Zentrum für Entwicklungsforschung
Center for Development Research
University of Bonn

ZEF

Working Paper Series 91

Katrin Gleisberg-Gerber

Livelihoods and land management in the Ioba Province in south-western Burkina Faso

universitätbonn

ISSN 1864-6638

Bonn, March 2012

ZEF Working Paper Series, ISSN 1864-6638
Department of Political and Cultural Change
Center for Development Research, University of Bonn
Editors: Joachim von Braun, Manfred Denich, Solvay Gerke, Anna-Katharina Hornidge and Conrad Schetter

Authors' addresses

Katrin Gleisberg-Gerber
E-mail: katrin.gleisberg@uni-bonn.de

www.zef.de

Livelihoods and land management in the Ioba Province in south-western Burkina Faso

Katrin Gleisberg-Gerber

Contents

Abstract

In Burkina Faso, policies influencing land management are bound to have deep impacts on the environment and on the livelihood of the rural population. Two such policies are the national program of *gestion de terroirs villageois* and the support programs for cotton cultivation by the private sector and the national government. This paper provides insights on the current livelihoods of rural households, identifies the key determinants of their livelihoods and categorizes them into household types. This is necessary to then analyze the impacts of the aforementioned policies on land management strategies of the different household types. The analysis includes the impacts of agricultural intensification and expansion on livelihoods as both have influenced the distribution of livelihood assets. The working paper uses data collected across three representative villages in the Ioba Province in south-western Burkina Faso in 2006/2007. It shows that poorer farm households are excluded from institutions that provide access to resources and have only limited means to employ agricultural practices to maintain soil fertility. The study indicates that differences in the land management of household types lead to differences in social and environmental outcomes. In other words, the livelihood strategies of the observed households vary. However, livelihood outcomes in the study area are rather homogenous. The homogeneity of the livelihood outcomes makes it difficult to categorize households into different types. One reason for this result might be that it is not enough to look at data that cover only one production year. Another reason is that farm households in the study region compensate limitations in one livelihood asset through a stronger focus on livelihood strategies that generate other assets.

Keywords: Burkina Faso, livelihoods, land management, household categorization, household description

1 Introduction

The scarcity of productive resources, especially agricultural land, and high environmental vulnerability are among the most crucial factors shaping resource management and sustainable development policy in Burkina Faso. More than 80 percent of the population in Burkina Faso is rural dwellers and agriculture remains a central part of the country's economy. Because it accounts for most land use in Burkina Faso, expansion of cropland or agricultural intensification have strong impacts on the environment. Agriculture employs the majority of the rural population and its main source of income. In the last decades, Burkina Faso has experienced a mushrooming of development and land conservation projects (Batterbury, 1998; 2005; Nagendra, Munroe et al., 2004; Paré, Söderberg et al., 2008; Rasmussen, Foga et al., 2001; Somda, Nianogo et al., 2002). Since the great droughts in the 1970s, the Burkinabé government, international donors and private enterprises have aimed to reduce the vulnerability of rural livelihoods and to enhance environmental sustainability (Gray, 1999) by implementing policies, such as the *gestion de terroirs villageois* (*GTV*) approach and promoting the cotton production system.

Understanding farmers' social, cultural and economic motivations contributes to the understanding of adaptive strategies and to the compliance or resistance to policies (Reenberg, 2001; Geist, Lambin et al. 2005; Scherr, 2000; Barrett, Reardon et al. 2001; Raynaut, 2001). The main objective of this working paper is therefore to give an insight into current household livelihoods and to describe land management strategies. These households are representative for the Ioba Province in south-western Burkina Faso. Specifically, the analysis seeks to identify key determinants of household livelihoods and to categorize household types based on the identified livelihood determinants.

1.1 The gestion des terroirs villageois approach

The *GTV* approach to manage natural resources at the village level emerged in the 1980s. It has its roots in community forestry initiatives and local soil conservation projects in francophone West Africa. In Burkina Faso, the approach was elaborated and implemented by researchers and Burkinabé government officers accompanied by the *Programme National de Gestion des Terroirs* (PNGT) that received international funding by the World Bank, UNDP and other donors. The approach is widely used by development projects working with the rural community of Burkina Faso (Batterbury, 1998; 2005; Gray, 2002). The unit of analysis is the village, covering the social and physical space controlled by the village community. Legally, all national land belongs to the state. At the village level, however, the state has only limited means for intervening in the tenure system. Historically, decision-making about land is held by the customary authorities of the villages (Gray, 2002). The overall objective of the *GTV* is to assist local communities to enhance sustainable natural resource management. According to the program guidelines and as a first step, villagers and extension agents map village land, soil quality, land uses, water bodies etc. The villages then form a committee that proposes and implements a rehabilitation plan for eroded pastures and fields using cheap but appropriate soil and water conservation measures. Technical assistance and transport is provided by development projects. The organization of labor for these activities is the responsibility of the village committee. After the end of a project, the responsibility passes to the village (Batterbury, 1998; 2005; Gray, 2002). Apart from enhancing participation of the villagers and strengthening local institutions, improved soil fertility, increased productivity and training of individuals and groups in natural resource management techniques were essential objectives of the *GTV* approach. These measures included for instance the construction of stone lines, soil bounds and improved traditional planting pits (*zai*) as well as the use of manure (Batterbury, 1998; 2005; Kaboré and Reij, 2004; Mazzucato and Niemeijer, 2000; Reij, Tappan et al., 2005). Another important aspect of the *GTV* approach relates to

the issues of uncertain land rights resulting from social changes, increasing population pressure, rainfall variability and changes in agricultural performance (Gray, 2002).

1.2 Cotton cultivation

Cotton was introduced to Burkina Faso by the French in the 1950s and was given a high priority since the 1970s (Gray, 2005). In the last decade Burkina Faso has become Africa's leader in cotton production. Cotton is of particular macroeconomic importance for the country's economy as it generates more than 60% of its export earnings. About two million people in the country built their living directly or indirectly on cotton (Liebhardt, 2005; World Bank, 2004).

The increase in cotton production mainly results from the reform of the cotton sector that started in 1994. Producers were given more bargaining power towards the formerly national cotton company SOFITEX. The transformation of the cotton sector also included a partial withdrawal of the Burkinabé government from SOFITEX and the establishment of the cotton union UNPCB (*Union Nationale des Producteurs de Coton du Burkina Faso*) that became an important partner for SOFITEX, the government, and the banks. The UNPCB is supported by local cotton grower associations, the *GPC*s (*groupement de producteurs de coton*). The *GPC*s have been more successful than the former local producer groups (*groupement villageois*) in repaying input credits and providing incentives for farmers to enter or expand cotton production. The *GPC*s correspond to credit cooperatives. SOFITEX delivers input such as cotton seeds, fertilizers and pesticides to the *GPC*s in the form of loans. The cotton harvest is bought by the company at a price level that is notified prior to sowing. Representatives of the cooperatives are responsible for the management and coordination of the distribution of inputs and technical assistance (Kaminski, 2007; World Bank, 2004)[1].

Cotton cultivation is associated with the expansion of the cultivated area and new technologies such as animal traction and chemical inputs (Fauré, Kleene et al., 1998; Gray, 2005; Sanders, Shapiro et al., 1996; Schwartz, 1996). SOFITEX provides training and support through its *correspondants coton* (CC) and its *agents techniques de coton* (*ATC*). SOFITEX is aiming at better resource allocation and use, and at improving its access to far rural areas by improving and constructing tracks (World Bank, 2004)[2].

A major effect of animal traction is an increase of crop land per worker. Oxen ploughs allow an expansion of cropland. Studies also indicate a positive relationship between animal traction and family size. Gaining a higher income allows the household head to have more wives and children. A larger family size in turn provides more labor for non-mechanized activities (Gray, 2005; Sanders, Shapiro et al., 1996).

Decreasing soil fertility is claimed to be the result of reduced fallow periods, inappropriate land use practices and abandonment of traditional land use practices (Gray, 2005; Gray and Kevane, 2001; Liebhardt, 2005; Sanders, Shapiro et al., 1996). The introduction of cotton has led to significant increases in the use of chemical inputs, especially mineral fertilizers, which have spread from cotton to maize and more recently to other crops. Although cotton yields vary due to weather conditions and diseases, the use of chemical inputs resulted in higher yields. Because of the low soil fertility in most regions, mineral fertilizers have been the most efficient nutrient source for cotton, maize and sorghum (Sanders, Shapiro et al., 1996).

[1] This information were also provided by Ousmane Ouedraoga, Chef service suivi evaluation of SOFITEX, during an interview in Bobo Dioulasso (07.05.2007)

[2] This information were also confirmed during interviews with Emile Ouedraogo, correspondant coton of SOFITEX, in Dano, (27.04.2007) and Ousmane Ouedraoga, Chef service suivi evaluation of SOFITEX, in Bobo Dioulasso (07.05.2007)

The export of cotton is problematic because of price volatility and decreasing prices at the cotton market particularly through the subsidies to cotton farmers in the US (Fauré, Kleene et al., 1998; Liebhardt, 2005). In the early 1990s, the world cotton price dropped while increased input prices worked as a disadvantage to farmers. Farmers' earnings from cotton considerably diminished and many farmers ran into debt and abandoned cotton (Gray, 1999; Liebhardt, 2005).

2 Conceptual framework

Conventional assessments of policies of Natural Resource Management tend to focus on the quantification of economic returns and cost-benefit analysis because they are considered key to poverty reduction. However, recent research acknowledges the community livelihood as a whole. This involves environmental, human and social conditions that ensure livelihoods as understood in the sense of Scoones (1998:5) in the long run. Various studies recognize the interdependency between changes in natural resources such as land and rural livelihood dynamics (see, e.g., Ashley and Hussein, 2000; Batterbury, 2001, 2005; Campbell, Sayer et al., 2001; Carswell, 1997; Ellis and Allison, 2004; Ellis and Freeman, 2005; Gottret and White, 2001).

The assessment of this study was based on the Sustainable Livelihoods framework (Adato and Meinzen-Dick, 2002; Ashley, 2000; Batterbury, 2001, 2005). The framework is used by various organizations such as UNEP and DFID and non-governmental organizations, for example CARE and Oxfam (Adato and Meinzen-Dick, 2007; Carswell and Jones, 2004). It was also used to study livelihoods and resource management in other regions in Burkina Faso (see e.g. Batterbury 1998, 2005).

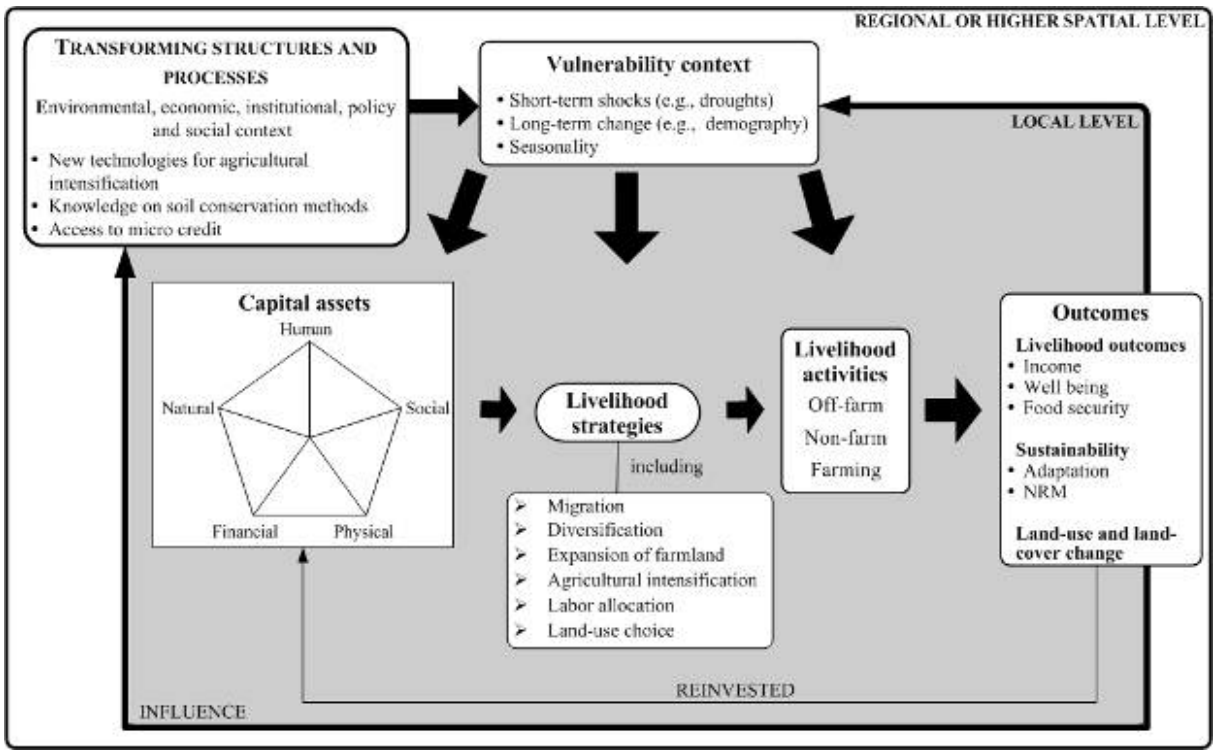


Figure 1: Conceptual model for the assessment of impacts of policy interventions on livelihoods and landscapes in south-western Burkina Faso.

Synthesized from DFID, 2001; Scoones, 1998; Soussan, Blaikie et al., 2001.

3 The study site

The research was carried out within the GLOWA Volta project (2000-2009)[3] and was conducted in the Black Volta Basin in the Ioba Province in south-western Burkina Faso (Figure 2). The Ioba Province covers an area of about 3,292 km² and consists of nine *départements*, two municipalities and 136 villages. The administrative capital of the province is Dano, a market town with about 14.000 inhabitants.

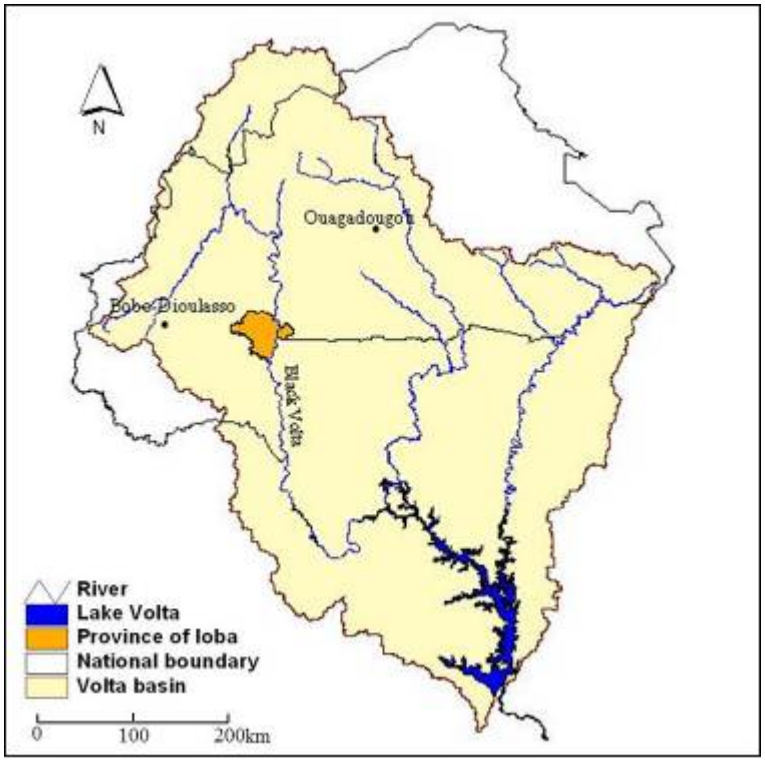


Figure 2: Location of the study sites within the Volta Basin and the Ioba Province, south-western Burkina Faso

Extensive research on land use and livelihoods was carried out in three typical villages of the region: (Figure 3) Téssiougane and Zouziégane are located in the *département* Dano about 10 km south-east of Dano. The village Wahablé is situated about 21 km north of Dano in the *département* Oronkua. Although it is administratively a community of the Ioba Province, the northern part of the territory of Wahablé is situated in the *département* Koti in the Tuy Province.

[3] Project homepage: www.glowa-volta.de, Rodgers, van de Giessen et al. 2007.

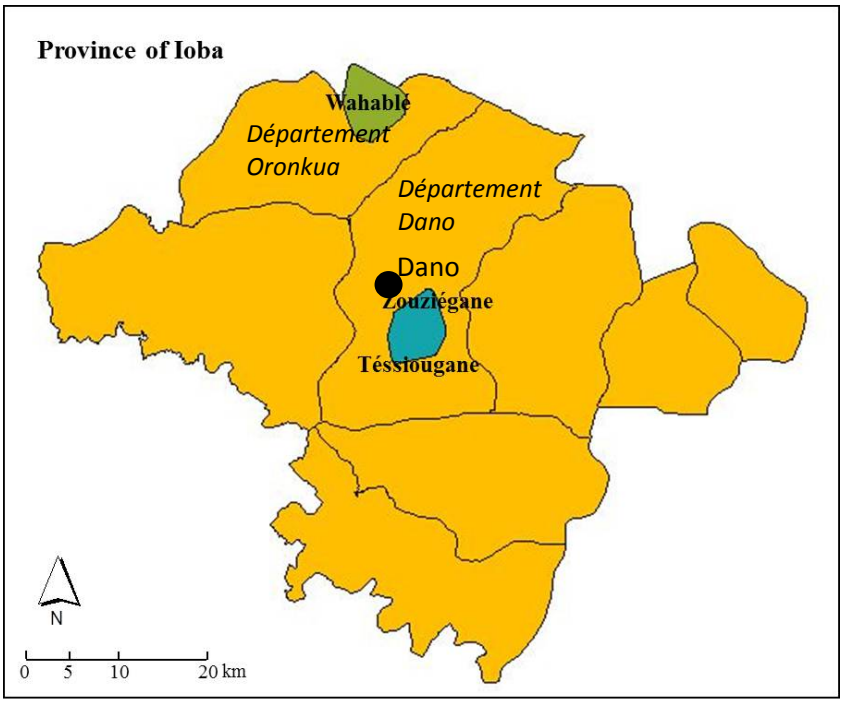


Figure 3: Location of the study villages within the Ioba Province

3.1 Social and economic characteristics

The three selected villages have similar resource base, ecological conditions and infrastructure. The population consists exclusively of *Dagara*, which is the main ethnic group of the Ioba Province.

Table 1: Population growth in the study villages

	Growth rate[a]	Total population			
		1998	2003	2006[b]	2008[b]
Téssiougane	2,7%	346[a]	395[b]	428	452
Zouziégane	2,7%	822[a]	930[b]	1017	1073
Wahablé	1,1%	n.a.	1376[a]	1422	1453

[a] Data from Sahelconsult (2003a, 2003b) and Concept Kory (2004),

[b] Projected population using population growth model: $P_{(year)} = P_{(0)} * (1 + p/100)^n$ where $P_{(year)}$ is the population projection for year x, $P_{(0)}$ is the population at the beginning (base), p is the growth rate, and n is the number of years

Unlike most parts of southern Burkina Faso, the study area has not experienced extensive immigration from the Central Plateau. Nevertheless, the population in the Ioba Province increased from 140,000 in 1985 to 185,000 in 2006 (INSD, 2008). Population density in the province is among the highest in Burkina Faso. Projections of INSD (2008) based on data from 1985 and 1996 show that the population density in 2006 was about 57 persons / km². Data further show that the population in the three villages under study increased from 1998 to 2008 (Table 1). However, the extent of the increase differs (Sahelconsult, 2003; Concept Kory, 2004).

Livelihood activities in the three study villages are diverse and often complementary. The dominant activity is rain fed agriculture that is characterized by a low degree of mechanization. Although the

village communities have access to reservoirs, irrigation agriculture is barely practiced. The small reservoir that is located between the village centers of Zouziégane and Téssiougane (see Figure 6) falls dry in dry season. In Wahablé, the irrigation system is dysfunctional due to inappropriate construction. Animal husbandry is the second important occupation. There are only few off-farm activities in the study region (see Figure 4).

Non-farm activities include fishing in the nearby reservoirs and hunting, some technical activities and petty trade mainly run by women[4]. Among the non-farm activities, brewing of the local beer, *dolo*, and selling cooked food are the most important activities providing an additional income particularly for women (McMillan, Sanders et al., 1998). Non-farm activities basically serve as a source of additional income and are of crucial importance for gaining cash. It is noteworthy that children and elders are often involved in farming, housework and livestock herding.

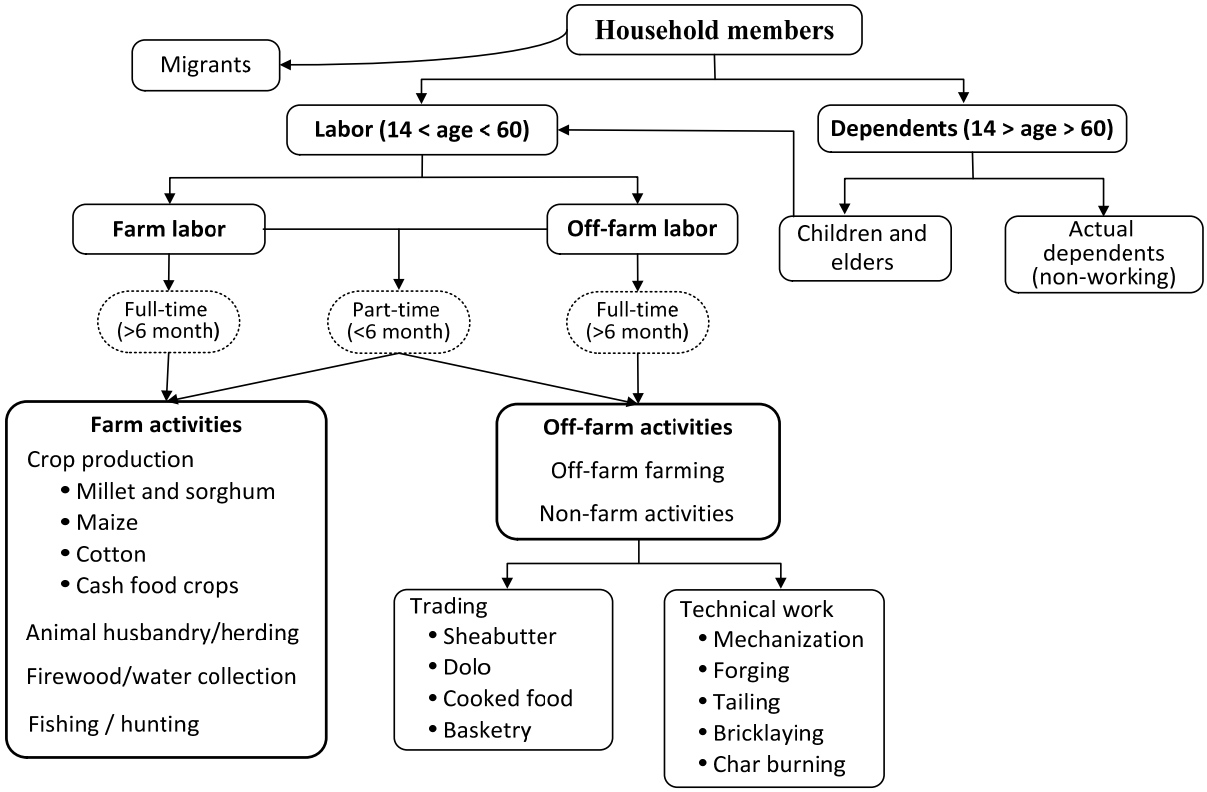


Figure 4: Labor allocation and activities of households. Source: Field observation and survey

Local social networks in the form of credit unions or agricultural cooperatives allow rural farm households to diversify their livelihoods. Access to micro credits facilitates non-farm activities especially for women, since these credits are provided for commerce performed by women. Another source of credit is SOFITEX and the BACB (*Banque Agricole et Commerciale du Burkina*). The BACB provides credits for agricultural equipment and inputs required to intensify agriculture (SAHELCONSULT 2003a, 2003b; Concept Kory 2004).

Migration is often claimed to be an important livelihood strategy in Burkina Faso (see e.g. Breusers, 2001; McDowell and de Haan, 1997). Although households reported seasonal migration during the dry season, it appears to be an important strategy only for few households. Long-term migration

[4] Whereas the definition of non-farm activities comprises all activities apart from crop production and animal husbandry, off-farm activities refer to non-farm activities and farming activities on non-household plots.

between two and three years is rare and concerns mainly young men who leave the village to earn money in urban centers of Burkina Faso or on plantations of the neighboring countries Ghana, Mali and Ivory Coast.

3.2 Biophysical conditions of the study region

3.2.1 Climate

The Ioba province is located in the North-Sudanian zone. During rainy season from April / May to October the region experiences an average rainfall of 800 - 1000 mm (de Zeeuw, 1997; Roose, 1991, 1992; Stoop, 1987). Nearly 100% of rainfalls occur during this period. The wettest months are August and September. From November to March/April, there is almost no rainfall. The hottest period is March / April with temperatures up to more than 40°C and the coolest months are August / September and the period from November to January with temperatures between 25 and 28°C (Concept Kory, 2004; Direction Régionale de l'Economie et de la Planification du Sud-Ouest, 2000; Sahelconsult, 2003a; 2003b).

3.2.2 Soils

The soils of the study region are dominated by leached ferruginous tropical soils washed on sand or sandy-clay material characterized by low a content of organic matter and phosphorus. Thus, they are inherently unfertile (Roose, 1991; Son and Bourarach, 2001). According to the FAO soil classification system, the most frequent soil type is Lixisols[5] typical for woodland and grassland savanna systems in western Burkina Faso (Sawadogo, Tiveau et al., 2005). The stony red or reddish soils have a medium texture often underlain by an indurated lateric pan at shallow depth. Therefore, they have a low water holding capacity and dry up quickly (Stoop, 1987). On these soils, agricultural production, particularly weeding is difficult because of the stones.

In depressions, the content of clay tends to increase. There, the greyish or brownish soils have a medium texture and a good water-holding capacity (Concept Kory, 2004; SAHELCONSULT, 2003a, 2003b).

3.2.3 Agricultural land-use types

Cultivation patterns are rather heterogeneous in the study area. In general, the agricultural system is rain-fed and subsistence oriented. Principle food crops are millet, white sorghum, red sorghum, maize, and groundnut. Apart from food crops, farmers grow cotton as a commercial crop.

Agricultural land-use categories were classified based on their location, requirement of fertilizer as well as on their objective for farm households. Four land-use categories were distinguished: (a) millet and sorghum, (b) maize, (c) cotton, and (d) cash crops. Though the clear distinction may sometimes be difficult because of intercropping, the principle crop on the plot determined the land-use type. A regular rotational cropping-fallow system could not be observed. Fallow land accounts for only 4% of the agricultural area under investigation.

[5] According to the USDA Soil Taxonomy the main soil types are alfisols and ultisols.

Table 2: Distribution of agricultural land-use types among observed households

Land use	Crop	Area (ha)	% of total area	Average size of plot (ha)
Millet		479.7	76.1	2.54
	Millet	142	22.5	0.97
	Sorghum	168.8	26.8	0.79
	White sorghum	60.8	9.6	0.78
	Red sorghum	108.1	17.2	0.79
Maize		74.5	11.8	0.35
Cotton		179.3	28.5	1.09
Cash crops		34.3	5.5	
	Groundnut	26.26	4.17	0.29
	Cowpea	4.74	0.75	0.12
	Rice	1.85	0.29	0.07
	Vegetables	0.79	0.12	0.1
	Chili	0.69	0.11	0.04
Fallow		31.2	4.9	0.89
Total		**630.2**	**100**	

Land use type 'Millet'

Millet, white sorghum and red sorghum were grouped into the land-use category 'Millet'. About 50% of the agricultural area researched is allocated to these crops (Table 2). Millet and white sorghum serve as basic food crops and are mainly used for household consumption. Red sorghum, on the other hand, is mainly used to brew *dolo*. Because of its taste, red sorghum only serves as a food crop when households face a shortage of millet and white sorghum.

Millet and sorghum show a good tolerance to drought and marginal soils (Sanders, Shapiro et al., 1996; Onwueme and Sinha, 1999). Therefore, these crops are allocated to landholdings at higher altitudes on large fields. However, they can also be found on small plots with low soil fertility where no other crops can be cultivated. In order to increase or maintain soil fertility, millet and sorghum are very often intercropped with cowpea. In order to decrease the risk of damages caused by livestock, these plots are at a greater distance from the houses (Prudencio, 1993).

Land use type 'Maize'

The main agricultural objective of households is to achieve food security with crops such as millet, sorghum, and maize. A period of food shortage occurs in the middle of the rainy season. Maize is grown to improve food availability in this period. Among the local food crops, maize has the shortest growing cycle (between 60 and 90 days) and is first harvested towards September (Prudencio, 1993). Before cotton was brought to Burkina Faso, maize production was only marginal. Its distribution and importance changed considerably with the introduction of the maize-cotton rotation system (Gray, 1999).

Maize requires more fertile soils than millet and sorghum. It is usually grown close to the dwellings where organic matter can be applied more easily. The size of the plots is determined by the availability of organic manure, since maize can only grow properly on soils with enhanced fertility. Among the cereals, maize is the most vulnerable crop regarding flood and drought (Maatman and Ruijs, 1996; Sanders, Shapiro et al., 1996).

Land use type 'Cotton'

In order to diversify their sources of income, farmers cultivate cotton. Cotton is the second most important crop in terms of cultivated land, accounting for about 28% of the agricultural area. Cotton fields are the largest fields with an average size of one hectare. The location of cotton field changes each season due to the demanded rotation system (OCDE/OECD, 2005). Nevertheless, the crop is likely to be grown on steeper land with hydromorphic soils in order to ensure both sufficient moisture and prevent water logging. Cotton production is only possible through the application of chemical inputs such as NPK and urea fertilizers, herbicides, and pesticides.

Land use type 'Cash crops'

The term 'cash crops' refers here to all marketed surplus (see e.g., Maxwell and Fernando, 1989). The land-use category *'cash crops'* comprises groundnuts, vegetable, chili, cowpea, and tuber crops. Cash crops are sometimes used for household consumption, but the greatest share is produced for sale at the local market. In total, cash crops are allocated to only 5.5% of the agricultural area. Groundnut is the most important cash crop (77% of the land under cash crops) followed by cowpea (about 14%).

Cash crops are usually grown far from the house to minimize the risk of livestock damage. They are rarely fertilized with manure. Chemical fertilizers, in particular NPK, are occasionally applied to cash crops. Since their cultivation is rather labor intensive, most cash crop plots are small.

4 Methods and Data collection

4.1 Identification of Livelihood Determinants

In total, ten variables were selected (Table 3) on the basis of the five capitals suggested by the SLF. In order to understand the households' livelihood strategies, the variables reflect both diversification and determinants of livelihoods.

Among these variables, household size (H_{size}) and educational status of the household ($H_{education}$) characterize the human capital of a household (Barrett, Reardon et al., 2001). Further, the dependency situation of the household was included. Child labor is very common in Burkina Faso and was covered by the actual dependency ratio ($H_{dependency}$).

Table 3: Variables included in identification of household categories

Variable	Definition
Human capital	
H_{size}	Number of household members
$H_{dependency}$	Ratio of the number of actual dependent household members and working household member
$H_{education}$	Household's education index (weighted years of formal schooling completed by household members older than 6 years)
Natural capital	
H_{land}	Household's total landholdings (hectare)
$H_{land/pers}$	Household's total landholdings per capita (hectare)
Financial capital	
$H_{in\text{-}nonfarm/pers}$	Household's gross non-farm income per capita (1,000 F CFA year^{-1})
$H_{\%in\text{-}nonfarm}$	Percentage gross income from non-farm activities (%)
Physical capital	
$H_{livestock/pers}$	Monetary value of household's livestock per capita (1,000 F CFA)
$H_{assets/pers}$	Monetary value of household's commodities and production means including means of transport per capita (1,000 F CFA)
Social capital	
$H_{participation}$	Household's participation in agricultural cooperatives or credit unions (yes/no)

Natural capital is characterized by total landholdings (H_{land}) and total landholdings per person ($H_{land/pers}$). Two variables, monetary value of livestock per person ($H_{livestock/pers}$) as well as commodities and physical production assets (including means of transport) per person ($H_{assets/pers}$), were chosen for representing the physical capital of a household (de Graaff, Nibbering et al., 1999). Non-farm income is becoming increasingly important for maintaining and improving rural livelihoods (Barrett, Reardon et al. 2001). In order to reflect this diversification, annual non-farm income per person ($H_{in\text{-}nonfarm/pers}$) and share of non-farm income in total annual gross income ($H_{\%in\text{-}nonfarm}$) were selected to represent financial capital.

The proxy for social capital is participation of the household in agricultural cooperatives or credit unions ($H_{participation}$). It is excluded from the statistical analysis because the variable is in dummy scale. However, it is recognized in the description of the household categories.

To avoid potential multicollinearity between the hypothesized livelihood variables and to facilitate further cluster analysis, it is necessary to combine determinants. Here, a Principal Component Analysis (PCA) was used to diminish the dimension of the nine selected variables. Varimax (variance maximizing) rotation was used because it amounts to maximize the variance of the extracted principal components. The criterion determining the number of principal components to be retained is their Eigenvalue that is 1.0 or more (Kaiser's rule). This way, only the most meaningful components were interpreted and used for further analyses (Campbell, Sayer et al., 2001; Lesschen, Verburg et al., 2005).

For further analysis, it was found to be useful to cluster the observed households into relatively homogeneous groups. K-Means cluster analysis (k-CA) was chosen as the method for the categorization. The groups of households were clustered in relation to their livelihoods, i.e., their socioeconomic characteristics, using the standardized scores of the principle components (Emtage, 2004; Emtage and Suh, 2005; Lesschen, Verburg et al., 2005). To respond to the overall level of inequality, i.e. the distribution of income, in a population or household type, the Gini coefficient was used. Graphically, the income distribution is represented by the Lorenz curve.

4.2 Data source

The Working Paper follows the definition of a household of the Burkinabé Institut National de Statistique du Développement (INSD). There, a household is defined as a

> "socio-economic unit, of which the different members, relatives or not, live together in the same house or compound, share their resources and satisfy together their need for food and other vital good" (INSD cited in de Graaff, Nibbering et al., 1999:36).

The analysis used survey data collected in the Ioba Province during the rainy season 2006 and dry season 2007[6]. The three survey sites were selected based on the following criteria: (i) distance to next market town and (ii) presence of cotton producer cooperatives.

Out of all households of the three villages, 111 were randomly selected from household lists for interviews. The lists of all households were compiled with the help of the villagers. Among the selected households 42 are in Wahablé, 50 in Zouziégane and 19 in Téssiougane. The selected households account for about 35% of all households of the three villages. Figures *5* and 6 show the location of the households and the observed plots in the three study villages. The dataset of the sampled households was used for the categorization and characterization of typical household types and their land management.

[6] For further information on field work see Gleisberg, 2008.

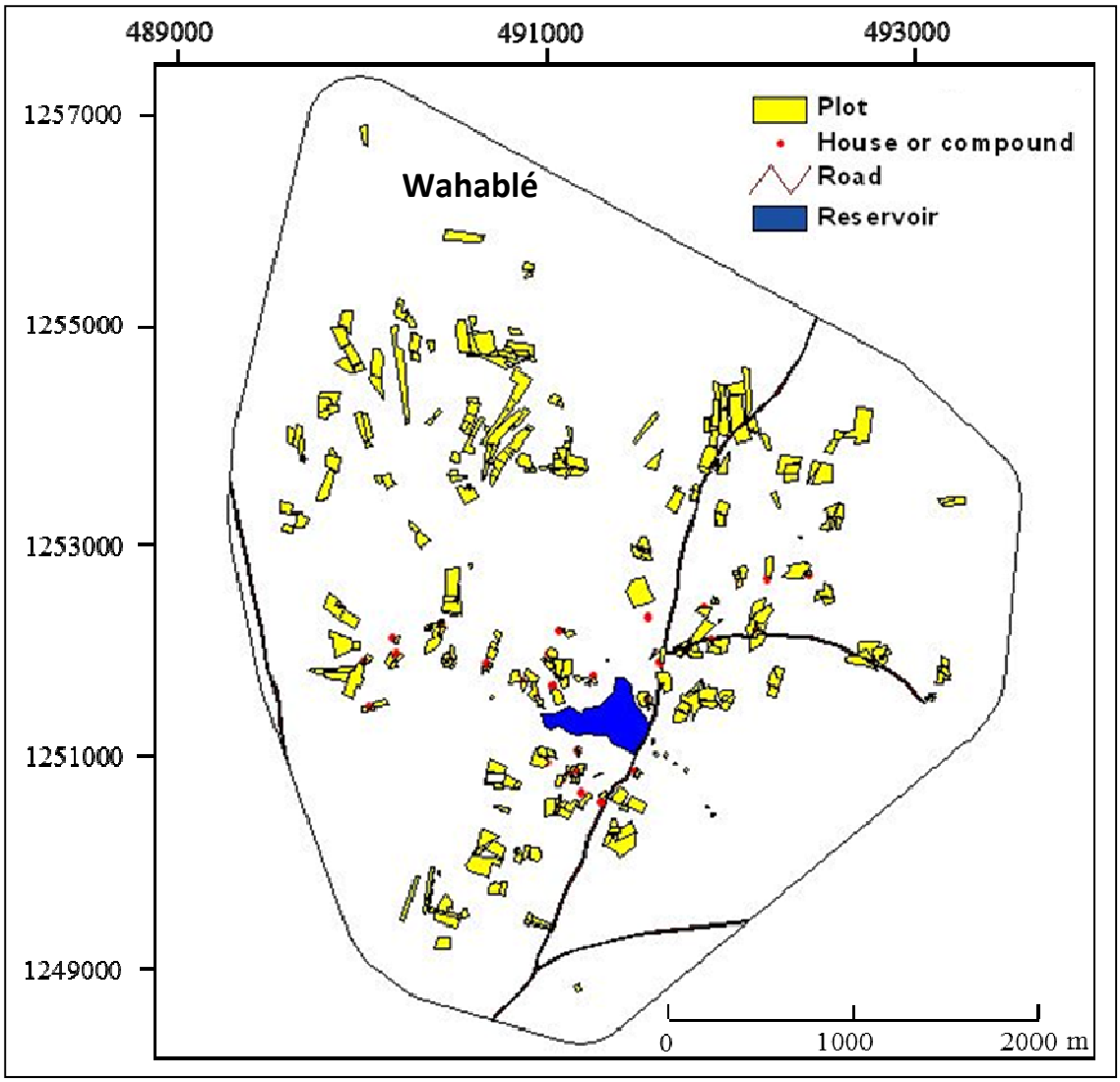


Figure 5: Location of the observed households and plots in Wahablé

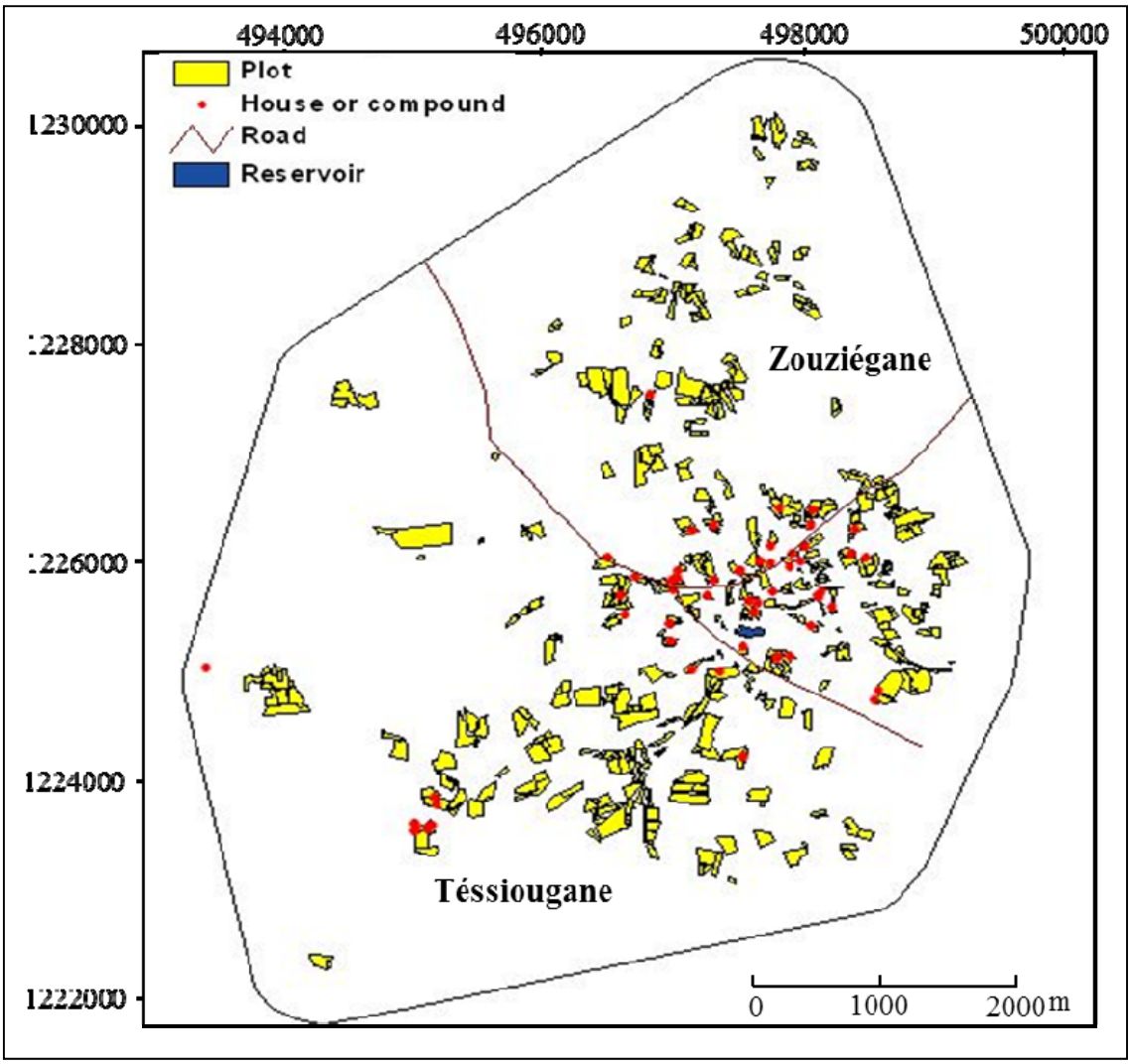


Figure 6: Location of the observed households and plots in Zouziégane and Téssiougane

In preparation of the household interviews, a map was developed for each village based on several group discussions with villagers (see appendix). Further, preliminary interviews were conducted to develop questionnaires. Through various pre-tests, the questionnaires were finally adapted with local interviewers and farmers. Every sampled household was interviewed three times. Figure 7 summarizes the structure and content of the questionnaires. The first questionnaire was used to elicit data on household characteristics.

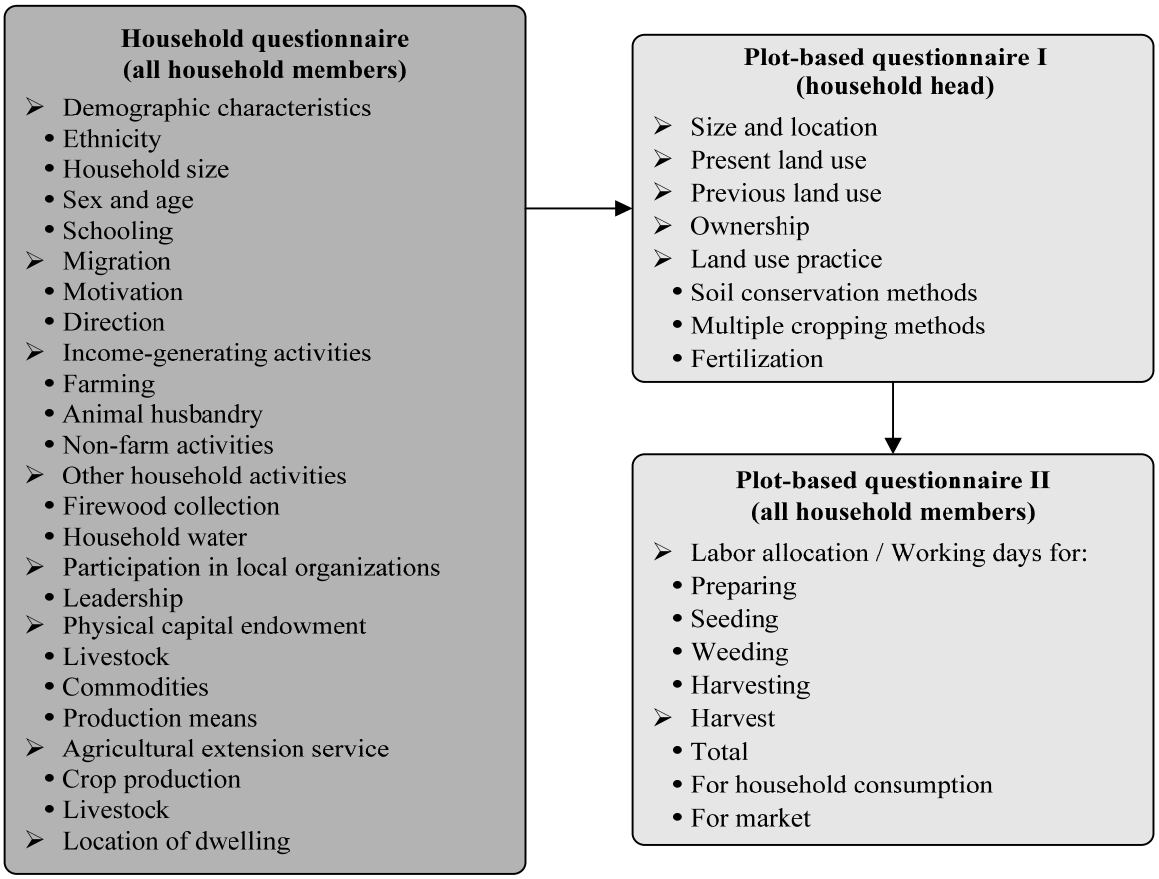


Figure 7: Structure and content of the survey

The second questionnaire, administered to the household head, included a guided tour to all household plots including fallow land. It covers relevant plot data. In the survey, farmland was divided in plots based on the cultivated crop and the applied land-use practices. In total, data for 964 plots were recorded. Using a global positioning system and Geographical Information System techniques, all plots of the sampled households were geo-referenced and measured. A sketch map showing all plots of the household was prepared for each farm household, 111 maps in total. This sketch map also contained orientation points such as school, wells, and market derived from the village maps to be able to refer to plots while asking about harvest and labor allocation for each plot during the third interview (see Figure 8).

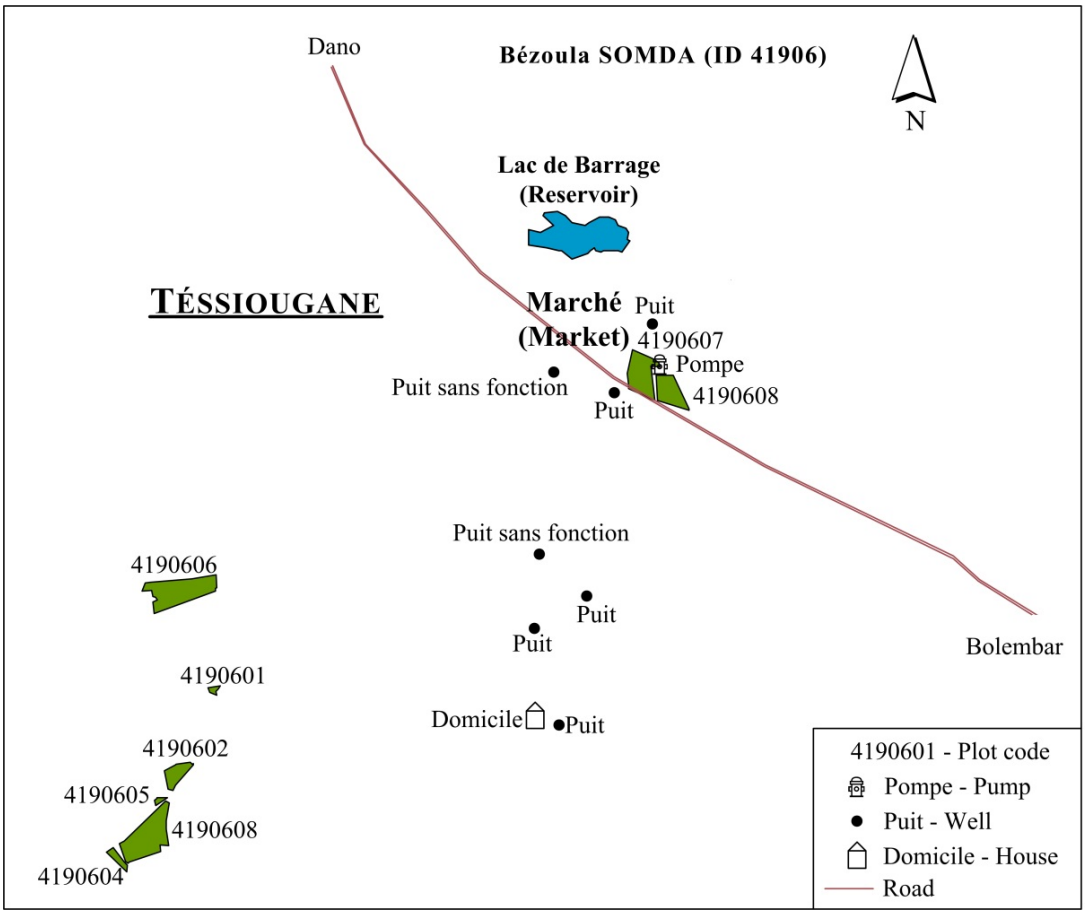


Figure 8: Geo-referenced map used in the interview with the household head Bézoula Somé

5 Results and discussionDeterminants of livelihood in the study site

By running a Principal Component Analysis (PCA), five principle components with total Eigenvalue greater than 1.0 were extracted. The five components explain about 79.9% of the total variance of the original independent variables (Table 4). The rotated component matrix showing the loadings of each variable then helps to deduce what the five components represent (Table 5).

The principal component 1 (PC1) accounts for 19.6% of the total variance of the original dataset. It is strongly explained by the annual non-farm income per person $H_{in\text{-}nonfarm/pers}$ (b=0.917) and the share of total gross income from non-farm activities $H_{\%in\text{-}nonfarm}$ (b=0.935). The component is named *Non-farm income*.

Table 4: Total variance explained using PCA

Compo-nent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumula-tive %	Total	% of Variance	Cumula-tive %	Total	% of Variance	Cumula-tive %
1	2.024	22.492	22.492	2.024	22.492	22.492	1.763	19.590	19.590
2	1.763	19.591	42.083	1.763	19.591	42.083	1.512	16.795	36.385
3	1.260	14.005	56.088	1.260	14.005	56.088	1.490	16.554	52.940
4	1.130	12.557	68.645	1.130	12.557	68.645	1.344	14.932	67.871
5	1.017	11.297	79.942	1.017	11.297	79.942	1.086	12.071	**79.942**
6	0.834	9.263	89.206						
7	0.546	6.064	95.269						
8	0.267	2.963	98.233						
9	0.159	1.767	100.000						

Table 5: Rotated Component Matrix using Varimax rotation with Kaiser Normalization

	Principle Component				
	1. Non-farm income	***2. Land resources***	***3. Physical capital***	***4. Labor***	***5. Education***
H_{size}	-0.010	-0.052	0.042	**0.958**	0.068
$H_{dependency}$	-0.189	-0.202	-0.273	-0.099	-0.467
$H_{education}$	-0.063	-0.043	-0.082	0.007	**0.920**
H_{land}	-0.063	**0.710**	0.090	0.592	0.011
$H_{land/pers}$	0.067	**0.923**	0.088	-0.137	0.072
$H_{in\text{-}nonfarm/pers}$	**0.917**	0.178	0.071	-0.168	-0.012
$H_{\%in\text{-}nonfarm}$	**0.935**	-0.124	-0.073	0.123	0.070
$H_{livestock/pers}$	-0.012	-0.081	**0.867**	0.064	-0.017
$H_{asset/pers}$	-0.002	0.239	**0.793**	-0.002	0.078

The second principal component (PC2) accounting for about 16.8% of the total variance is highly correlated with household's total landholdings H_{land} (b=0.710) and total landholdings per person

$H_{land/pers}$ (b=0.923). Thus, the component is named *Land resources*. The third principal component (PC3) is most weighted by the household's monetary value of livestock per person $H_{livestock/pers}$ (b=0.867) and by its commodities and production means, including means of transport per person $H_{assets/pers}$ (b=0.793). Both variables are considered as physical capital within the livelihood framework. Therefore, the component is labelled *Physical capital*. The principal component 4 (PC4) is strongly explained by household size H_{size} (b=0.958). Since this variable refers to labor availability of the household, the component is called *Labor*. The component 5 (PC5) is most determined by the variable education index $H_{education}$ (b=0.920) and hence named after its original variable that represents it best *Education*.

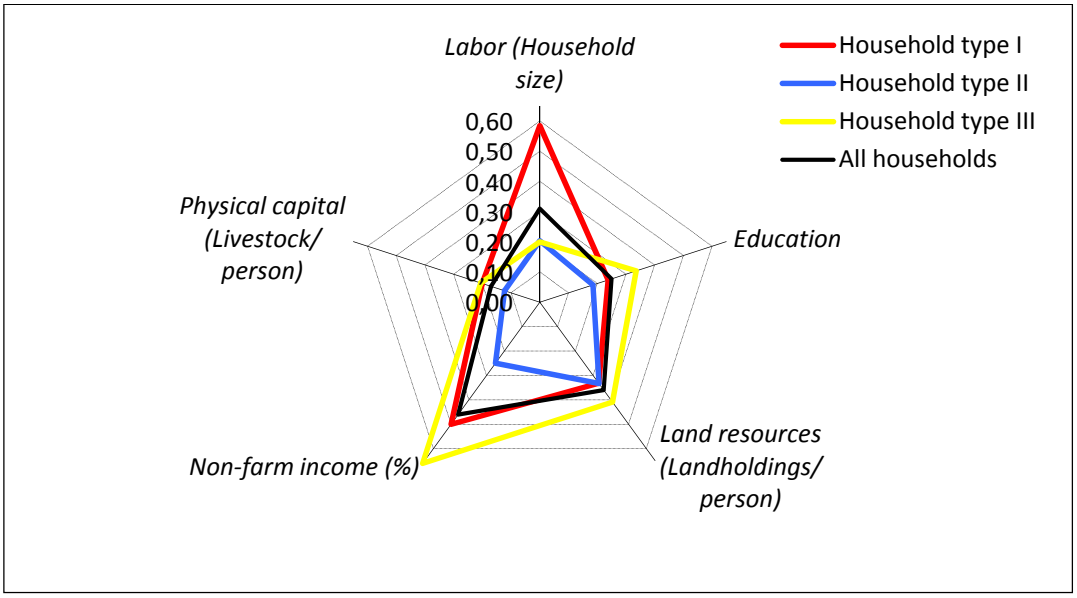


Figure 9: Indicators of livelihood dimensions of the household types

Using standardized scores of the six principle components, the k-means cluster analysis with k=3 resulted in three household types I, II, and III with group sizes 31, 43, and 37, respectively. A radar diagram of standardized scores (*Figure 9*) illustrates in which livelihood dimensions the identified types differ.

5.2 Livelihoods of identified groups

This section describes the three identified household types resulting from running PCA and K-means Cluster Analysis. The identification of household categories is based on the descriptive statistics of variables that are given in Table 6, land-use and income composition of the farm households.

Table 6: Descriptive statistics of categorizing variables

	Group	N	Mean	SD	SE	95% CI		Min	Max
						Lower	Upper		
Human capital									
H_{size}	I	31	15.5	3.58	0.64	14.14	16.76	9	25
	II	43	6.7	2.22	0.34	5.99	7.36	3	14
	III	37	6.6	2.15	0.35	5.88	7.31	2	11
$H_{dependency}$	I	31	0.7	0.4	0.07	0.54	0.84	0	1.7
	II	43	1.2	0.94	0.14	0.91	1.49	0	5
	III	37	0.6	0.34	0.06	0.48	0.71	0	1.3
$H_{education}$	I	31	1.3	0.95	0.17	0.91	1.61	0	4.3
	II	43	1	1.05	0.16	0.66	1.31	0	4.4
	III	37	1.8	1.78	0.29	1.19	2.37	0	5.3
Natural capital									
H_{land}	I	31	8.8	4.09	0.73	7.26	10.26	2	18.3
	II	43	5	2.89	0.44	4.14	5.92	0.9	12.4
	III	37	4.9	2.82	0.46	3.97	5.85	0.6	13.2
$H_{land/pers}$	I	31	0.62	0.22	0.04	0.54	0.7	0.23	1.07
	II	43	0.62	0.34	0.05	0.52	0.73	0.14	1.69
	III	37	0.74	0.41	0.07	0.61	0.88	0.09	1.69
Financial capital									
H_{income}	I	31	1286	631.86	113.48	1054.26	1517.8	489	2922
	II	43	454	243.84	37.18	379.17	529.26	89	1226
	III	37	944	456.66	75.07	791.91	1096.43	244	2029
$H_{income/pers}$	I	31	84.6	38.83	6.97	70.37	98.86	27.6	176.1
	II	43	72.6	50.07	7.64	57.24	88.06	20.3	306.6
	III	37	150.9	67.74	11.14	128.27	173.44	48.7	298.1
$H_{in\text{-}nonfarm/pers}$	I	31	37.1	23.02	4.13	28.63	45.52	13.1	94.1
	II	43	15.8	16.93	2.58	10.58	21	0	76
	III	37	91	46.86	7.7	75.37	106.61	14.4	172
$H_{\%in\text{-}nonfarm}$	I	31	44.5	16.35	2.94	38.53	50.52	16.6	85
	II	43	22.3	22.16	3.38	15.49	29.13	0	76.7
	III	37	59	15.23	2.5	53.89	64.05	29.6	88.9
Physical capital									
$H_{livestock/pers}$	I	31	84.5	87.43	15.7	52.38	116.53	2.3	417.9
	II	43	51.9	60.94	9.29	33.1	70.61	0.6	271
	III	37	86.5	95.64	15.72	54.64	118.41	1.4	414.7
$H_{asset/pers}$	I	31	61.2	31.18	5.6	49.75	72.62	20	127.9
	II	43	49.9	35.02	5.34	39.09	60.64	6.6	201.7
	III	37	66.8	49.95	8.21	50.17	83.48	6.7	242.4

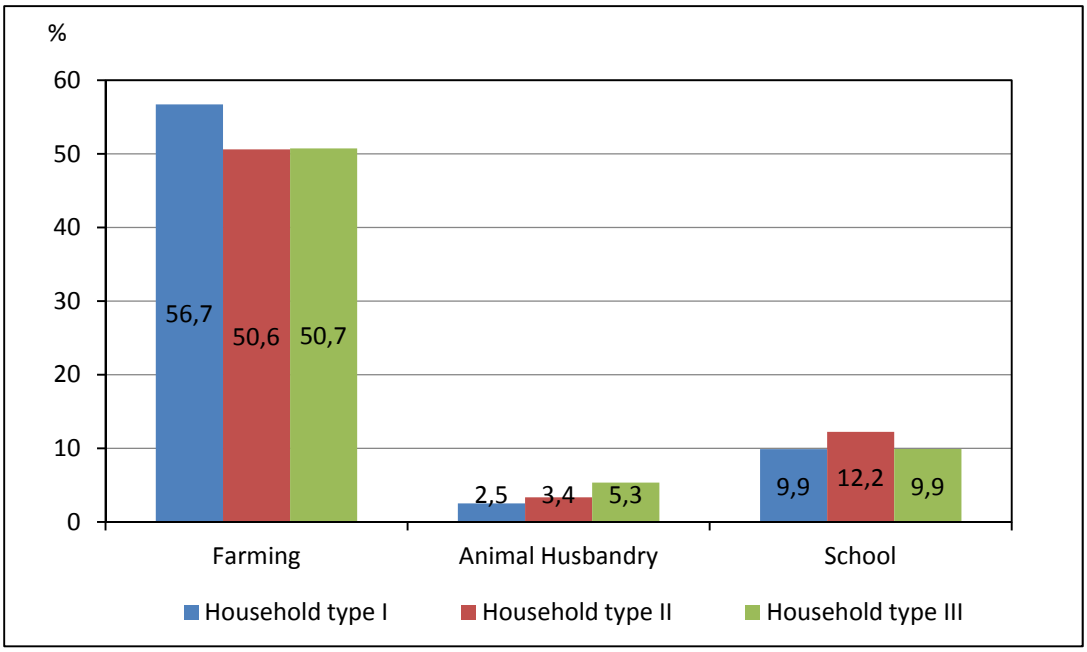


Figure 10: Main activities of household types

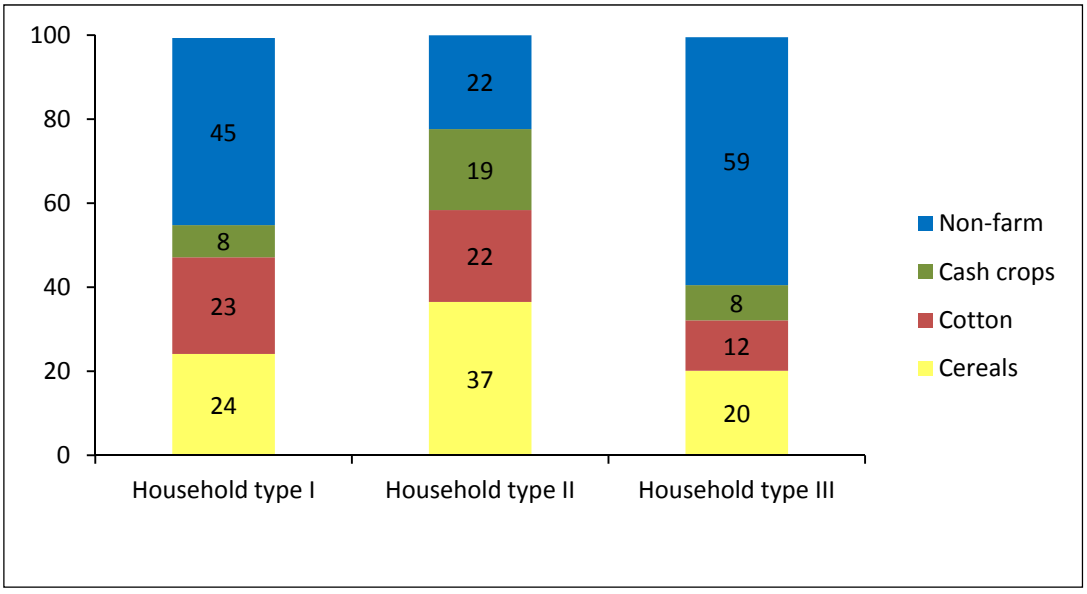


Figure 11: Income composition

Table 7: Land-use composition

Land-use	Household type I		Household type II		Household type III	
	ha	%	ha	%	ha	%
Millet	4.1	50.8	2.3	53.3	2.3	55.0
Maize	1.1	10.7	0.6	12.2	0.6	14.0
Cotton	2.6	29.5	1.3	26.6	1.1	20.3
Cash crops	0.4	6.0	0.3	5.0	0.2	5.3

5.2.1 Household type I – Diversified farm households

The first household type comprises 31 households accounting for about 28% of the study population. The main differentiating factor is household size. In terms of human capital, a big family size and high labor availability discriminate these households from the other two groups. Fifty-seven percent of household members of group I are engaged in crop production (Figure 10). Among the three groups, they show a moderate educational level and dependency ratio. Even though the majority of the household heads (74%) has no formal education, there are only two households that have not sent any household member to school or literacy classes.

Table 8: Highest educational level

		No formal education		Primary school		Secondary school		Literacy class*	
		N	%	N	%	N	%	N	%
Group I	Head	23	74	3	10	0	0	5	16
	Member	2	6	18	58	10	32	1	3
Group II	Head	33	77	4	9	0	0	6	14
	Member	12	28	26	60	3	7	2	5
Group III	Head	22	59	5	14	3	8	7	19
	Member	7	19	13	35	12	32	5	14

*Literacy in Dagara

Diversified farm households can be further distinguished from the other types with regard to their natural capital. They are best endowed with total area of landholdings. Because of the big family size, they show only moderate landholdings per family member. Since food security has highest priority, most land is allocated to cereal production (61.5%). Compared to the other two types, this is a small share. However, in total this area is more than 4 ha per household, which is almost double the size of the area that group II and III allocate to cereals. This indicates a rather extensive farming strategy. These households also have the largest landholdings for cotton and cash crop production (see Table 7).

Diversified farm households are the richest in terms of total gross income. They have a moderate income per person because of their large household size. They derive about 55% of their income from farming and 45% from non-farm activities. These households have a relatively high total income from non-farm activities. Among the three household types, these farm households derive the highest income from cotton.

About 36% of the diversified farm households are involved in a credit union that is either *BACB* providing credits for agricultural equipment or a union that offers micro credit for commerce. This allows them for example to invest in production means for non-farm activities.

The strong involvement in cotton production is evident looking at the participation in local *GPC*s. All households of this group participate in a *GPC*. This means, that they all have access to agricultural extension services provided by SOFITEX and to mineral fertilizers mainly for cotton and maize production. The importance of cotton to maintain their livelihood is also apparent in the good endowment of the households with agricultural production means. More than 80% of them own at least one pair of oxen (Table 9). The access to animal traction is central to the extensive farming strategy.

Table 9: Access to institutional assets and production means

	Credit		Oxen		Extension service		Fertilizer	
	N	%	N	%	N	%	N	%
Household type I	11	35.5	25	80.6	31	100.0	31	100.0
Household type II	6	14.0	17	39.5	39	90.7	39	90.7
Household type III	5	13.5	20	54.1	33	89.2	32	86.5

To sum up, household type I comprises households that generate most income by agricultural production that is rather extensive. Because of their orientation towards cotton production, these households are strongly exposed to risk from global market price fluctuations for inputs and outputs. In order to minimize this risk, diversified farm households generate a large share of their income from non-farm activities and have good savings in the form of livestock.

Example of a typical diversified farm household

The household of Baterbié Somè in Wahablè consists of 13 members: Baterbié himself, his wife, two sons, one daughter, three daughters-in-law, and five grandchildren. Only 4 of his 7 children under 14 years old are real dependents. No family member has attended school. One daughter-in -law is mainly engaged in housework and child care. Once or twice a week, she sells *dolo* at the village market, ensuring a regular non-farm income. All other adults and three children are mainly occupied in agricultural production. The household keeps a few cattle, sheep, goats and chicken for which one of the grandsons cares. In 2006, the household portioned its 7 ha of land in 12 plots. Baterbié allocated 3 large plots (42% of his landholding, 3 ha) to millet and sorghum. On two plots, together about 2.5 ha (37% of his land), he cultivated cotton. On three smaller plots, in total 1 ha (15% of total landholdings), Baterbié produced maize. Four small plots of 0.5 ha in total were allocated to groundnuts and cowpea. To facilitate farm work, the household uses an oxen-plough. Cotton production contributed 40% to the household's total income in the survey year. Baterbié is a member of the *GPC Fatimion*, one of the village's cotton-producer cooperatives. In 2006, the household has generated 1.1 Mio F CFA. 25% of this income was earned through selling *dolo* and 75% were derived from crop production.

5.2.2 Household type II – Cash crop-oriented farm households

Household type II includes 43 households accounting for about 39% of the sampled households. Regarding human capital, they are characterized by the smallest family sizes, lowest labor availability and highest dependency ratio (Table 6). About 50% of the household members are employed in crop production. The high share of dependents extracts some potential labor from farming for housework including child care. Cash crop-oriented farm households are further characterized by the highest share of members attending school (more than 12%). Nevertheless, this group shows the highest share of households without any formal education and no household head attended a secondary school (Table 8).

In terms of natural capital, this household type cultivates on average 5 ha (Table 6). They have about the same farm land per person than the first household type. Most land is allocated to subsistence crops such as millet, sorghum and maize (about 66%), to ensure food security. Cash crop-oriented farm households are strongly involved in commercial agriculture. The total area allocated to cotton and cash crops is smaller than for diversified farm households. The share of land under cotton and cash crops, however, shows, that theses households have similar priorities than type I households in crop production. With regard to income, the group II households generate a high share by cotton.

Among the groups, they have the highest income share from cash crops (Figure 11). This indicates a higher degree of agricultural intensification in cash crop production.

In total, cash crop-oriented farm households have the lowest gross income among the groups. Because of the small household size, they have a higher income per person on average than group I. Most income is derived from farming activities. In comparison with the other groups, these households have the lowest total income from non-farm activities (about 23%). Among the household types, they generate the highest share of income from cereals. This clearly points to the importance of ensuring food security for the high number of dependents.

Example of a typical cash-crop oriented household

The household of Nybahynir Somé in Zouziégane consists of 4 adults and 6 children. One of the children is Nybahynir's son. The others are the children of his brothers and sisters who live together with him. Two of the children attend the school. Nybahynir himself and his sisters went to the center of alphabetization in Wahablé for a few years. Two children are still very young. The other two work together with the four adults on the family fields. A sister sells *dolo* and cooked food at the market of Zouziégane twice a month. The family keeps a 25-head herd of cattle and a few sheep, goats and chicken. In 2006, the household allocated 3 plots to cereals, accounting for 4 ha or 61% of the 6.6 ha, that are cultivated by the family. On two plots, in total about 2.5 ha (37% of the household landholdings') cotton was cultivated. On a very small plot (0.1 ha), Nybahynir produced chili. Because the household is involved in cotton production, they have an oxen plough and Nybahynir is a member in a cotton producer cooperative. In 2006, the household generated about 863,000 F CFA. Selling *dolo* and cooked food contributes to 35% and crop production to 65% of the total income.

Although farming is the most important source of income, cash crop farmers cannot afford to invest as much as type I households in agricultural production means. Only about 40% of the households have at least one pair of oxen. In about 14% of the cash crop-oriented households at least one household member participates in a micro credit program. About 91% of the households participate in a local *GPC* (Table 9).

To conclude, the group of cash crop-oriented farm households is made up of farm households that are oriented towards food production for subsistence needs and rely for the generation of cash on cash crop production. Compared to the other household types, they are the poorest in terms of financial assets with relatively limited equipment. Moreover, these households are characterized by low labor availability and a high dependency ratio. These characteristics have strong implications for the land management of this group. The focus on cereal and cash crop production reflects the constraints and priority of survival or subsistence of this household type. It also demonstrates that these farm households may be even more exposed to risk from increasing input prices than diversified farmers.

5.2.3 Household type III – Non-farm oriented farm households

The third household type consists of 37 households that are strongly involved in non-farm activities and are thus called non-farm-oriented households. They represent about 42% of the sample. Compared to diversified farm households, they show small family size and low labor availability. Most household members (about 51%) are employed in farming. A relatively high share of family members (5%) is employed in animal husbandry. Non-farm-oriented households are further characterized by low dependency ratio and best education among the three groups (Table 6). The household heads are better educated than the household heads of the other household types. About 32% of them have attended a secondary school (Table 8).

In terms of natural capital, non-farm oriented farm households have about the same total size of landholdings than cash crop-oriented farm households which is about 5 ha. However, they have the largest landholdings per person because of the small family size (Table 6). Among the groups, these households allocate most land to food crop production for household consumption (67%). Because of their limited total landholdings, they allocate less land to cotton and cash crops than the other two groups. They also have the smallest proportion of these two land-use types (Table 7).

Non-farm oriented households are the richest in terms of total annual income per person. Although farming is very important, these households derive a large proportion of their income from non-farm activities (59%). Because of the high share of non-farm income, these households have the lowest share of income from cereals, cash crops and cotton among the three household types.

Example of a typical non-farm-oriented household

The household of Nestor Kambolé is a relatively small household with 6 members: Nestor himself, his wife, two older daughters and sons of 9 and 3 years. The children did not yet attend school. However, his wife and one daughter went to primary school for a few years. Nestor, his wife and one daughter are fully involved in crop production. One daughter does the housework, takes care of the children and is involved in the production of *dolo* and sheabutter, which are sold at the market. She is member of a credit union and obtained 5,000 F CFA from the local bank of Dano for her small enterprise. The household has only a few sheep and goats. Nestor has portioned his 2.5 ha of farmland into 7 plots. A small plot (0.1 ha) is fallow land. On 4 plots accounting for 2 ha of the household landholdings, cereals were cultivated in 2006. Groundnuts and other cash crops were produced on 0.4 ha (2 plots). The household is one of the few households in the villages under study that is not engaged in cotton production. In 2006, the total income of the household was about 600,000 F CFA, which is quite low. However, because of the small family size, the per capita income was relatively high. About 51% of the income was generated by non-farm activities and 49% by crop production.

Focusing on non-farm activities for income generation, households of the third category rather invest in bicycles and agricultural production assets. About 54% of them own at least one pair of oxen (Table 9). Their strong involvement in non-farm activities makes them less dependent on cotton production. This group shows the least participation in local *GPC*. Surprisingly, non-farm oriented farmers are less involved in credit unions (Table 9). Occasionally, these households invest more labor in non-farm activities because they have no access to unions that provide credits for agricultural production. Another reason for the limited participation in credit unions may be that these households have a larger portfolio of non-farm activities. Whereas households of group I and II are mainly engaged in *dolo* production and selling cooked food, non-farm oriented households are strongly involved in non-farm activities that are not supported by the micro credit program such as sheabutter production, tailing and bricklaying.

In conclusion, non-farm oriented farmers maintain their livelihood through balancing market and subsistence activities. They are characterized by comparatively good education and large landholdings per person. Households of this group allocate their resources to a large extent to cash-income-generating activities. Partly because of their better education, households of this group pursue a more diverse array of non-farm activities. As a result, these households have the highest per capita income among the groups. The income diversification makes non-farm households the least vulnerable towards risks from climate and markets. However, the strong orientation towards the generation of cash income eventually results in a labor shortage in subsistence crop production.

5.3 Income equality

The Gini coefficient of 0.35 for all households indicates inequality in the income distribution. This value is rather low. This means that the households are relatively similar in relation to total annual income. To draw conclusions about the livelihoods in the study region it is insufficient to look only at income and income distribution of the households.

Within the household types, the level of inequality is even lower. The Gini coefficient for diversified and non-farm oriented farm households is about 0.26. Within the population of the diversified farm households, 50% accumulate about 30% of the total income. About 80% of the population of the first household type gathers about 66% of the income. The cash crop oriented and the non-farm-oriented farmers show a similar distribution. However, the Gini coefficient of 0.29 indicates that the income distribution within the second household type is more uneven than within the first and third groups.

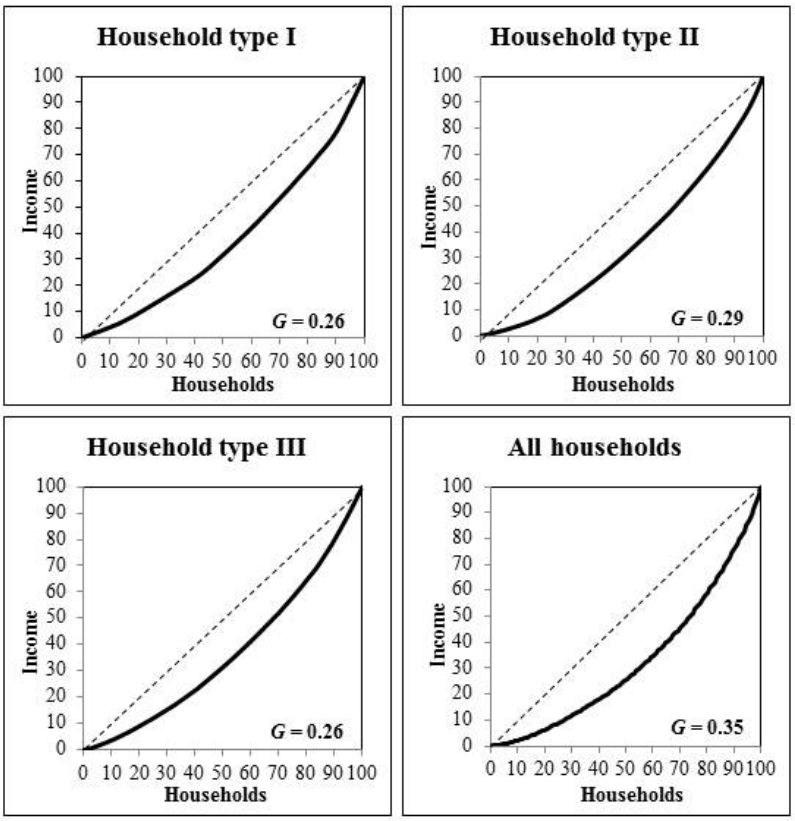


Figure 12: Lorenz curve and GINI coefficients

5.4 Land management of the household types

Farm households of the three study villages change the natural landscape through expansion of cropland and intensification to enhance agricultural productivity. In fact, they apply a wide repertoire of locally adjusted soil and water conservation measures to increase and maintain soil fertility at the same time (Stoop, 1987; Mazzucato and Niemeijer, 2000; Gray, 2005). Table 10 provides an overview about the techniques.

Whereas crop rotation, intercropping, fallowing, and mulching are traditional techniques, the well-directed application of mineral and organic fertilizers as well as physical anti-erosive measures are

rather new practices (Mazzucato and Niemeijer, 2000; 2001; 2002). Physical anti-erosive measures, mainly soil and earth bounds, emerged from the *GTV* approach. The application of mineral fertilizers, especially NPK and urea, is highly associated with cotton cultivation. Farm households that are not involved in cotton production are excluded from access to mineral fertilizers (Gray, 2005; Liebhardt, 2005).

Table 10: Soil and water conservation practices in the study region

Practice	Management	Objective
Crop rotation	Certain combinations of crops are rotated such as maize and cotton.	Reduction of soil nutrient depletion and the risk of pests and weeds
Intercropping	Multiple crops are grown together on the same plot such as millet / sorghum / cowpea.	Reduction of soil nutrient depletion Reduction of the risk of total crop failure
Fallowing	After some years of continuous cropping, bush fields are occasionally abandoned. Plots close to houses are not fallowed.	Natural soil fertility regeneration
Mulching	After harvest, crop residues are left on the plot.	Increase in soil organic matter Reduction of evaporation and soil erosion
Manure	Manure of livestock that is kept next to houses is distributed mainly to plots close to the houses.	Increase in soil organic matter
Mineral fertilizer	Mineral fertilizers, in particular NPK and urea, are applied on bush plots where cotton, maize, or cash crops are cultivated.	Increase in soil nutrients
Physical anti-erosive measures	Earth and stone bunds built around the plots	Decrease in runoff and retaining organic matter on plot

Source: Mazzucato and Niemeijer, 2000 and field observations

Table 11 shows land-use practices applied by each household category, the average labor input (man days ha^{-1}) for the land-use categories as well as the average plot size. Some practices are applied to a very similar extend to the different land uses by the three groups. This includes rotation and intercropping. The groups also show a similar behavior in the employment of physical anti-erosive measures. Other techniques are applied to different extents to the land-use categories in accordance with their cultivation requirements and dominant management behavior of the household types. Because the household types follow different production and income generating strategies, there are household-type-related differences in the application of land-use practices.

Diversified farm households have the largest total landholdings and the largest household plots for all land-use categories. This is not surprising, since they are more involved in cotton production. Thus, they have better access to animal traction than the two other groups. Animal traction considerably facilitates agricultural production on larger plots. Additionally, these farm households have intensified their production systems using more mineral fertilizers for millet, sorghum and cash crops than other households. They mitigate the lower soil fertility of marginal land, to where they have expanded their cropping area, by using more manure than cash crop-oriented and non-farm-oriented households. The labor-demanding application of manure is possible because of the large family size and high labor availability. Their strong focus on cotton production and sufficient labor availability appear to result in better adoption of soil conservation methods and application of organic fertilizers.

Compared to non-farm oriented and diversified farm households, cash crop-oriented farm households invest considerably more labor in the cultivation of cash crops. This reflects their strategy

to generate cash income and to compensate the limited access to chemical fertilizers. Moreover, they don't have sufficient labor and access to draft oxen for larger scale cotton production as alternative source of cash income. To ensure food security and balance the labor shortage, these households apply more than double the amount of NPK to maize than the other two groups. The relatively low monetary value of livestock and the labor shortage explain the limited use of manure. Land-use practices and allocation of production inputs reflect the socioeconomic situation and subsistence cropping strategy of cash crop-oriented households.

Table 11: Land-use practices of the household types

	Group	N	Rotation	Inter-cropping	Manure	Physical anti-erosive measures	NPK	Man days	Plot size
			(%)	(%)	(%)	(%)	(kg/ha)	(ha^{-1})	(ha)
Millet	I	124	69	97	15	30	8	173	0.96
	II	94	67	93	4	23	6	216	0.76
	III	156	72	88	7	28	5	182	0.80
Maize	I	62	21	92	68	24	74	228	0.43
	II	52	17	96	44	19	168	234	0.33
	III	94	18	84	54	21	72	267	0.31
Cotton	I	63	100	0	25	24	137	164	1.26
	II	36	100	0	19	25	132	123	1.07
	III	68	100	0	15	24	139	167	0.89
Cash crops	I	60	47	100	20	28	130	348	0.29
	II	51	53	92	14	22	46	545	0.11
	III	70	57	90	10	29	83	412	0.17

Non-farm-oriented households are best endowed with livestock and household and production assets per capita. However, they apply less manure and physical anti-erosive measures on their fields than diversified farm households. The main reason for that is their orientation towards non-farm activities that partly results in labor shortage for certain farming activities. Because some households are not engaged in cotton production, the average per hectare use of NPK is rather low compared to the other two groups.

Despite increasing pressure on land, fallowing is still practiced by all households (Table 12). However, many farmers reported that the fallow length has considerably decreased. The shortening of fallow periods has implications on the environment. Field studies have shown that an increasing employment of soil-fertility enhancing land-use practices such as the use of mineral fertilizer does not compensate for the loss of soil fertility through shorter fallow periods (Gray, 2005). The farmers mentioned two reasons for the shorter duration. First, they needed to expand their cropping area for cotton production and ensuring food security at the same time. This means that most farmers opened new land for cotton production. Because of the required rotation practice, farmers cannot leave their land fallow for a long period of time. Second, there is a growing fear among the farmers that other farmers could come and claim a piece of land to be their land in case nobody produces crops at this place[7]. Farmers reported that this becomes more and more a problem also with the

[7] This was also observed by Gray, 2005

decreasing power of the traditional leaders. In the past, the *chef de terre* of the village was the traditional leader in charge of the land ownership and of the distribution of land. Since the decentralization process has started, new power structures in land allocation and clearing of new land have emerged. These structures differ from village to village depending on local *GTV* measures and actions. Among the study villages, the most traditional power structures were observed in Wahablé.

Table 12: Fallowing

	Households		Average size	Average duration	Min duration	Max duration
	N	%	ha	years	years	years
Household type I	6	19	1.25	3	1	6
Household type II	8	19	0.75	4	2	6
Household type III	12	32	0.91	4	1	7

About 19% of the diversified farm households had some fallow land during the survey period. The average size of these fallows was about 1.25 ha. The average fallow duration of 3 years is the shortest among the three household types.

Within the cash crop-oriented group, 8 households or 19% respectively, had some fallow land with an average area of 0.75 ha and average fallow period of 4 years. Some of these households do not intend to increase soil fertility by leaving land fallow. Because of the small family size, if they cannot afford to hire extra labor, they are sometimes short of labor.

The non-farm farmers leave their land fallow more frequent than the other two groups. About 32% of them had fallow land within the survey period. The average size of these fallows was about 0.91 ha. Non-farm oriented farmers also leave land fallow because of labor shortage. Some family members generate more income with non-farm activities and are therefore not employed in agricultural production.

6 Conclusions

Access to land, labor availability, education, asset endowment as well as income and income composition vary between the household categories in the study site. Households pursue different land-use practices in line with their resource allocation strategies and with the impacts that land-use policies have on them. Whereas the *GTV* approach affected all households, the cotton programs reach only those households that have sufficient labor and landholdings. Both policies led to changes of the social structure of the local communities: new social groups formed in the villages (e.g. the *GPC*s, water and land user groups) and require a certain level of cooperation to be beneficial.

Cotton cultivation had a strong impact on the wealth of the households. Households that are strongly involved in cotton production have the highest total annual income. They have more draft oxen and more labor than other households. This has also implications on the cropping area and on the environment. An expansion of cultivated area at the expense of savannah and forest is highlighted in the literature as a primary effect of the introduction of cotton (see Fauré, Kleene et al., 1998; Gray, 2005; Liebhardt, 2005). Indeed, the results suggest that households with a focus on cotton (diversified farm households) tend to have a larger area under cultivation than other farm households. However, these households are strongly exposed to risk from price fluctuations in global markets for production inputs and outputs. Poor households such as the cash-crop oriented households are not able to bear the risk of taking a loan. Thus, they are excluded from cotton cultivation that is one of the surest pathways to increase income in Burkina Faso (Oxfam, 2002). These households are characterized by low labor availability resulting in the insufficient application of measures for enhancing land productivity.

For some households, agricultural intensification through the application of chemical fertilizers for cash crops and maize has emerged as a household strategy to improve food security. This also means that these households are more exposed to the risk of increasing input prices. In this context, the introduction of credit schemes to aid farmers' access to production inputs, as observed in the study area, is helpful for farmers in improving crop productivity as well as in reducing market risk.

Investment in non-farm activities is a promising strategy for those farm households lacking land and labor resources for agricultural production. A stronger involvement in non-farm activities leads to the diversification of income sources and thus reduces the vulnerability to climate risks and market prices. A strong orientation towards activities generating cash income may eventually result in a labor shortage for the production of subsistence crops.

Interestingly, the livelihood outcomes of the households are very similar. Farm households in the study region set different foci in their portfolio of activities to maintain their livelihoods. However they do not differ much in their per capita asset endowment and all of them are more or less involved in the same activities. The estimation of the Gini coefficient supports this conclusion. The income is rather evenly distributed over all households. This means, that the categorization of housholds into household types requires more than income variables.

Because of costs and efforts, the field research to collect data and information covered only one production cycle. A more profound household categorization that could be used to evaluate policy measures to improve livelihoods needs to take into account a longer period of time.

7 References

Adato, M. and R.Meinzen-Dick (2002). Assessing the impact of agricultural research on poverty using the sustainable livelihoods framework. FCND Discussion Paper 128. IFPRI.

Adato, M., R. Meinzen-Dick, P. Hazell, and L. (2007). Integrating Social and Economic Analysis to Study Impacts on Livelihoods and Poverty: Conceptual Frameworks and Research Methods. In: Adato, Michelle and Ruth Meinzen-Dick (eds). Agricultural Research, Livelihoods, and Poverty: Studies of Economic and Social Impacts in Six Countries. The John Hopkins University Press. Baltimore.

Ashley, C. (2000). Applying Livelihood Approaches to Natural Resource Management Initiatives: Experiences in Namibia and Kenya. Working Paper 134. ODI.

Ashley, C. and K. Hussein (2000). Developing Methodologies for Livelihood Impact Assessment: Experience of the African Wildlife Foundation in East Africa. Working Paper 129. ODI. London, UK.

Barrett, C. B., T. Reardon, and P. Webb (2001). Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications. Food Policy 26 (4), pp. 315-331.

Batterbury, S. (1998). Local environmental management, land degradation and the "gestion des terroirs" approach in West Africa: policies and pitfalls. Journal of International Development 10(7), pp. 871-898.

Batterbury, S. P.J. and A. J. Bebbington (1999). Environmental Histories, Access to Resources and Landscape Change: An Introduction. Land Degradation & Development 10 pp. 279-289.

Batterbury, S. (2001). Landscape of diversity: a local political ecology of livelihood diversification in south-western Niger. Ecumene 8 (4), pp. 437-464.

Batterbury, S. (2005). Within, and beyond, territories: a comparison of village land use management and livelihood diversification in Burkina Faso and Southwest Niger. In: Gausset, Q., M. Whyte et al. (eds). Beyond territory and scarcity: exploring conflicts over natural resource management. Nordiska Afrikainstitutet. Uppsala.

Breusers, M. (2001). Searching for Livelihood Security: Land and Mobility in Burkina Faso. Journal of Development Studies 37(4), pp. 49 - 80.

Campbell, B., J. A. Sayer, P. Frost, S. Vermeulen, M. Ruiz Pérez, A. Cunningham, and R. Prabhu (2001). Assessing the performance of natural resource systems. Conservation Ecology 5 (No. 2), pp. 22. http://www.consecol.org/vol5/iss2/art22/

Carswell, G. (1997). Agricultural Intensification and Rural Sustainable Livelihoods: A 'Think Piece'. IDS Working Paper 64. IDS, University of Sussex. Brighton, UK.

Carswell, G. and S. Jones (2004). Introduction - Section IIIA: Tools for Analysis. In: Jones, S. and G. Carswell (eds). The Earthscan Reader Environment, Development and Rural Livelihoods. Earthscan. London, UK.

Concept Kory (2004). Plan de Gestion de Terroir du Village de Wahablé.

de Zeeuw, F. (1997). Borrowing of Land, Security of Tenure and Sustainable Land Use in Burkina Faso. Development and Change 28 pp. 583-595.

DFID (2001). Sustainable livelihoods guidance sheets. DFID. London, UK.

Direction Régionale de l'Economie et de la Planification du Sud-Ouest (2000). Monographie de la Province du Ioba. Gaoua, Burkina Faso.

Ellis, F. and E. Allison (2004). Livelihood diversification and natural resource access. Overseas Development Group, University of East Anglia, UK.

Ellis, F. and H.A. Freeman (2005). Conceptual framework and overview of themes. In: Ellis, F. and H.A. Freeman (eds). Rural Livelihoods and Poverty Reduction Policies. Routledge. London.

Emtage, N. F. (2004). Typologies of Landholders in Leyte, Philippines, and the implications for development of policies for small-holder and community forestry. In: Baumgartner, D. M.: Proceedings of human dimensions of family, farm and community forestry. Washington State University, USA.

Emtage, N. F. and J. Suh (2005). "Variations in Socioeconomic characteristics, farming assets and livelihood systems in Leyte rural households." Annals of Tropical Research 27(1), pp. 35-54.

Fauré, G., P. Kleene, and S. Ouédraogo (1998). Le conseil de gestion aux agriculteurs dans la zone cotonière du Burkina Faso: une approche renouvelée de la vulgarisation agricole. Etud. Rech. Sys. Agraires Dév. 31, pp. 81-92.

Geist, H., E. Lambin, W. McConnell, and D. Alves (2005). Causes, Trajectories and Syndroms of Land-Use/Cover Change. IHDP Newsletter 3/2005.

Gleisberg, K. (2008). Cultivating fields of knowledge: The problem of knowledge transfer in field research on land use in Burkina Faso. In: P. P. Mollinga and C. R. L. Wall (eds.) Fieldwork in difficult environments. Methodology as boundary work in development research. Münster, Lit., pp. 69-81.

Gottret, M.A.V.N. and D. White (2001). Assessing the impact of integrated natural resource management: challenges and experiences. Conservation Ecology 5 (2), pp. 17. http://www.consecol.org/vol5/iss2/art17/

Graaff, J. de, Mijl, J.P. van der, and Nibbering, J.W. (1999). Farm survey design in the Sahel: Experiences from Burkina Faso. Quarterly Journal of International Agriculture 38(1), pp. 35 - 52.

Gray, L. C. (1999). Is land being degraded? A multi-scale investigation of landscape change in southwestern Burkina Faso. Land Degradation & Development 10 (4), pp. 329 - 343.

Gray, L. C. and M. Kevane (2001). "Evolving Tenure Rights and Agricultural Intensification in Southwestern Burkina Faso." World Development 29(4), pp. 573-587.

Gray, L. C. (2002). Environmental policy, land rights, and conflict: rethinking community natural resource management programs in Burkina Faso. Environment and Planning D: Society and Space 20(2), pp. 167-182.

Gray, L. C. (2005). What kind of intensification? Agricultural practice, soil fertility and socioeconomic differentiation in rural Burkina Faso. The Geographical Journal 171 (1), pp. 70 - 82

Institute Nationale de Statistique de Développement (INSD) (2008). Recensements généraux de la population 1985 et 1996, et projections 2005.

Kaboré, D. and C. Reij (2004). The emergence and spreading of an improved traditional soil and water conservation practice in Burkina Faso. EPTD Discussion Paper. Washington D.C. IFPRI

Kaminski, J. (2007). ”Interlinked Agreements and the Institutional Reform in the Cotton Sector of Burkina Faso.” Working paper, ARQADE, Toulouse School of Economics.

Lesschen, J. P., P. H. Verburg, and S. J. Staal (2005). Statistical methods for analysing the spatial dimension of changes in land use and farming systems, ILRI, Nairobi, Kenya & LUCC Focus 3 Office, Wageningen University, the Netherlands.

Liebhardt, J. (2005). "White Gold or Fool's Gold: What Will a Rollback of U.S. Cotton Subsidies Mean for Farmers in Burkina Faso?" Multinational Monitor 26(5&6).

Maatman, A. and A. Ruijs (1996). Synopsis of a linear programming study of farmers' strategies on the Central Plateau in Burkina Faso. Groningen, The Netherlands, University of Groningen, Centre for Development Studies (CDS).

Mazzucato, V. and D. Niemeijer (2000). The Cultural Economy of Soil and Water Conservation: Market Principles and Social Networks in Eastern Burkina Faso. Development and Change 31 pp. 831-855.

Mazzucato, V. and D. Niemeijer (2001). Overestimating land degradation, underestimating farmers in the Sahel. Issue Paper Drylands Programme 101. IIED. London.

Mazzucato, V. and D. Niemeijer (2002). Population Growth and the Environment in Africa: Local Informal Institutions, the Missing Link. Economic Geography 18 pp. 117-193.

Maxwell, S. and A. Fernando (1989). "Cash Crops in Developing Countries: The Issues, the Fact, the Policies." World Development 17(11), pp. 1677-1708.

McDowell, C. and A. d. Haan (1997). Migration and Sustainable Livelihoods: A Critical Review of the Literature. Brighton, UK, IDS.

McMillan, D. E., J. H. Sanders, D. Koenig, K. Akwabi-Ameyaw, and T.M. Painter (1998). New Land is not enough: Agricultural performance of New Lands settlement in West Africa. World Development 26(2), pp. 187-211.

Nagendra, H., D. K. Munroe, and J. Southworth (2004). "From pattern to process: landscape fragmentation and the analysis of land use/land cover change." Agriculture, Ecosystems & Environment 101(2-3, pp. 111-115.

OECD (2005). Importance économique et sociale du coton en Afrique de l'Ouest: Rôle du coton dans le développement, le commerce et les moyens d'existence. Secrétariat du Club du Sahel et de l'Afrique de l'Ouest

Onwueme, I. C. and T. D. Sinha (1999). Field Crop Production in Tropical Africa. Ede, The Netherlands, The Technical Centre for Agricultural und Rural Co-operation.

Oxfam (2002). Cultivating poverty: the impact of US cotton subsidies on Africa. Oxfam Briefing Paper

Paré, S., U. Söderberg, M. Sandewall, and J. M. Ouadba (2008). Land use analysis from spatial and field data capture in southern Burkina Faso, West Africa. Agriculture, Ecosystems & Environment 127 (3-4), pp. 277-285.

Prudencio, C. Y. (1993). Ring management of soils and crops in the West African semi-arid tropics: The case of the mossi farming system in Burkina Faso. Agriculture, Ecosystems & Environment 47(3), pp. 237-264.

Rasmussen, K., Bjarne Foga, and J. E. Madsenb (2001). Desertification in reverse? Observations from northern Burkina Faso. Global Environmental Change 11 pp. 271-282.

Raynaut, C. (2001). Societies and nature in the Sahel: ecological diversity and social dynamics. Global Environmental Change 11 (1), pp. 9-18.

Reenberg, A. (2001). Agricultural land use pattern dynamics in the Sudan–Sahel: towards an event-driven framework. Land Use Policy 18 pp. 309-319.

Reij, C., G. Tappan, and A. Belemvire (2005). Changing land management practices and vegetation on the Central Plateau of Burkina Faso (1968-2002). Journal of Arid Environments 63, pp. 642-659.

Rodgers C., van de Giesen, N., Laube, W., Vlek, P.L.G., and Youkhana, E. (2007). The GLOWA Volta Project: A Framework for Water Resources Decision-Making and Scientific Capacity Building in a Transnational West African Basin.-In: Craswell, E. T., M. Bonell, D. Bossio, S. Demuth, N. Van De Giesen: Integrated Assessment of Water Resources and Global Change: A North-South Analysis, pp. 295-313.

Roose E. 1991. Conservation des sols en zone méditarrénenne. Synthèse et proposition d'une nouvelle stratégie de lutte antiérosive: la GCES. Cah. ORSTOM Pédol. 26(2). Pp. 145-181.

Roose, E. (1992). La gestion conservatoire de l'eau et la fertilité des sols : une nouvelle stratégie pour l'intensification de la production et la restauration de l'environnement en montagne. Réseau Erosion, Bulletin N°12. ORSTOM.

Sahelconsult (2003a). Plan de Gestion du Terroir de Téssiougane. Report

Sahelconsult (2003b). Plan de Gestion du Terroir de Zouziégane. Report

Sanders, J. H., B. I. Shapiro, and S. Ramaswamy (1996). The Economics of Agricultural Technology in Semiarid Sub-Saharan Africa. Baltimore and London, The John Hopkins University Press.

Sawadogo, L., D. Tiveau, and R. Nygård (2005). Influence of selective tree cutting, livestock and prescribed fire on herbaceous biomass in the savannah woodlands of Burkina Faso, West Africa. Agr. Ecosyst. Environ. 105, pp. 335-345.

Scherr, S. J. (2000). A downward spiral? Research evidence on the relationship between poverty and natural resource degradation. Food Policy 25 (4), pp. 479-498.

Schwartz, A. (1996). "Pratique paysannes et gestion de la fertilité des terres sur les exploitations cotonières dans l'ouest du Burkina Faso." Cah. Sci. hum. 32(1), pp. 153-175.

Scoones, I. (1998). Sustainable Rural Livelihoods: A Framework for Analysis. Brighton, UK, IDS.

Somda, J., A. J. Nianogo, S. Nassa, and S. Sanou (2002). Soil fertility management and socio-economic factors in crop-livestock systems in Burkina Faso: a case study of composting technology. Ecological Economics 43(2-3), pp. 175-183.

Son, G. and E. H. Bourarach (2001). Problems of crop establishment in West Burkina Faso. I World Congress on Conservation Agriculture. Madrid, Spain: 11.

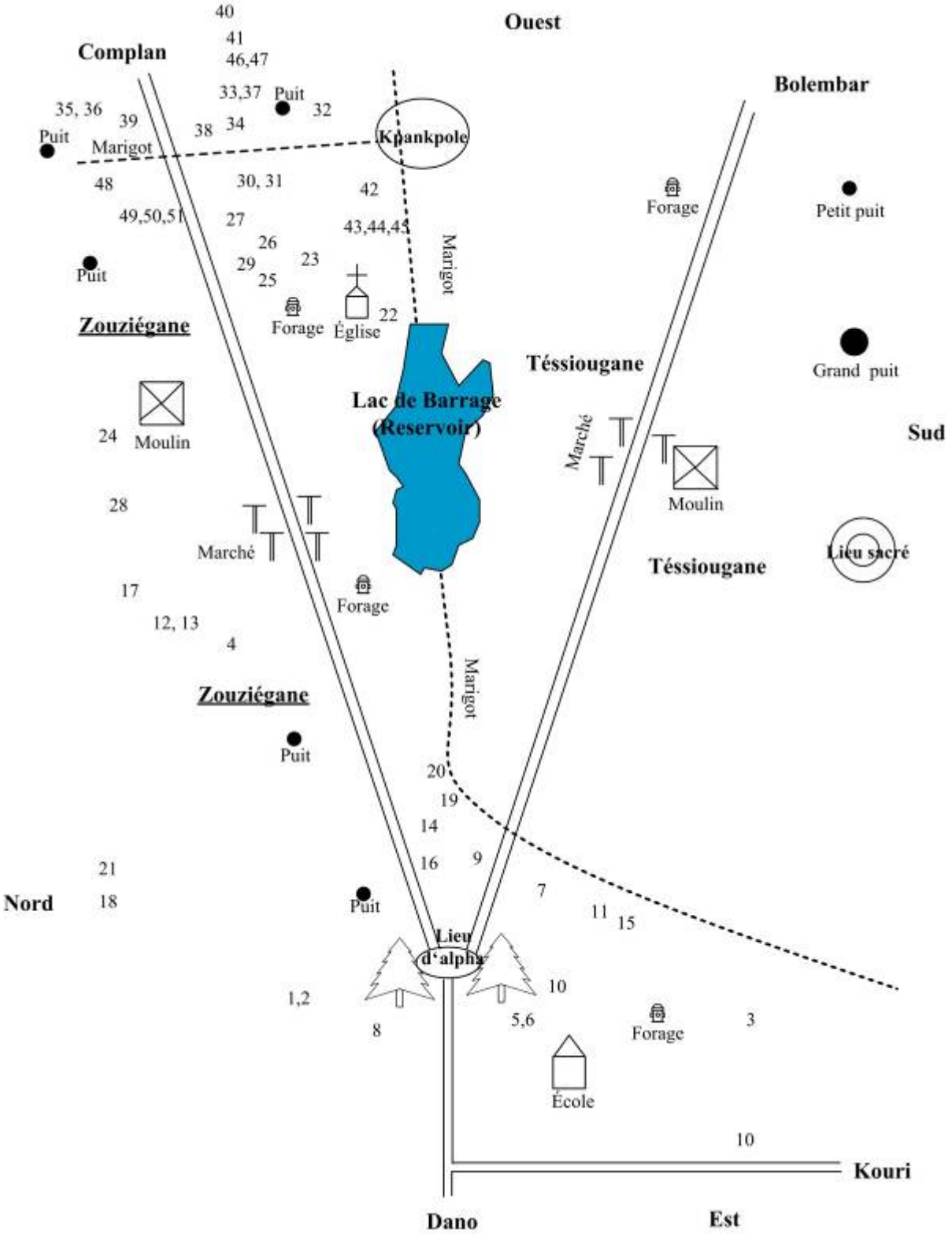
Soussan, J., P. Blaikie, O. Springate-Baginski, and M. Chadwick (2001). Understanding Livelihood Processes and Dynamics. Livelihood-Policy Relationships in South Asia. Working Paper 7. DFID.

Stoop, W. A. (1987). "Variations in soil properties along three toposequences in Burkina Faso and implications for the development of improved cropping systems." Agriculture, Ecosystems & Environment 19(3), pp. 241-264.

Worldbank (2004). Cotton cultivation in Burkina Faso - A 30 year success story.

Appendix

Example of a village plan: Zouziégane



ZEF Working Paper Series, ISSN 1864-6638
Department of Political and Cultural Change
Center for Development Research, University of Bonn
Editors: Joachim von Braun, Manfred Denich, Solvay Gerke, Anna-Katharina Hornidge and Conrad Schetter

31. Mollinga, Peter P. (2008). For a Political Sociology of Water Resources Management.
32. Hauck, Jennifer; Youkhana, Eva (2008). Histories of water and fisheries management in Northern Ghana.
33. Mollinga, Peter P. (2008). The Rational Organisation of Dissent. Boundary concepts, boundary objects and boundary settings in the interdisciplinary study of natural resources management.
34. Evers, Hans-Dieter; Gerke, Solvay (2009). Strategic Group Analysis.
35. Evers, Hans-Dieter; Benedikter, Simon (2009). Strategic Group Formation in the Mekong Delta - The Development of a Modern Hydraulic Society.
36. Obeng, George Yaw; Evers, Hans-Dieter (2009). Solar PV Rural Electrification and Energy-Poverty: A Review and Conceptual Framework With Reference to Ghana.
37. Scholtes, Fabian (2009). Analysing and explaining power in a capability perspective.
38. Eguavoen, Irit (2009). The Acquisition of Water Storage Facilities in the Abay River Basin, Ethiopia.
39. Hornidge, Anna-Katharina; Mehmood Ul Hassan; Mollinga, Peter P. (2009). 'Follow the Innovation' – A joint experimentation and learning approach to transdisciplinary innovation research.
40. Scholtes, Fabian (2009). How does moral knowledge matter in development practice, and how can it be researched?
41. Laube, Wolfram (2009). Creative Bureaucracy: Balancing power in irrigation administration in northern Ghana.
42. Laube, Wolfram (2009). Changing the Course of History? Implementing water reforms in Ghana and South Africa.
43. Scholtes, Fabian (2009). Status quo and prospects of smallholders in the Brazilian sugarcane and ethanol sector: Lessons for development and poverty reduction.
44. Evers, Hans-Dieter; Genschick, Sven; Schraven, Benjamin (2009). Constructing Epistemic Landscapes: Methods of GIS-Based Mapping.
45. Saravanan V.S. (2009). Integration of Policies in Framing Water Management Problem: Analysing Policy Processes using a Bayesian Network.
46. Saravanan V.S. (2009). Dancing to the Tune of Democracy: Agents Negotiating Power to Decentralise Water Management.
47. Huu, Pham Cong; Rhlers, Eckart; Saravanan, V. Subramanian (2009). Dyke System Planing: Theory and Practice in Can Tho City, Vietnam.
48. Evers, Hans-Dieter; Bauer, Tatjana (2009). Emerging Epistemic Landscapes: Knowledge Clusters in Ho Chi Minh City and the Mekong Delta.
49. Reis, Nadine; Mollinga, Peter P. (2009). Microcredit for Rural Water Supply and Sanitation in the Mekong Delta. Policy implementation between the needs for clean water and 'beautiful latrines'.
50. Gerke, Solvay; Ehlert, Judith (2009). Local Knowledge as Strategic Resource: Fishery in the Seasonal Floodplains of the Mekong Delta, Vietnam
51. Schraven, Benjamin; Eguavoen, Irit; Manske, Günther (2009). Doctoral degrees for capacity development: Results from a survey among African BiGS-DR alumni.
52. Nguyen, Loan (2010). Legal Framework of the Water Sector in Vietnam.
53. Nguyen, Loan (2010). Problems of Law Enforcement in Vietnam. The Case of Wastewater Management in Can Tho City.
54. Oberkircher, Lisa et al. (2010). Rethinking Water Management in Khorezm, Uzbekistan. Concepts and Recommendations.
55. Waibel, Gabi (2010). State Management in Transition: Understanding Water Resources Management in Vietnam.
56. Saravanan V.S.; Mollinga, Peter P. (2010). Water Pollution and Human Health. Transdisciplinary Research on Risk Governance in a Complex Society.
57. Vormoor, Klaus (2010). Water Engineering, Agricultural Development and Socio-Economic Trends in the Mekong Delta, Vietnam.
58. Hornidge, Anna-Katharina; Kurfürst, Sandra (2010). Envisioning the Future, Conceptualising Public Space. Hanoi and Singapore Negotiating Spaces for Negotiation.
59. Mollinga, Peter P. (2010). Transdisciplinary Method for Water Pollution and Human Health Research.
60. Youkhana, Eva (2010). Gender and the development of handicraft production in rural Yucatán/Mexico.
61. Naz, Farha; Saravanan V. Subramanian (2010). Water Management across Space and Time in India.
62. Evers, Hans-Dieter; Nordin, Ramli, Nienkemoer, Pamela (2010). Knowledge Cluster Formation in Peninsular Malaysia: The Emergence of an Epistemic Landscape.
63. Mehmood Ul Hassan; Hornidge, Anna-Katharina (2010). 'Follow the Innovation' – The second year of a joint experimentation and learning approach to transdisciplinary research in Uzbekistan.
64. Mollinga, Peter P. (2010). Boundary concepts for interdisciplinary analysis of irrigation water management in South Asia.
65. Noelle-Karimi, Christine (2006). Village Institutions in the Perception of National and International Actors in Afghanistan. (Amu Darya Project Working Paper No. 1)
66. Kuzmits, Bernd (2006). Cross-bordering Water Management in Central Asia. (Amu Darya Project Working Paper No. 2)
67. Schetter, Conrad; Glassner, Rainer; Karokhail, Masood (2006). Understanding Local Violence. Security Arrangements in Kandahar, Kunduz and Paktia. (Amu Darya Project Working Paper No. 3)

68. Shah, Usman (2007). Livelihoods in the Asqalan and Sufi-Qarayateem Canal Irrigation Systems in the Kunduz River Basin. (Amu Darya Project Working Paper No. 4)

69. ter Steege, Bernie (2007). Infrastructure and Water Distribution in the Asqalan and Sufi-Qarayateem Canal Irrigation Systems in the Kunduz River Basin. (Amu Darya Project Working Paper No. 5)

70. Mielke, Katja (2007). On The Concept of 'Village' in Northeastern Afghanistan. Explorations from Kunduz Province. (Amu Darya Project Working Paper No. 6)

71. Mielke, Katja; Glassner, Rainer; Schetter, Conrad; Yarash, Nasratullah (2007). Local Governance in Warsaj and Farkhar Districts. (Amu Darya Project Working Paper No. 7)

72. Meininghaus, Esther (2007). Legal Pluralism in Afghanistan. (Amu Darya Project Working Paper No. 8)

73. Yarash, Nasratullah; Smith, Paul; Mielke, Katja (2010). The fuel economy of mountain villages in Ishkamish and Burka (Northeast Afghanistan). Rural subsistence and urban marketing patterns. (Amu Darya Project Working Paper No. 9)

74. Oberkircher, Lisa (2011). 'Stay – We Will Serve You Plov!'. Puzzles and pitfalls of water research in rural Uzbekistan.

75. Shtaltovna, Anastasiya; Hornidge, Anna-Katharina; Mollinga, Peter P. (2011). The Reinvention of Agricultural Service Organisations in Uzbekistan – a Machine-Tractor Park in the Khorezm Region.

76. Stellmacher, Till; Grote, Ulrike (2011). Forest Coffee Certification in Ethiopia: Economic Boon or Ecological Bane?

77. Gatzweiler, Franz W.; Baumüller, Heike; Ladenburger, Christine; von Braun, Joachim (2011). Marginality. Addressing the roots causes of extreme poverty.

78. Mielke, Katja; Schetter, Conrad; Wilde, Andreas (2011). Dimensions of Social Order: Empirical Fact, Analytical Framework and Boundary Concept.

79. Yarash, Nasratullah; Mielke, Katja (2011). The Social Order of the Bazaar: Socio-economic embedding of Retail and Trade in Kunduz and Imam Sahib

80. Baumüller, Heike; Ladenburger, Christine; von Braun, Joachim (2011). Innovative business approaches for the reduction of extreme poverty and marginality?

81. Ziai, Aram (2011). Some reflections on the concept of 'development'.

82. Saravanan V.S., Mollinga, Peter P. (2011). The Environment and Human Health - An Agenda for Research.

83. Eguavoen, Irit; Tesfai, Weyni (2011). Rebuilding livelihoods after dam-induced relocation in Koga, Blue Nile basin, Ethiopia.

84. Eguavoen, I., Sisay Demeku Derib et al. (2011). Digging, damming or diverting? Small-scale irrigation in the Blue Nile basin, Ethiopia.

85. Genschick, Sven (2011). Pangasius at risk - Governance in farming and processing, and the role of different capital.

86. Quy-Hanh Nguyen, Hans-Dieter Evers (2011). Farmers as knowledge brokers: Analysing three cases from Vietnam's Mekong Delta.

87. Poos, Wolf Henrik (2011). The local governance of social security in rural Surkhondarya, Uzbekistan. Post-Soviet community, state and social order.

88. Graw, Valerie; Ladenburger, Christine (2012). Mapping Marginality Hotspots. Geographical Targeting for Poverty Reduction.

89. Gerke, Solvay; Evers, Hans-Dieter (2012). Looking East, looking West: Penang as a Knowledge Hub.

90. Turaeva, Rano (2012). Innovation policies in Uzbekistan: Path taken by ZEFa project on innovations in the sphere of agriculture.

91. Gleisberg-Gerber, Katrin (2012). Livelihoods and land management in the Ioba Province in south-western Burkina Faso.

ZEF Development Studies

edited by Solvay Gerke and Hans-Dieter Evers

Center for Development Research (ZEF), University of Bonn

Shahjahan H. Bhuiyan
Benefits of Social Capital. Urban Solid Waste Management in Bangladesh
Vol. 1, 2005, 288 p., 19.90 EUR, br. ISBN 3-8258-8382-5

Veronika Fuest
Demand-oriented Community Water Supply in Ghana. Policies, Practices and Outcomes
Vol. 2, 2006, 160 p., 19.90 EUR, br. ISBN 3-8258-9669-2

Anna-Katharina Hornidge
Knowledge Society. Vision and Social Construction of Reality in Germany and Singapore
Vol. 3, 2007, 200 p., 19.90 EUR, br. ISBN 978-3-8258-0701-6

Wolfram Laube
Changing Natural Resource Regimes in Northern Ghana. Actors, Structures and Institutions
Vol. 4, 2007, 392 p., 34.90 EUR, br. ISBN 978-3-8258-0641-5

Lirong Liu
Wirtschaftliche Freiheit und Wachstum. Eine international vergleichende Studie
Vol. 5, 2007, 200 p., 19.90 EUR, br. ISBN 978-3-8258-0701-6

Phuc Xuan To
Forest Property in the Vietnamese Uplands. An Ethnography of Forest Relations in Three Dao Villages
Vol. 6, 2007, 296 p., 29.90 EUR, br. ISBN 978-3-8258-0773-3

Caleb R.L. Wall, Peter P. Mollinga (Eds.)
Fieldwork in Difficult Environments. Methodology as Boundary Work in Development Research
Vol. 7, 2008, 192 p., 19.90 EUR, br. ISBN 978-3-8258-1383-3

Solvay Gerke, Hans-Dieter Evers, Anna-K. Hornidge (Eds.)
The Straits of Malacca. Knowledge and Diversity
Vol. 8, 2008, 240 p., 29.90 EUR, br. ISBN 978-3-8258-1383-3

Caleb Wall
Argorods of Western Uzbekistan. Knowledge Control and Agriculture in Khorezm
Vol. 9, 2008, 384 p., 29.90 EUR, br. ISBN 978-3-8258-1426-7

Irit Eguavoen
The Political Ecology of Household Water in Northern Ghana
Vol. 10, 2008, 328 p., 34.90 EUR, br. ISBN 978-3-8258-1613-1

Charlotte van der Schaaf
Institutional Change and Irrigation Management in Burkina Faso. Flowing Structures and Concrete Struggles
Vol. 11, 2009, 344 p., 34.90 EUR, br. ISBN 978-3-8258-1624-7

Nayeem Sultana
The Bangladeshi Diaspora in Peninsular Malaysia. Organizational Structure, Survival Strategies and Networks
Vol. 12, 2009, 368 p., 34.90 EUR, br. ISBN 978-3-8258-1629-2

Peter P. Mollinga, Anjali Bhat, Saravanan V.S. (Eds.)
When Policy Meets Reality. Political Dynamics and the Practice of Integration in Water Resources Management Reform
Vol. 13, 216 p., 29.90 EUR, br., ISBN 978-3-643-10672-8

Irit Eguavoen, Wolfram Laube (Eds.)
Negotiating Local Governance. Natural Resources Management at the Interface of Communities and the State
Vol. 14, 248 p., 29.90 EUR, br., ISBN 978-3-643-10673-5

William Tsuma
Gold Mining in Ghana. Actors, Alliances and Power
Vol. 15, 2010, 256 p., 29.90 EUR, br., ISBN 978-3-643-10811-1

Thim Ly
Planning the Lower Mekong Basin: Social Intervention in the Se San River
Vol. 16, 2010, 240 p., 29.90 EUR, br., ISBN 978-3-643-10834-0

Tatjana Bauer
The Challenge of Knowledge Sharing - Practices of the Vietnamese Science Community in Ho Chi Minh City and the Mekong Delta
Vol. 17, 2011, 304 p., 29.90 EUR, br., ISBN 978-3-643-90121-7

Pham Cong Huu
Floods and Farmers - Politics, Economics and Environmental Impacts of Dyke Construction in the Mekong Delta / Vietnam
Vol. 18, 2012, 200 p., 29.90 EUR, br., ISBN 978-3-643-90167-5