisture availability		(0) soil dries out too fast, droughty (2) soil is drought prone in dry season (4) soil holds moisture well, gives and takes water easily	
Infiltration		(0) Water does not soak in, sits on top or runs off (2) Water soaks slowly, some runoff or puddling after heavy rain (4) Water soaks right in, soil is spongy, no ponding	
Drainage	1990	(0) Poor drainage, soil often waterlogged or over saturated (2) Soil drains slowly, slow to dry out (4) Soil drains at good rate for crops, water moves through	
Compaction		(0) Soil is compacted, thick hardpan (2) Thin hardpan or hoe layer (4) Soil stays loose, no hardpan	
Surface Crust		(0) Soil surface is hard, cracked when dry, compacted (2) Surface is smooth with few holes, thin crust (4) Surface does not crust, is porous	
Hardness (when dry)	1999	(0) Soil is hard, dense or solid, will not break between two fingers (2) Soil is firm, breaks between fingers under moderate pressure (4) Soil is soft, crumbles easily under light pressure	
Aeration		(0) Soil is tight, closed, almost no pores (2) Soil is dense, has few pores (4) Soil is open, porous, breaths	
Tillage Ease		(0) Difficult tillage, very hard (2) Fairly easy tillage (4) Easily tillage	
Surface cover		(0) Soil surface is clean, bare, residue removed or buried following harvest (2) has little residue, mostly buried (4) Surface is thrashy, lots of mulch left on top or cover crop	

ERCSICN	DEPOSITION	Type	1990	WS Sheet erosion WR Rill erosion WG Gully erosion WT Tunnel erosion WD Deposition
		Indicator		How do you observe the erosion / deposition type (which indicators)
		% Area affected within land-scape unit	↓	0% 0 - 5% 5 - 10% 10 - 25% 25 - 50% > 50%
		Degree	1999	(0) Severe erosion, considerable topsoil moved, gullies (2) Moderate erosion, signs of sheet and rill erosion, (4) Little erosion evident
		Activity		A Active at present R Active in recent past

Section N: Soil Biological Characteristics

Biological Activity		**List** fauna species (e.g. termites, earthworms, ants, millipedes, centipedes) and **their activity / abundance** (0) Soil shows little biological activity, no signs of soil microbes (2) Moderate biological activity, some wormlike threads (4) Biological activity high, wormlike threads	
Dominant Natural Vegetation inside / adjacent to the community	1990 ↓ 1999	**1.** Describe dominant natural vegetation **inside the community** within landscape units. **2.** Describe dominant natural vegetation **adjacent to the community.** ***Coding*** N No vegetation G Grass land F Forest W Woodland S Shrubland SA Savanna	
Type		**Type** of natural vegetation 1. Local name 2. English name	

LUT name	-	Copy LUT from above	
Quantity		**Estimate** the **coverage** of the vegetation on the soil within landscape No cover 0-15% 15-40% 40-80% > 80%	
Usage		Note **use of specific vegetation types**. ***Example:*** Napier grass->mulching ->thatching	
Weeds **Problem**		**1.** Do you have a **problem with weeds**? -> Y/N	
Name	1990	**2. List** local / English **names** of weeds	
Area / Degree	↓	**3.** Which **areas** of your field / landscape are **effected** by weeds? How seriously? a) little b) moderate c) seriously	
Pressure in 1990		**5.** Was the **weed pressure similar 10 years ago?** YN	
Reasons for change	1999	**6.** If not **what are the reasons for the changes**	
Reasons for present pressure		**7.** What are the **reasons for the present weed pressure** (only if farmer considers weed as a problem) ? - permanent agriculture - low soil fertility - not enough labour for weeding - no availability of - herbicides - climate change - other	

LUT name	-	Copy LUT from above	
Weeds **Yield reduction**		**8.** To **what degree do you think your yields from this plot are affected by weeds** (% reduction)? < 10, 10-30, >30	
Strategies		**9.** What **strategies** do you use / could be used **to reduce weed pressure?** - make herbicides available - subsidize herbicides - improved crop managem. (specify) - improved land managem. (specify) - other?	

Section O: Crop Quality

Pests / Diseases **Problem**		**1.** Are your **crops often affected** by a) Pests YN b) Diseases YN	
Stress / Resistance		**2.** (0) Crops damaged severely by pests / diseases (2) Crops stressed by pests / diseases (4) Crops tolerate pests / diseases well	
Serious affects	1990	**3. How often** has your crop production been **seriously affected** in the past ten years? a) Pests 12345678910 b) Diseases 12345678910	
Name	↓	**4. List** local / English **names** of a) Pests b) Diseases	
Most Affected Crops	1999	**5.** Which **crops** of your field / landscape are the most **effected**?	
Seriously affected		**6.** What **proportion of crops** was **seriously affected** by a) Pests / b) Diseases 1990 1999 Crop1 Crop2 Crop3	
Pressure in 1990		**7.** Was the **pressure similar 10 years ago for** a) Pests b) Diseases	

LUT name	-	Copy LUT from above	
Pests / Diseases **Reasons for change**		**8.** If pest / disease pressure was different 10 years ago, **what are the reasons for the changes**	
Reasons for present pressure		**9.** What are the **main reasons for the present pressure** (only if farmer considers weed as a problem) ? a) pest b) disease ***Example*:** - permanent agriculture - low soil fertility - not enough labour for weeding - no availability of - herbicides - climate change - other	
Strategies		**10.** What **strategies** do you use / could be used **to reduce pressure?** a) pests b) diseases	
Yield reduction		**11.** To **what degree do you think your yields from this plot are affected by** a) pests b) diseases (% reduction compared to unharmed crop)? < 10, 10-30, >30	
Appearance		(0) Overall crop is poor, stunted, discolored, in an uneven stand (2) Overall crop is light green, small, in a thin stand (4) Overall crop is dark green, large, tall, dense stand	
Nutrient deficiency		(0) Crop shows signs of severe deficiencies (blighted, streaky, spotty, discolored, leaves dry up) (2) Crop falls off or discolors as season progresses (4) Crop has what it needs, shows little signs of deficiencies	

LUT name	-	Copy LUT from above	
Roots		(0) Crop roots appear unhealthy poorly developed (2) Roots are shallow, few fine roots (4) Crop roots are deep fully developed	
Stems	1990	(0) Stems are short, spindly, lodging often a problem (2) Stems are thin, leaning to one side (4) Stems are thick, tall, standing, straight	
Leaves	↓	(0) Leaves are yellow, discolored, few (2) Leaves are small, narrow, light green (4) Leaves are full, lush, dark green	
Drought Resistance	1999	(0) Crops dry out quickly, never completely recover (2) Crops suffer in dry spells, slow to recover (4) Crops withstand dry spells, fast to recov.	

Part 4: Overall assessment

Section P:			
LUT name	-	Copy LUT from above	
Major Land degradation problems	1990 ↓ 1999	Together with the farmer, you **summarize knowledge gathered from CRM and TW to extract the top priority issues for this community** **1.** Ask farmers for their major land degradation problems in 1999 within landscape units. **2. Guide farmers** asking them about land degradation problems according to categories (landscape, landuse, soil, crop, soil fertility / soil-water conserv. management, climate) **2. Rank list** according to farmers´ priority. ***Example:*** 1. steep slopes 2. highly fragmented land 3. lack of knowledge/ skills for appropriate steep slope cultivation	
Potential For Improve-ments	1990 ↓ 1999	**1. Ask farmers** for their major potentials for improvements of land degradation problems in 1999 within landscape units. **2. Guide farmers** asking them about potentials for improvements according to categories (landscape, landuse, soil, crop, soil fertility / soil-water conserv. Management, climate) **2. Rank** list according to farmers´ priority. ***Example:*** 1. steep slopes 2. highly fragmented land 3. lack of knowledge/ skills for appropriate steep slope cultivation	

3.3 Soil sampling strategy

A soil sampling strategy was developed to collect representative soil samples along a catena traversing the main landscape units of a community area.

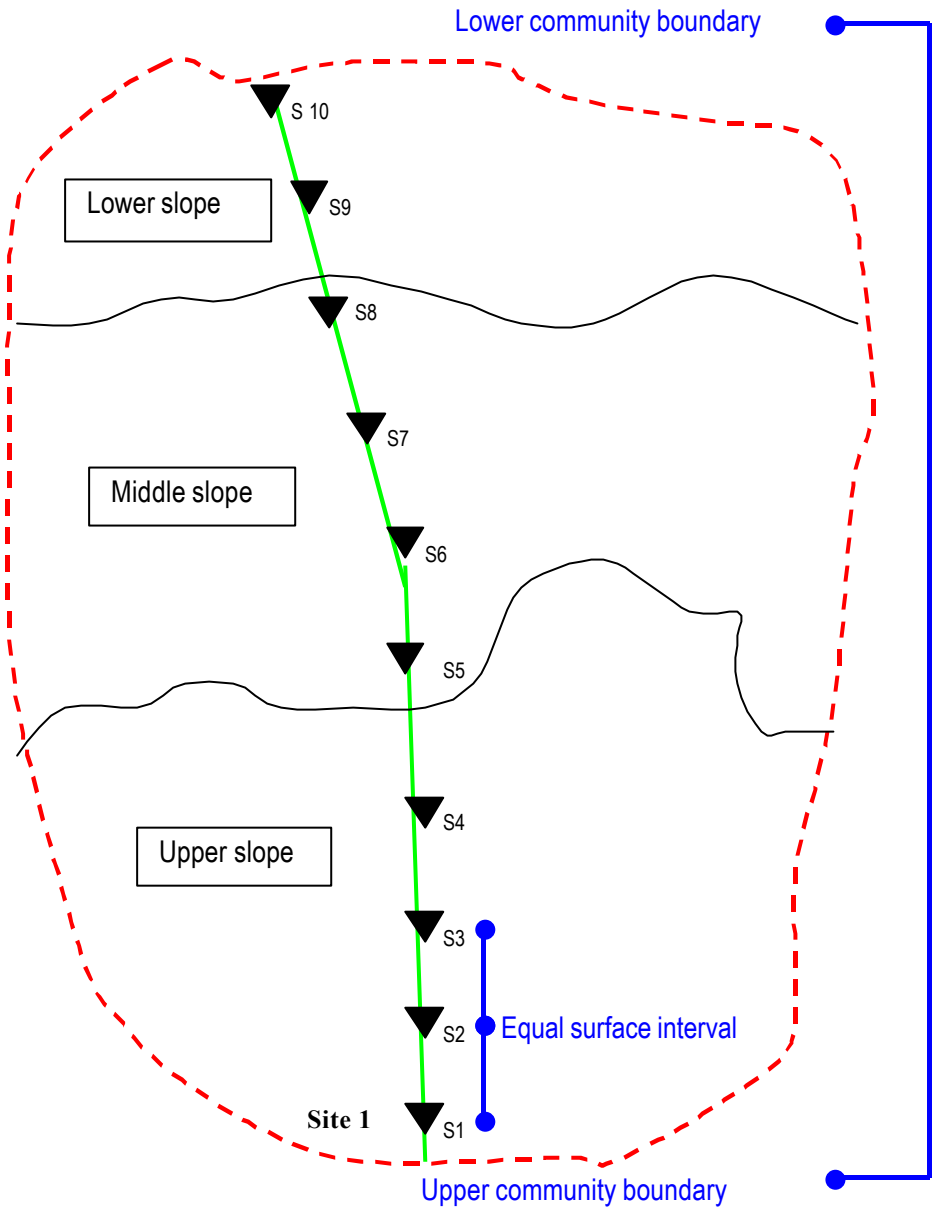
1. The natural flow of water through the different landscapes of a community was traced in the environment and the corresponding transect route was outlined on the soils map.

2. Approximately 10 top-soil samples were collected along that transect route. The sites for those samples were distributed in an equal surface interval from the top to the bottom of the community boundary following the transect route. Coordinates of each site were recorded by GPS and marked on the soil map. (Figure 3).

3. At each sampling site one composite top-soil sample was collected at a depth of 0-15 cm.

4. Natural resource and land management features of those sites that corresponded to a specific landscape unit were recorded in the questionnaire under “Part III, transect walk”.

Figure 3: Example transect route with soil sampling sites



4 Regional Survey Management

The regional community resource mapping survey covered 108 communities in Central, South and some parts of North Uganda. One coordinator organized four teams with each two research assistants to carry out the survey simultaneously in spatially distributed communities. Those survey teams and the coordinator used two four-wheel drive project vehicles and in some cases additional public transport. The whole logistics to manage that regional community resource mapping survey required comprehensive preparations, a strict time plan and team members that were fully trained to perform the survey procedure routinely. The logistical details and step-by-step survey procedure are described in the following.

Regional Community Resource Survey Management

Objectives

1. To introduce project and community survey to LC1 chairman and community representatives, To select community and to identify farmers;
2. To draw and to describe boundaries of communities within the selected LC1;
3. To record and to describe reference points in the LC1 and community;
4. To draw resource maps of the selected community and to describe its features;
5. To record landscape and soil fertility features, to sample soil and record their location, to verify the resource maps during a transect walk through the community;

Outputs

1. **Introduction of LC1 chairman and community representatives** to:
   - Project: Project title, collaborating institutions, objectives of the project, major activities
   - Community Survey: objectives of community survey, request for assistance in survey
   - Community Resource Mapping (CRM): objectives of CRM, request for assistance in survey

2. **Boundary of communities** within the selected LC1 are delineated as a georeferenced map
   - Spatial boundaries are mapped, names of representative LC1 and communities are recorded

3. **Reference points** in the LC1 and community are recorded with GPS and characterized
   - Coordinates of 1 reference point for a LC1 & 3-4 community reference points are recorded
   - Name and description of relative location of reference points are recorded

4. **Community resource map** of the selected community is drawn in a "Field-GIS" in form of several georeferenced maps including the following features:
   - Features for orientation within and outside community boundary map: roads, striking features
   - Land use categories in second season 1999 and changes in land use since 1990
   - Local soil type boundaries are drawn in CRM; names and criteria for soil types are recorded

5. **Transect walk** based collection of landscape & soil features, soil samples and map verification
   - Transect route is drawn on CRM
   - Soil fertility relevant features in specific landscape positions are recorded
   - Topsoil samples and GPS coordinate are collected
   - Boundaries of resource map features are checked and modified if necessary

Schedule for Each Community

Day	Location / Particip.	Begin	Time	Task
Pre-survey schedule				
1 week before survey	District Agric. Office / DAO, Research assistants			- Introduction of project -Extension service officers are asked to assist during survey
3-4 days before Day I:	LC1 office / LC1 chairman, Prior research team	Morning	1 hr.	- Brief introduction to project & survey - Selection of community within LC1 - LC1 chairman asked to assist in farmer selection, meeting place, date and time with selected farmers
Survey schedule				
Day I:	LC1 office / LC1 chairman Research assistants	8.00 AM	2 hrs.	- Introduction: project, comm. survey, - GPS point recording of LC1 location -Drawing community bound. within LC1
	Transport to selected community			
	community / community chairman, selected farmers, RA	12.00	4 hrs.	- GPS point recording within community settlement - Community Resource Mapping – Part I
Day II:	community & transect / community chairman, selected farmers, research assistants	8.00 AM 12.00 PM	3 hrs. 3 hrs.	- Transect walk - Community Resource Mapping – Part II
	Transport to next LC1			

Pre-Survey Activities at DAO and LC1 chairman

Outputs

District Agricultural Officer has been introduced to the project and asked for assistance:

- Project: Project title, collaborating institutions, objectives of the project, major activities,
- Community Survey: objectives of community survey, request for assistance in survey
- DAO asked for extension service officer to assist during the survey

LC1 chairman has been briefly introduced to the project and asked for assistance

- Project: Project title, collaborating institutions, objectives of the project, major activities, contact persons
- Community Survey: objectives of community survey, request for assistance in survey
- Community is randomly selected
- LC1 chairman asked to select and coordinate for farmers for CRM and transect walk

Participants

- District Agricultural Officer, LC1 chairman
- Two research assistants

Preparation

- Letter of introduction addressed to the respective LC1 chairman with announcement about start of survey in respective community

Material

- Documents: Project outline, letter from the Dean, community survey outline, letter of introduction "Community Resource Mapping"
- Random number table

Schedule

Day	Location / Particip.	Begin	Time	Task
1 week	District Agric.	Morning	1 hr.	- Introduction of project
before survey	Office / DAO, **Research assistants**			- Ask for extension service officers to assist during survey
3-4 days tasks	LC1 office /	Morning	1 hr.	- Brief introduction to project & survey
before	LC1 chairman,			- Selection of community within LC1
Day I:	**prior team**			- LC1 chairman ask to assist in farmer selection, meeting place, date and time with selected farmers

Procedure

1. Research assistants will meet the District Agricultural Officers (DAO) and introduce the project and the survey tasks.
   - The DAO will be asked for assistance during the survey through providing the contact of extension workers in the respective communities.

2. A prior team will meet the LC1 chairman
   - To give a brief introduction about the project and the community survey
   - To randomly select one community within LC1 using the random number table
     The name of the selected community and the names of those communities that were not selected within the LC1 will be recorded on the questionnaire.
   - To ask LC1 chairman to assist in the selection of farmers according to criteria specified in the questionnaire and to organize them at a respective meeting place, date and time to allow research assistants to start the survey without delay.

1. Introduction of Project, Community Survey & CRM

Outputs

LC1 chairman and community representatives are informed about:

- Project: Project title, collaborating institutions, objectives of the project, major activities
- Community Survey: objectives of community survey, request for assistance in survey
- Community Resource Mapping (CRM): objectives of CRM, request for assistance in survey

  List with names of selected farmers for CRM and transect walk

Participants

- LC1 chairman and/or community chairman / community representatives
- Two research assistants

Preparation

- Name and location of LC1 specified
- Letter of introduction addressed to the respective LC1 chairman with announcement about start of survey in LC1/community delivered to LC1 chairman

Material

- Documents: Project outline, letter from the Dean, community survey outline
- Random number table

Schedule

Day	Location / Particip.	Begin	Time	Task
Day 0:	LC1 office / LC1 chairman	5.00 PM	1 hr	- Introduction: project, community survey, CRM

Procedure

1. Meet the LC1 chairman in his office or any other suitable place.
2. Explain the specific objectives of the project, the community survey and the community resource mapping using the documents provided.
3. Record names of identified farmers and the name of LC1 chairman on the questionnaire
   - recommendation for place in community to draw CRM
   - introduction to the farmers in the community

2. Boundary Delineation of Communities within LC1

Outputs

- Boundary of communities within selected LC1 are drawn as a georeferenced map
- Names of representative LC1 and communities are recorded

Participants

- LC1 chairman and/or community chairman / community representatives
- Two research assistants

Preparation

- Topographical map (TM) of LC1 area selected and scale enlarged
- Boundary of LC1 and enumeration area mapped on transparency overlaying TM
- A standardized legend with symbols for boundaries and orientation features
- A pre-established questionnaire for information on boundaries and orientation features
- A pre-established example of a LC1 boundary including community boundaries

Material

- TM of LC1 area
- Example of a map with LC1 boundary including community boundaries
- Tracing paper, cotton to wipe out drawing errors, adhesive tape
- Cardboard paper as stable basis for maps, non-permanent pens in different colors

Schedule

Day	Location / Particip.	Begin	Time	Task
Day I:	LC1 office / LC1 chairman	8.00 AM	2 hrs.	- Drawing bound. of communities within LC1

Procedure

1. Meet the LC1 chairman outside his office or any suitable place outside to facilitate orientation for drawing the boundary map.
2. Explain the specific objectives and the expected outputs of that specific task 2.
3. Present the materials.

Continuation: 2. Boundary Delineation of Communities...

4. Guide the LC1 chairman in the orientation within the TM map. Begin with broader and very striking features in the larger area followed by smaller features in the LC1 area

   - Place the TM in such a way that the orientation is according to terrain and infrastructure visible from your point of view.
   - Identify, point at and explain to the LC1 chairman location of features in the TM corresponding with features to be seen in or to be known from the LC1 area.
     Follow the sequence: Main roads, rivers, main terrestrial landscape units, etc.
   - Fix the tracing paper on the TM.

5. Draw the standardized map layout and enter information on title, date and authors (Figure 4).

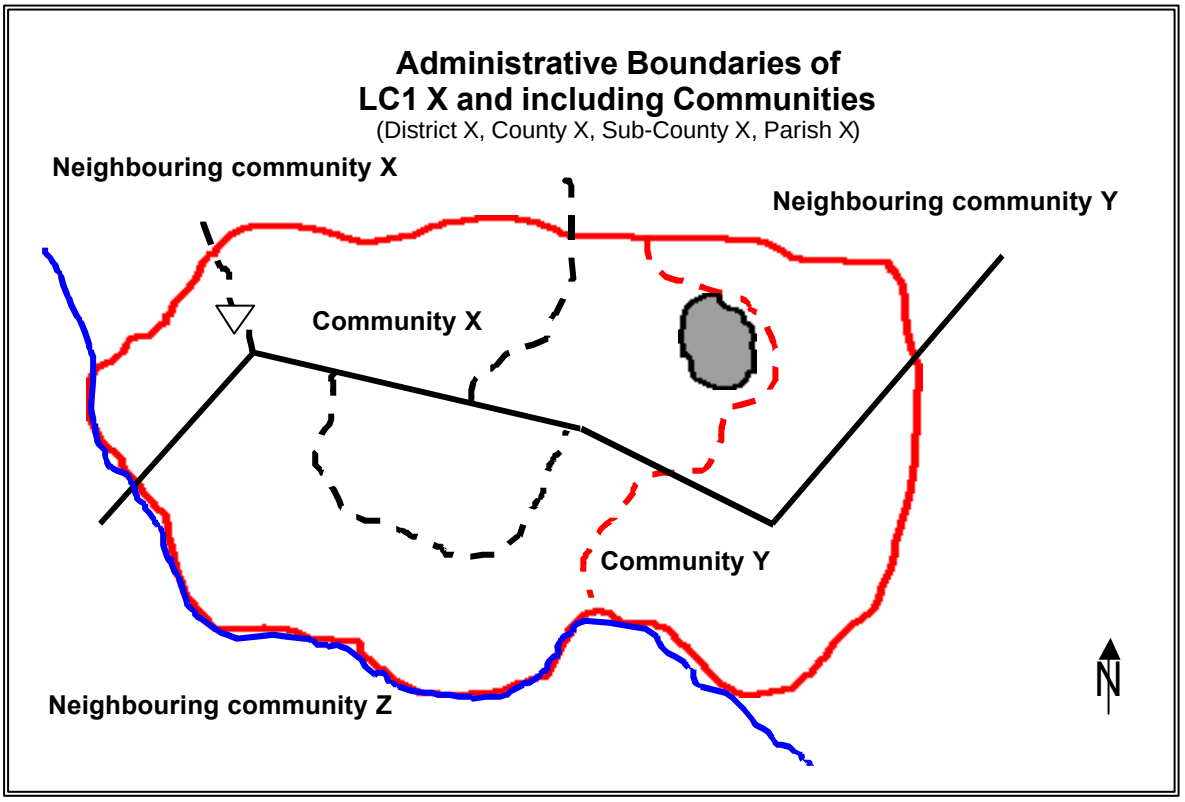


Figure 4: Example administrative boundary map

6. In agreement with the LC1 draw the location of striking features you have previously identified within and in the narrow area of the LC1.

7. Draw the boundaries of the LC1 and including communities on the tracing paper with a red pen according to the pre-defined symbols in the standardized legend.

8. Write the names of the communities within the LC1 as well as neighboring communities on the map along the boundary line.

3. Reference Points Recording within LC1 and Community

Outputs

Reference points in the LC1 and community are recorded by GPS and location name is described

- Name and GPS codes of reference points are recorded
- Coordinates of 1 reference point for LC1, 10 reference points for community are recorded

Participants

- Two research assistants

Preparation

- Pre-established questionnaire

Material

- GPS

Schedule

Day	Location / Particip.	Begin	Time	Task
Day I:	LC1 office / and community	8.00 AM 12.00	30 min..	- GPS point of LC1& in community recorded

Procedure

Record 1 reference point of the LC1 and at least 8 reference points of the selected community

- Generally the reference points should be in some wider distance to each other and should have a relatively equal distribution covering the community settlement.
- Move to striking features (e.g. office of LC1 chairman, school, meeting place, market)
- Receive the GPS coordinates
- Mark landmark in the GPS and specify name under <create message>:

  Record name of feature, the continuous GPS-Code (e.g. LMK-05) and the GPS-Code for the LC1/community (e.g. (Kawanda-01, Kawanda-02) in questionnaire
- Record GPS coordinates and altitude in questionnaire
- Draw the GPS point of the LC1 into the *Administrative Boundaries Map.*

  The GPS points from the community will be drawn on *Community Base Map* (CBM), which will be established for better orientation in the CRM.

4. Community Resource Mapping

Outputs

Farmers are informed about objectives and tasks of project, community survey & CRM. They are aware about what kind of participation is expected from them.

CRM of the selected community is drawn in form of several georeferenced maps:

- **COMMUNITY BASE MAP (CBM)** with features for orientation within and in the narrow area outside the community boundary map including: roads, community boundary, rivers,
- **LANDSCAPE MAP (LM)** showing boundaries of landscape units within community boundary;
- **LAND USE, CROPPING SYSTEMS AND LIVESTOCK MAP (LUCLM)**showing the distribution of land use categories in second season 1999 and changes since 1990. Within the category cultivated land, cropping systems and their changes in the same time period are mapped;
- **SOIL TYPE MAP (STM)** with local names and criteria for soil types;

Participants

- Community chairman and previously selected farmer group
- Two research assistants

Preparation

- Group of farmers identified and collected at the place for the CRM exercise
- Topographical map (TM) of LC1 area selected and scale enlarged
- Landscape features already outlined on the TM
- A standardized legend with pre-defined symbols for features
- A pre-established questionnaire for information on features
- A pre-established example of a community resource map

Material

- Documents: community resource mapping and community resource survey
- TM of LC1 / community area
- Example of a community resource map
- Tracing paper, cotton to wipe out drawing errors, water bottle, non-permanent pens in different colors, adhesive tape, cardboard paper as stable basis for maps, flip chart paper, ruler

Schedule

Day	Location / Particip.	Begin	Time	Task
Day I:	community /	12.00	4 hrs.	- CRM Part I (VBM, LM, LUCLM, STM
Day II:	community chairman + selected farmers	12.00	4 hrs.	- CRM Part II (LDM, LQM)

Continuation: 4. Community Resource Mapping

Procedure

1. Choose a suitable place outside a building to facilitate orientation for drawing the CRM.
2. Explain briefly the objectives and tasks of the project, community survey.
3. Elaborate in more details the specific tasks of the community resource mapping and the transect walk, and what kind of participation you would like to request from them.
4. Present the materials and give farmers enough time to look at the TM
5. Guide farmers in the orientation within the TM map. Begin with broader and very striking features in the larger area followed by smaller features in the LC1 and community area.
   - Place the TM in such a way that the orientation is according to terrain and infrastructure visible in the community from your point of view.
   - Identify, point at and explain to farmers location of features in the TM corresponding with features to be seen in or to be known from the community area.
     Follow the sequence: Main roads, rivers, main terrestrial landscape units (e.g. hill, slope, swamp), settlement area, striking features within settlement area, agricultural land.
6. Fix the tracing paper on the TM.
7. Show the example map of the already drawn base map.
8. Draw the standardized map layout (frame) and enter information on title, date and authors (see Administrative Boundary Map).
9. **COMMUNITY BASE MAP**
   - In agreement with farmers draw the CBM. Give it the title <community name> Base Map.
   - Use the TM to locate main features you have previously identified within and in the narrow area of the community for further orientation. Place the location of these features on the map as precise as possible. Main features include: roads, rivers, striking point features, etc.
10. Choose a farmer (in common agreement) who will make the drawings.
11. The farmer draws the features of the CRM.
    Guide the farmer in using the pre-defined symbols (Figure 5). Add new categories and symbols to adjust the assessment to local conditions.
12. **LANDSCAPE MAP**
    - Divide the community land in a number of polygons each of these identifying and locating main landscape units drawing the respective landscape symbols in black color.
      (upper slope – middle slope – lower slope –flat land)
    - Draw the landscape units into the community base map and note the landscape units and a possible local name in the questionnaire (Part II, Section A).

Continuation: 4. Community Resource Mapping

13. **LAND USE, CROPPING SYSTEMS AND LIVESTOCK MAP**

- Divide the community land into a number of polygons, each of these identifying and locating main Land Use Types. Land use in second season 1999 is drawn in blue color, whereas land use around 1990 is drawn in green color.

  Asks farmers for reasons of change in specific land use categories and note answers in questionnaire (Part II, Section B).
- Ask farmers which main Crops they have grown / which Cropping System they had in the second season 1999/1990. Did they use the crops as cash and/or as food crops. Draw the respective boundaries of cropping areas with symbols of the respective crop / cropping system into the specific land use / landscape units. Indicate cash-, food- or cash/food crop with c,f, c/f indices respectively. Use blue color for conditions in 1999 and green color for 1990.

  Asks farmers for reasons of change in specific crop / cropping systems and note answers in questionnaire (Part II, Section C).
- Ask farmers which main Livestock they had in the second season 1999/1990. Did they Draw the respective boundaries of grazing areas with symbols of the respective livestock into the specific land use / landscape units. Use blue color for conditions in 1999 and green color for 1990.
- Asks farmers for reasons of change in specific livestock and note answers in questionnaire (Part II, Section D).

14. **SOIL TYPE MAP**

- Divide the community land into a number of polygons, each of these identifying and locating main Soil Types.

  Asks farmers about criteria for local soil classification. Record answers on questionnaire (Part II, Section D).

- Ask farmers whether they have physical land degradation problems in general in their community. Ask them in which specific landscape units land degradation problems occur. Then focus on each landscape unit and ask farmers in open-end questions which physical land degradation problems they are facing.
- List the responses collected for each landscape unit on the flip chart paper.
- Use closed-end questions to ask farmers whether land degradation in their community could be related to problems which they had not yet mentioned, like soil erosion, soil fertility decline / loss, pests, diseases, weeds, drought, nature of soils (low inherent soil fertility, stony, sandy). Add additional problems to the list after farmers have agreed.

- Do pair wise ranking for the problem list in each landscape unit.
- Note the ranked problem list within the landscape units on the questionnaire (Part II, Section E) and in the legend
- Assess the increase, decrease or stability of the problem since 1990 until present (-> questionnaire)
- Assess the speed of change for each problem since 1990 until present (-> questionnaire)
- Draw the symbols and boundaries of the three most important problems in each landscape unit.

Evaluate soil, plant & water indicators of land quality for the respective landscape unit. This leads then to a ranking of land quality between marginal and favorable conditions.

- Note the land quality within the landscape units on the questionnaire (Part II, Section F).and in the legend
- Assess the increase, decrease or stability of the land quality since 1990 until present (-> questionnaire)
- Assess the speed of change for land quality since 1990 until present (-> questionnaire)

Figure 5: Legend of Community Resource Mapping

Administrative boundaries

District

County

Sub-County

Parish

LC1

Community

Roads

All weather road

Dry weather road

Motorable track

Footpath

Railway

River or Stream

Transect (x = number)

Striking features (x = cont. GPS LMK-Code)

Road junction

Community chairman´s office

Market

Sch**o**ol

Church

Community gathering

Hospital

Borehole

Soil sample

Land use type / Land cover type

Cultivated land

Fallow

Grazing area

Forest/Woodland

Swamp/Wetland

Natural/Undisturbed land

Settlement

Bush/Scrub

Lake

Landscape units

Upper slope

Middle slope

Lower slope

Flat land

5. Transect Walk

Outputs

Collection of landscape & soil features, soil samples and map verification

- Route of transect is drawn into CRM
- Slope gradient of landscape units is measured
- Soil quality relevant features in specific landscape positions are recorded
- Topsoil samples are taken from representative sites within landscape positions, location is recorded with GPS, site characteristics are recorded
- Boundaries of resource map features are checked and modified if necessary

Participants

- Community chairman and previously selected farmer group
- Two research assistants

Preparation

- Group of farmers identified and ready for CRM exercise
- The pre-established community resource map
- The pre-established Community Base Map for orientation
- A standardized legend with pre-defined symbols for features
- A pre-established questionnaire for information on features

Material

- Community Base Map for orientation + SM, LUM, etc.
- Tracing paper, cotton to wipe out drawing errors
- Cardboard paper as stable basis for maps
- Non-permanent pens in different colors, adhesive tape
- Soil sampling equipment
- Flip chart paper

Schedule

Day	Location / Particip.	Begin	Time	Task
Day II:	community transect(s) community chairman + selected farmers	8.00 PM	3 hrs.	- Transect Walk

Procedure

1. Meet the farmers at a place from where you can explain details about the transect walk.
2. Explain farmers briefly the objectives, outputs of the transect walk and what kind of participation you would like to request from them.
3. Suggest a transect route that traverses all major landscape units
   Indicate the route in the CRM. Discuss the route with farmers in terms of accessibility. When you have agreed on the route, draw it into the map (see legend).
4. Proceed to one of the extremes of the selected route, with the group of farmers. If possible, start at the highest point from where you have an overview of the landscape and the settlement.
5. Start walking to the lowest landscape unit and stop at each distinct landscape unit, identified by farmers and discuss and put your notes on the questionnaire:
   - Characteristics of the landscape unit and/or soil type: what are the criteria farmers use to distinguish land units or soil types
   - Dominant form and diversity of land use
   - Crops, cropping systems, crop rotations and fallow land
   - Soil fertility status
   - Management practices, including soil fertility management
   - Soil conservation and agro-forestry practices
   - Opportunities for soil fertility improvements, soil conservation, agro-forestry, etc.
6. Check the CRM whether boundaries are accurate, features are included.
7. Take soil samples from each landscape unit according to the sampling plan:
   - Follow the composite sampling strategy for top soil sampling in the same landscape unit
   - Assess the characteristics of the soil sample. Use the codes of the pre-defined soil characteristics form. Record the results on the questionnaire.
   - Assess landscape and surface features around the area of the soil sample. Use the codes of the pre-defined landscape characteristics form. Note the results on the questionnaire.
8. When returning from the transect walk, draw the details of transect on a large sheet of paper and present the information in the form of a matrix (see example)

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