

**VINVAL**

FU 5<sup>th</sup> Framework INCO2 funded research project. contract no.: ICA4-CT-2001-10047



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**Agricultural and natural  
production systems in the  
eastern region of  
Burkina Faso  
A Rapid Diagnostic Appraisal  
in three inland valleys**

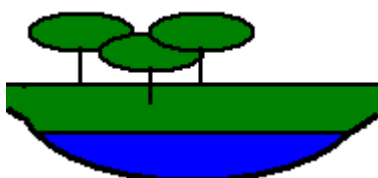
**J. van den Berg**

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**Working Paper 2003-02**

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# Impact of changing land cover on the production and ecological functions of vegetation in inland valleys in West Africa

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Due to several reasons, food shortage problems are a major issue in sub-Saharan Africa. In attempts to solve the shortages considerable effort has been devoted to strategies for increasing agricultural production. This is being achieved by an expansion of cultivated area, as well as by higher productivity per unit. The need for new agricultural land has been a strong argument for the extensive clearing of natural vegetation. This has resulted in widespread environmental degradation. As this is now resulting in serious constraints to sustainable development, there is clearly a need to develop an integrated approach towards land use planning involving and balancing both agricultural production objectives and environmental concerns.

## **Overall Objective:**

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The overall objective of the project is to develop a tool for integrated land use planning at watershed scale that contributes to improve sustainable agricultural production systems in inland valleys in West Africa. Inland valleys are the upstream areas of drainage systems. This tool will take into account the balance between production and protection objectives and will assist in making informed decisions on allocating land use activities of small holder farmers across the watershed on both agricultural and natural land. Natural land is here defined as all land that is covered by natural and fallow vegetation. Such decisions are based on knowledge of the productive value of these land use activities and their impact on ecological functions.

## **Specific Objectives:**

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- Quantify the production, regulation (water, sediment and nutrient flows) and biodiversity functions of natural and agricultural ecosystems at farm and watershed scale in three inland valleys in Ghana and Burkina Faso with distinct different land use intensities.
- Assess the economic importance of the tradeoffs and complementarities between natural and agricultural ecosystems and the different functions they provide.
- Develop a GIS-based tool for integrated, multifunctional watershed-level land use planning for use by extension services and planners. This tool will support the analysis of the impact of different land use development scenarios on the ecological and

production functions. The tool can be used in the decision-making process of land development.

### **Duration**

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This project will run from 2001 until 2005.

### **Location**

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The project will work in selected inland valleys of West Africa, where land cover ranges from almost natural to intensive agricultural production. The selected inland valleys are located in Ghana (Ashanti Region) and Burkina Faso (Kompienga).

### **The Participants**

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The project outputs are organised in the following report series:

- **WP = Working Paper**

In these reports the most important results of the project activities are presented. These reports have the status of working papers of which some will be published in scientific journals.

- **MR = Mission reports**

These reports present the activities undertaken during missions of the European project partners to China and Vietnam.

- **PM = Project Management reports**

These reports contain information about two important issues, the progress of the VINVAL project and accounts of the official project workshops.



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## **ABSTRACT**

This report presents the results of a Rapid Diagnostic Appraisal (RDA) on agricultural and natural production systems in three inland valleys in the eastern region of Burkina Faso. The RDA was carried out within the framework of the VINVAL project that aims to develop a tool for integrated land use planning at watershed scale that contributes to an improvement of sustainable agricultural production systems in inland valleys in West Africa. The RDA aims to identify main research issues to be included in the programmed two-years socio-economic monitoring survey.

The report starts with an outline of the work plan of the RDA and tools used. In addition, the study area and research sites are presented.

The second chapter deals with the population living in the three research sites and the organisation of their villages and economic activities. Firstly, the chapter describes some of their characteristics in terms of their size, ethnic composition, organisation and market access. Secondly, different types of economic activities are presented. In particular, attention is paid to gender and wealth differences.

The third chapter starts with a section on the history of current land occupation by the village communities. Secondly, after a short presentation of main land-use types, the main characteristics of customary tenure of land and non-timber forest products (NTFP) species are described.

The fourth chapter presents the findings on agricultural production. Attention is paid respectively to: different field types; the organisation of agricultural work; the main crops; the agricultural calendar; and marketing of crops.

The fifth chapter presents the findings on the exploitation and management of NTFPs. Firstly, an idea is given on the diversity of NTFPs and their social-cultural value. Secondly, results are presented on the commercialisation of NTFPs. Finally, information is given on sources of exploitation, availability and management techniques of eight NTFP species.

The sixth and final chapter presents the conclusions and the main research issues for further research.



# 1 INTRODUCTION

This report presents the results of a Rapid Diagnostic Appraisal (RDA) on agricultural and natural production systems that was carried out in August 2002 in selected inland valleys in the eastern region of Burkina Faso. The RDA was carried out within the framework of the VINVAL project that aims to develop a tool for integrated land use planning at watershed scale that contributes to an improvement of sustainable agricultural production systems in inland valleys in West Africa. The VINVAL project is executed in both Ghana and Burkina Faso.

The objective of the RDA was to identify the main research issues to be included in the programmed two-years socio-economic monitoring survey of the VINVAL project in Burkina Faso. This survey aims to collect socio-economic data at household level and to quantify agricultural and natural production systems. The RDA follows-up an exploratory Participatory Rapid Appraisal that was carried out in June 2002 in the selected research sites. The set of basic social economic data that resulted of this appraisal was used to set the terms of the RDA. The RDA was carried out in the same villages as the exploratory appraisal and intended to get a better understanding of its main findings.

In view of the socio-economic dimension of sustainable land-use the RDA focused on the following research themes:

- Social organisation
- Mode of subsistence and distribution of wealth
- Land-utilisation types
- Land tenure and rights to forest products
- Agricultural production
- Non-timber forest product

These issues will be dealt with in Chapter 2 to Chapter 5. In chapter 6 the conclusions of the report are presented. The conclusions are grouped around main issues to be included in the socio-economic monitoring survey.

## 1.1 Work plan of the RDA and methodology

The RDA was done in August 2002. Four social scientists and an ecologist participated in the RDA team. Three were engaged in the exploratory appraisal that was mentioned above. The research team established the RDA planning in two preparatory meetings. In figure 1.1 an overview is given of the work plan and tools used in RDA in the village of Sambouali. In the other research villages the same schedule was used. The RDA research team divided into subgroups that worked on different themes at the same time. These groups were formed according to the expertise of the individual researchers and command of local languages. Checklists for non-structured interviews with small groups and key informants were prepared in evening team meetings, during which the RDA process and preliminary results were also discussed.

A general meeting was organised, in all research villages, to introduce the VINVAL project and the objectives and activities of the RDA to the population, before starting any RDA activity. On the third day of the RDA in each research village, the population was invited to

join a feedback meeting, during w preliminary results were discussed and local needs and opportunities prioritised.

Figure 1 Work plan and tools used in the RDA in the village of Sambouali

Day	Group	Theme	Tools
Day 1	1	Social organisation	Social mapping Semi-structured interviews Non-structured interviews
	1	Mode of subsistence	Matrix ranking Non-structured interviews
Day 2	1	Wealth differences	Wealth ranking by cards
	2	Land utilisation types	Transect walk Non-structured interviews
	2	Land tenure and rights to forest products	Transect walk Semi-structured interviews Non-structured interviews Histories of individual fields & NTFP resources
Day 3	1	Agricultural production	Matrix ranking Non-structured interviews
	2	Non timber forest products	Matrix ranking Non-structured interviews
	1&2	Feedback meeting with villagers	Group discussion

Burkina Faso, situated between latitudes 10° and 15° N, is surrounded on the north and west by Mali, on the east by Niger, and on the south by Benin, Togo, Ghana and Ivory Coast. The country gained independence in 1960 as Upper Volta, and is today one of the world's poorest countries in terms of its GNP per capita US \$250. The three selected inland valleys are located in the southern part of the eastern region of Burkina Faso and administratively belong to the Gourma province. The southern part of this region falls in the Sudano-Sahelian ecological zone with a rainfall around 1 000 mm. There is a single rainy season from May-June until September. Savannah woodlands are the dominant vegetation type in the area. Typical tree species are the shea tree (*Butyrospermum parkii*), the locust tree (*Parkia biglobosa*), the BBB (*Andansonia digitata*), the mahogany tree (*Khaya senegalensis*) and various acacia species.<sup>1</sup>

The main ethnic groups represented in the area are the Gourmantché, Yamaa, Mossi and Fulbe. The eastern region is the traditional territory of the Gourmantché ethnic group, and until today the Gourmantché form the largest group in the area. Mossi from the Central

<sup>1</sup> Maccucato and Niemeijer, 2000:71

Plateau and Fulbe from the Sahel have joined them mainly through in-migration. Their in-migration speeded up when drought struck the country in the mid 1980s. In their customs and language the Yaama are more closely related to the Mossi than to the Gourmantché.<sup>2</sup> Agriculture is the main means of subsistence of the Gourmantché, Yamaa and Mossi, whereas Fulbe are agro-pastoralist. The Fulbe form the smallest minority.

## **1.2 Selected inland valleys<sup>3</sup>**

Three inland valleys were selected in such way that they cover the gradient of low, medium and high land use intensity (see Figure 1.2). The site with low land use intensity is Sambouali (see plate I). The valley bottom is mainly used for fishing, hunting and collection of forest products and has never been exploited for agricultural purposes. The site belongs partly to the nature reserve *Réserve partielle de Pama*. The Diamanga/Tanyelle site is characterised by moderate land use intensity (see plate II). The valley is exploited for the production of rice and maize, and because of declining rainfall in recent years for millet production also. The site with highland use intensity is Bounou, which mainly consist of old fallow lands (see plate III). The selected inland valleys belong according to customary right to four different village communities.

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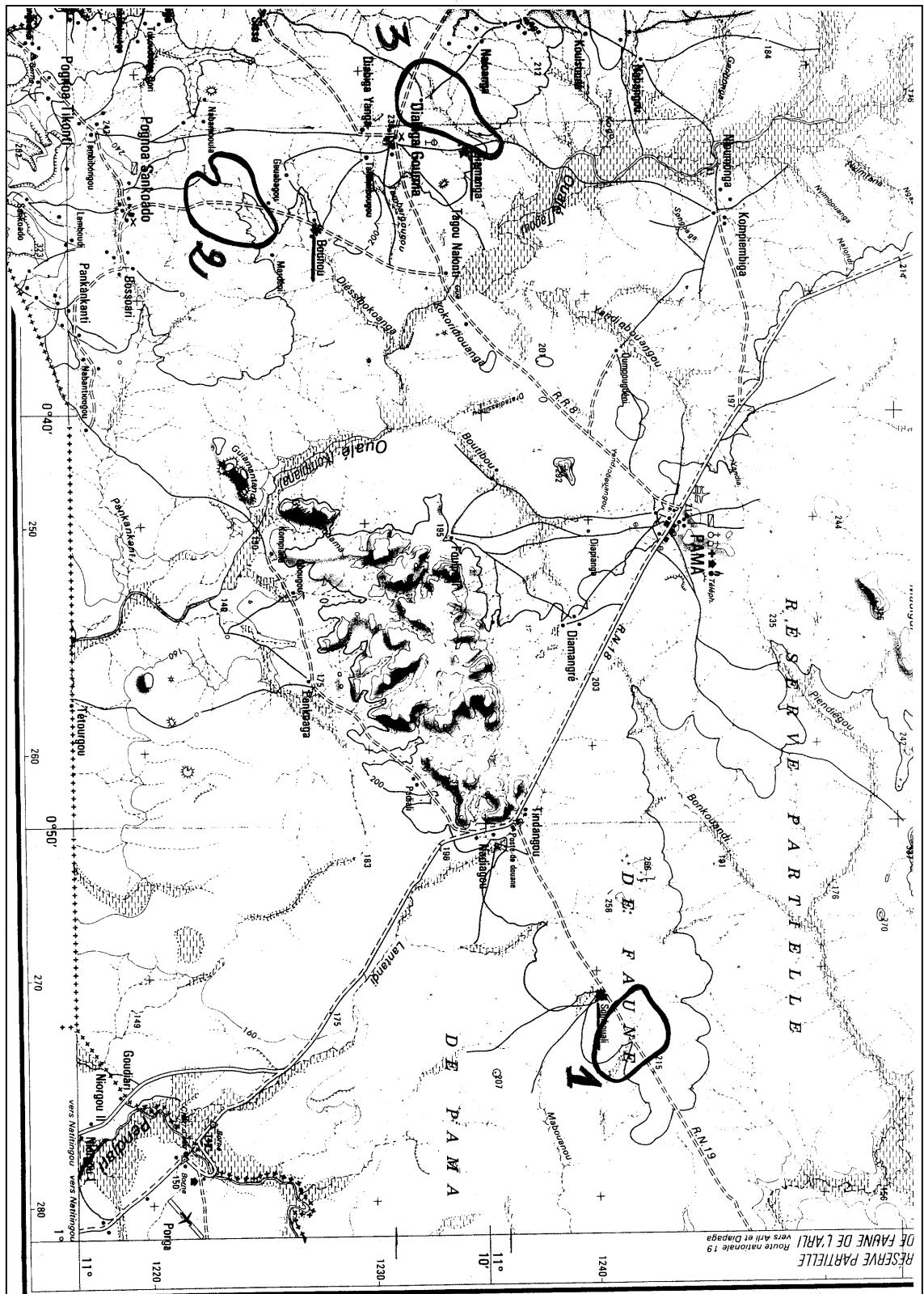
<sup>2</sup> Ibid, 2000:72

<sup>3</sup> The selected inland valleys are named after the village communities to which the valleys belong according to customary right.

Figure 2 Study area and research sites







- 1** Sambouali
- 2** Bounou
- 3** Diamanga/Tanyelle

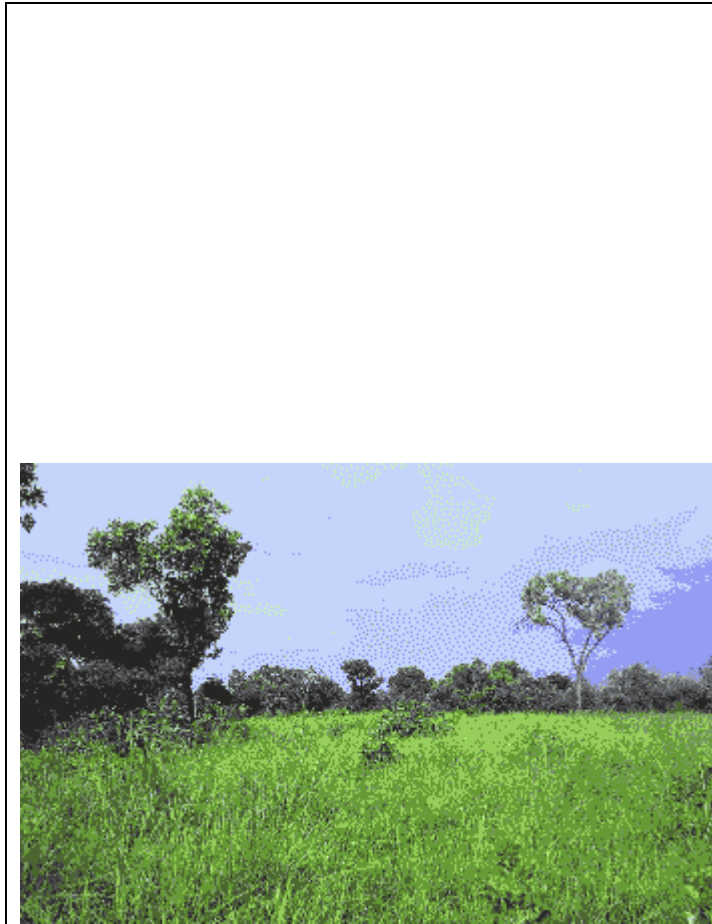


Plate I Sambouali valley bottom





Plate II Diamanga/Tanyelle valley bottom

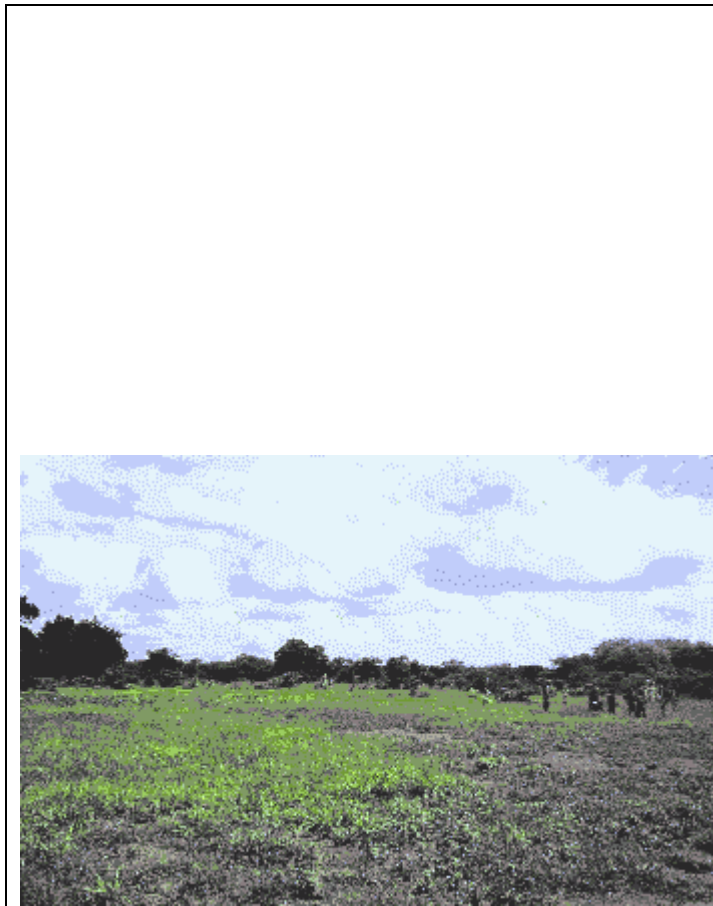


Plate III Bounou valley bottom

## **2 POPULATION, SOCIAL ORGANISATION AND ECONOMIC ACTIVITIES<sup>4</sup>**

### **2.1 Population figures and ethnic composition of the research villages**

In the villages Sambouali, Diamanga and Bounou residents who belong to the Gourmantché ethnic group are the ones who have been present in the area for the longest. In contrast, in Tanyelle the Yamaa were the first inhabitants. Mossi from the Central Plateau and Fulbe from the Sahel have joined the Gourmantché and Yamaa. In addition to these groups, there are smaller numbers of (recent) immigrants originating from neighbouring countries (i.e. Togo and Niger).

Sambouali with 330 inhabitants is the smallest research village. Gourmantché and Mossi farmers living in distinct village quarters inhabit the village.<sup>5</sup>

Gourmantché, Mossi and Fulbe inhabit Diamanga. The Gourmantché are the majority group and live together with some Mossi in the only and central quarter of the village. The Fulbe families live together at the Northeast border of this quarter.<sup>6</sup> The village comprises also a fishing camp that is inhabited by in-migrants from other parts of Burkina-Faso and immigrants from Mali, Niger and Togo.

Tanyelle is mainly inhabited by Yamaa and Gourmantché farmers, with one compound of Fulbe agro-pastoralists at the Northwest village border and one compound of a Gourmantché farmer from Togo.<sup>7</sup> Village residents said that recently a considerable number of Mossi farmers have settled in the village in search for agricultural land. Most of them come from neighbouring villages. The Yamaa and Gourmantché live in the same quarter of the village and equally account for fourteen households.

Bounou is much larger than the other three research villages with more than seven hundred inhabitants, whilst the size of the other villages is about 330 –366 inhabitants. In Bounou there are three ethnic groups present: Gourmantché, Mossi and Fulbe. There is also one household of a Bobo farmer (see village map Bounou in Annex 1). The village comprises of four quarters with inhabitants of different ethnic groups amongst which the fishing camp *Palpougouni* near the barrage of lake Kompienga. There are two other quarters in the village which are inhabited by one ethnic group only: Gourmantché (*Yensiga*) and Fulbe.

### **2.2 Social and economic infrastructure**

Tanyelle is the most isolated village compared to the other three research villages, particularly during the wet season. Paths link the village to dirt roads towards neighbouring villages. The asphalted road towards the nearest city Kompienga is about 6 km away. The one and only hand-operated pump in this village does not work. Bounou is

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<sup>4</sup> Participatory mapping and additional interviews were used to collect data on village characteristics. The tools of matrix ranking and wealth ranking were used respectively to identify and rank different economic activities and wealth differences among village residents.

<sup>5</sup> See for details social map Sambouali in Appendix I.

<sup>6</sup> See for details social map Diamanga in Appendix I.

<sup>7</sup> See for details social map Tanyelle in Appendix I.

located near the asphalted road to Kompienga. In this village there is one well and two hand-operated pumps. Residents from the neighbouring villages Diabinga and Pognoa-Sankoado come here to collect drinking water. In Diamanga, there are two hand-operated pumps that are located in the central village quarter and the fishing camp. There is also a fish weighing-house where catch is sold to one (and the same) buyer coming from the city of Ouagadougou. Sambouali is located alongside a dirt road that links the village to the asphalted road 10 km away connecting Tindangou with Pama. In the village, there is one hand-operated pump near the compound of the village chief. Mossi in-migrants, however, are not allowed to collect drinking water. Residents of all research villages consider that their water needs are not adequately met, particularly drinking water.

Table 1 Socio-economic characteristics of the four research villages

	<b>Sambouali</b> (low land use intensity)	<b>Diamanga</b> (moderate land use intensity)	<b>Tanyelle</b> (moderate land use intensity)	<b>Bounou</b> (high land use intensity)
Total population	330	350	366	706
Ethnic groups	Gourmantché and Mossi	Gourmantché, Mossi and Fulbe	Yamaa, Gourmantché, Mossi and Fulbe	Gourmantché, Mossi, Fulbe and Bobo
Number of quarters ( <i>quartiers</i> Fr.)	1	1 and a fishing camp	1 and a Fulbe camp	5 and a fishing camp
Accessibility	Good	Good	Moderate	Good
Distance to town market	10 km to Tindangou and 36 km to Pama	25 km to Kompienga and 25 km to Pama	1 km to Diabiga, 25 km to Kompienga and 60 km to Pama	19 km to Kompienga and 54 km to Pama

In all research villages there is no social infrastructure (i.e. schools or health centres), and their residents depend on facilities that are located in the neighbouring villages. For the residents of Sambouali the nearest health centre is located in Tindangou, about 10 km away. In this village also schools are located. Children living in Tanyelle, Bounou and Diamanga visit schools in Diabiga (2-4 km away). Here are also literacy courses organised throughout the year. In Bounou there is a satellite school that is used by a very restricted group of children only. The nearest market for residents of Sambouali is located in Tindangou. The other three research villages profit from the small regular market in Pognoa-Sankoado (2-4 km away). The nearest larger markets for all research villages are located in Kompienga and Pama at considerable distance from these villages.

### 2.3 Organisation of the villages

Diamanga and Bounou are divided into quarters, shown in Table 2.1. Sambouali and Tanyelle consist of one quarter only, but Tanyelle comprises a Fulbe camp also.

Quarters are inhabited by particular families that among native villagers and long established village residents accommodate the members of a particular descent group together with those people attached to it through marriage. Within each quarter there are one or more residential compounds, accommodating those relatives who share the

control of a single family head. Each residential compound consists of several households, among which nuclear families and those of (old) widows. Newly established immigrants often live in separate small residential units that consist of a nuclear family or one or more men, either related through kinship or not.

Authority over Sambouali, Diamanga and Tanyelle is vested in village chiefs, who act as land chiefs also (see 3.1). In Bounou, the administrative delegate (*délégué administratif* Fr.) performs the role of village chief. Tanyelle is the only village that is not an official administrative unit. A council comprised of the elders of the major native descent groups supports the village chiefs. Most disputes among village residents, whether belonging to the same village or not, are settled by local institutions, i.e. family meeting and village court. Mossi immigrants and Fulbe agro-pastoralists are allowed to participate in village meetings and village courts. The balance of power between the native village leaders and immigrants remained, however, unclear.

A newly arrived immigrant is expected to place himself under the protection and representation of an established member of the village community, who is either a native village resident or an immigrant (either a kin or not) who already is established in the village community.

## **2.4 Economic activities**

In Appendix II the results of the matrix ranking exercises are presented that were carried out to evaluate economic activities that are explored in the research villages. Below these activities are discussed in terms of their contribution to cash income. Particular attention is paid to gender and ethnic differences.

### **2.4.1 Agriculture**

In all villages, agriculture is valued as the most important economic activity by both men and women regardless of their ethnic background. A lot of energy is invested in agricultural activities, it provides for food crops and for monetary income for both men and women. Hence, land is a crucial resource. The main crops grown in the research villages are: millet, maize, sorghum (red and white), groundnuts, cowpea and to a lesser extent rice and soya. Cow peas and groundnuts are mainly produced for the market and represent a very important source of revenue for both men and women. Other crops are produced for both the market and home consumption. In Tanyelle, the production of watermelon is a very important income generating activity for both Gourmantché and Yamaa male farmers. In Diamanga, the production of calabash and to a lesser extent that of cassava is highly valued for their contribution to cash income by men. In the village of Bounou, two Mossi men are involved in irrigated vegetable growing. According to them there are considerable fluctuations in incomes from this activity.

### **2.4.2 Cotton**

The production of cotton is carried out in Sambouali only, where Mossi migrants introduced it recently. Here, this activity highly contributes to the incomes of producers. Villagers also value cotton for social-cultural reasons also: large production contributes to the social status of producers and locally woven cotton tissues are used in burial rites. Main production constraints cited by villagers are: limited means to purchase inputs such as seeds, fertilisers and pesticides, and labour shortages.

### **2.4.3 Livestock**

Cattle is a man's responsibility among farmers and is a very important source of revenue for male residents of the research villages, except for men living in Sambouali. In Bounou for Mossi farmers, livestock is the most important income generating activity, whereas for Gourmantché farmers agricultural and livestock activities were equally valued. Mossi farmers value cattle for medicinal purposes also, in contrast to Gourmantché farmers. Apart from cattle, sheep, goats, horses, donkeys and poultry are kept. Women mainly derive income from small rudiments. In Sambouali, a group of women is involved in pork breeding for market purposes.

### **2.4.4 Fishing**

Fishing in lake Kompienga is an important income raising activity in Diamanga and Bounou. In the latter village only young Gourmantché residents are involved in this activity. One trader with a two tons container truck from Ouagadougou monopolises the commercialisation of fish. He buys fish for a fixed, and according to villagers low, price of 400 CFA per kg. Villagers say that although there is still a great variety of fish species in the lake Kompienga, their availability is diminishing. After the creation of the dam, a governmental agency supported fishery development in the area by planting fry, but this was stopped after a few years.

### **2.4.5 Forest products**

For women in all research villages, selling of products of the Shea tree and the African locust bean represent an important source of monetary income (see 5.1 for detailed information). Male residents of Sambouali and Tanyelle earn money by selling timber from the *Borassus sp.* (*Ronier Fr.*).

## **2.5 Other economic activities**

There are few economic activities outside the trade of agricultural (including livestock) and forest produce and fish. For women in particular, petty trade is an important source of income. They prepare foods, process forest products and brew beer (from red sorghum) to sell in the villages and on local markets. Both women and men sell tobacco. Men are also engaged in commerce.



### 3 Wealth differences

During the wealth ranking exercises, farmers (regardless of their ethnic origin or gender) mentioned the same type of criteria to distinguish between rich and poor households. The two most important criteria according to the participants are: food self-sufficiency and the number of livestock, in particular cattle. Farm inputs such as pesticides and fertilisers and farming assets such as a plough, cart or draught animals result in higher outputs in farming, more food and increased money income from selling surplus produce. Farmers said that due to declining rainfall in the past years, it has become more difficult to produce enough food to sustain their families. They need to cultivate larger areas to do so.

For Gourmantché and Yamaa farmers, labour availability is an important secondary indicator for economic well being, whereas for Mossi farmers it is access to land. Several material indicators were also mentioned: a moped, television and corrugated iron roofs.

Table 2 Wealth classes in the research villages (in % of number of households)

Wealth classes	Sambouali N= 59	Diamanga N= 57	Tanyelle N= 27	Bounou N= 125
Poor	46 %	32 %	37 %	58 %
Average	38 %	51 %	41 %	25 %
Well-off	13 %	-	-	-
Rich	3 %	17 %	22 %	17 %

Poor households are often those of handicapped villagers and widows. In Bounou and Sambouali recently settled Mossi immigrants (often contract labourers) and households comprising many young children were also classified as being poor. In general, these households do not produce enough food to be self-sufficient. They also do not have money to buy or rent agricultural assets or agricultural inputs. Furthermore, they do not have any livestock.

Rich and well-off farmers own livestock, in particular cattle, and agricultural assets and buy agricultural inputs. Participating women mentioned the presence of children at a working age and migrated family members as additional indicators for wealth. Rich and well-off family heads are, as a result of their economic well being able to keep themselves and their family members in good health.

## **4 TENURE OF LAND AND OTHER NATURAL RESOURCES**

### **4.1 The occupation of village lands<sup>8</sup>**

#### **4.1.1 Tanyelle**

Around the end of the nineteenth century a Yamaa farmer named Laladaogo coming from the neighbouring village Diabiga 2 km away, installed himself in the area in search of good agricultural land. Soon after his installation a number of Yamaa farmers belonging to the family Kiemkodogo joined him. Till today people belonging to this family are considered by fellow villagers and residents of neighbouring villages as the natives of the village, and are regarded as the lawful owners of the village and the lands that surround it. The Mossi families Sawadogo and Salambabga and the Gourmantché family Thiombiano came to settle in first years after the creation of the village. The other inhabitants of Tanyelle installed themselves only recently.

#### **4.1.2 Bounou**

Bounou is created in the beginning of the twentieth century by a Gourmantché farmer named Dahani Kondja who came from the near by located village Diabiga. About six years after his installation a number of his brothers and Gourmantché farmers belonging to other families (Onadja, Odjou and Tankoano) joined him. Till today, these four families are regarded as the lawful owners of the village lands. In the beginning of the nineteen thirties farmers belonging to a Yamaa family settled, but are no longer present nowadays. The first Fulbe agro-pastoralist joined the village in the end of the fifties, whilst the Mossi inhabitants and immigrants from neighbouring countries have to come to settle recently. Initially the village was located alongside the river Kompienga. After the creation of the large dam, the village was re-located at its actual site.

### **4.2 Diamanga**

A Gourmantché named Yemmiama who originated from the city Fada N'Gourma founded Diamanga in the end of the nineteenth century. Initially Yemimiamia settled on the nearby hill Diamanpelgo, where people belonging to the Gourmantché families Thiombiano, Tadano and Koadima joined him. In the beginning of the twentieth century, after a tribal war period, the village was relocated to its actual site. The first inhabitants of the village are still regarded as the lawful owners of the village lands. In the course of time other Gourmantché farmers and Mossi farmers settled in the village, as well as Fulbe agro-pastoralists. Today Diamanga still receive migrants and immigrants from neighbouring countries.

### **4.3 Sambouali**

The first inhabitants of Sambouali belonged to the Gourmantché family Onadja. Their descendants are regarded, until today, as the lawful owners of the village lands. The founder of the village named Bilempo had left the near by village of Tindangou in search

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<sup>8</sup> The data presented here are mainly based on the Participatory Rapid Appraisal organized in July 2002.

of good agricultural land. It is not clear when the first Mossi farmers have settled in the village area. A considerable part of fertile agricultural lands and other natural resources belonging to Sambouali, among which parts of the valley bottom, form a part of the Wildlife Reserve of Pama.<sup>9</sup> Village residents have strong feelings of anger about this situation, because they are not allowed to cultivate their fields, to hunt, fish or collect forest products within the borders of the park. In fact, their customary rights seem to be absorbed into the national reserve. There are hardly any extension efforts to inform the villagers on the management purposes of the reserve, let alone the active involvement of villagers in actual management activities, except of the very few occasions that men are hired as guides. Also, there is hardly any (financial) compensation for the loss of their customary rights in the reserve, although villagers have the right to share the meat of animals that are killed for management purposes. In reality, this is very rarely realised.

#### **4.4 Land use types**

According to vegetation characteristics, three land use types can be distinguished: bush land, long-term non-cultivated land and fields and fallow land. Bush land consists of bush savannahs and savannah woodlands that differ in terms of tree densities. Savannah woodlands are more forested than bush savannahs. The latter vegetation type is dominant in all research villages and is also found on long-term non-cultivated land. Bush land has never been cleared for agricultural purposes and is mainly used by villagers to herd their livestock, collect firewood, harvest medicinal and wild food products and to cut construction wood. The occurrence of large game is very uncommon in the area (except for the protected areas) and villagers only hunt small wildlife, either on bush land or elsewhere on the village lands. In the past, though, hunting, was an important activity. The Gourmantché were renowned hunters working with wildlife traps, bows and arrows and later also with guns.<sup>10</sup> In Diamanga and Bounou, villagers said that there is no bush land left that belongs to their respective village. Fallow land, either young or old fallow, is fringed by fallow vegetation in different stages of growth. These lands are also a source for NTFP, energy and fodder. In the area, several economically useful NTFP species are integrated in the cropping system (see 5.2 for details).

#### **4.5 Land tenure and tenure of NTFP species**

In the four research villages, allocation of land rights is based on the principle of *primi occupanis*. The first person(s) to develop land resources establishes rights in that land, including use, management and transmissibility. These rights also concern land left in fallow. All land is inherited from father to son and daughters are excluded from any land inheritance. Widows, however, can hold land in trust for their sons.

The lineage or family head holds collective rights for his kin and other family members over the fields and fallow lands that were inherited from previous generations. The family head, together with the elders, distribute these lands among the households belonging to his family. In daily practice, these households are the significant units in managing these lands. The family head also controls access to valuable NTFP species found on the family lands, except for land under cultivation.

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<sup>9</sup> *Réserve Partielle de Pama*.

<sup>10</sup> Mazzucato and Niemeijer, 2000:72

The village chief or land chief, belonging in all research villages (except of Bounou) to one of the indigenous families of the village, is responsible for the management of bush lands that belong to the village. Village boundaries are generally not well defined. Villagers said that describing boundaries will generate misfortune, and in fact is regarded as a taboo. The village chief is also engaged in with land loans between different families, as at least he must be informed about this type of land transaction. Furthermore, immigrants gain access to land by intervention of village chiefs. Village chiefs either allot directly a plot of bush land to an immigrant or give them information about where to ask for land. In general, the villages are interested to host immigrants in order to enlarge the village population and to learn about new cropping methods. It is not clear whether land may be taken back from immigrants if a landholder has a need for it or bequeaths it to his heirs.

Immigrants do not pay native villagers to get access to agricultural land. In the area land still does not have monetary value, although villagers said that in Kompienga and surrounding villages land is sold. There are, however, social obligations for the land lenders; participation in funerals, baptism, marriage etc. There is also a ban on investments to borrowed land, such as for instance the planting of trees, without authority of the landholder. Furthermore, land lenders are not allowed to harvest shea nuts or exploit other economic important trees without permission of the landowner. These restrictions also apply to native villagers with a land loan.

Tenure in NTFP resources is primarily shaped by land tenure arrangements. In all research villages, holders of customary land titles, either groups (i.e. extended family, households) or individuals are also the owner(s) of the NTFP resources located on their land. In all research villages, secondary user rights to NTFP resources limit land right holders. The distribution of secondary user rights differs between the research villages and varies according to land types. Table 3.1 presents the distribution of property rights for three economic NTFP species: Shea tree (*Vitellaria paradoxa*), African locust bean (*Parkia biglobosa*) and *Ronier* (Fr.) (*Borassus sp.*).

In Sambouali and Tanyelle, both village residents and the inhabitants of neighbouring villages exploit NTFP species that occur on bush lands, which are believed to belong to the villages. Villagers in Tanyelle said that rights of village residents prevail over those of neighbouring villagers.

Compound heads<sup>11</sup> manage the economically valuable trees that occur on inherited land that is not cultivated for a long time. Villagers in Sambouali and Tanyelle said that in daily practice, the women who belong to a compound supervise the harvesting of shea nuts and allocate the produce among compound members. Compound heads and the family elders are always allotted a part of the shea nut yield.

The distribution of user rights to Shea tree and African locust bean found on long-term uncultivated land differ among the research villages. In Bounou and Diamanga, all village residents are entitled to harvest shea nuts and seeds of the African locust bean (either for home consumption or market purposes), whereas in Bounou also people belonging to neighbouring villages have these user rights. The same arrangements are true for the village of Sambouali, except that the right to harvest for the market is reserved for landholders. In Tanyelle only members of the lineage or lineage segment to which the land

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<sup>11</sup> Compounds usually consist of several households, among which nuclear families and those of (old) widows.

belongs are allowed to harvest seeds of the African locust bean, whereas shea nuts may also be harvested by people belonging to neighbouring villages, but for home consumption only.

In general, landholders manage NTFP resources found on their fields and fallow land. Villagers in Bounou said that the wife or wives of the landholder supervise the harvesting of the seeds of the African locust bean. In Sambouali and Bounou all village residents are allowed to harvest shea nuts and seeds of the African locust bean for home consumption. However, harvesting for the market is reserved for the landholder, his wife/wives and children.

In all research villages, the decision to fell an exemplar of *Borassus sp.*, either for personal use or for the market, and regardless of the land use type on which it grows, is always taken by men and always at the level of the compound.

Table 3 Distribution of property rights for three economic NTFP species: Shea tree, African locust bean and Ronier (Fr.)

	<b>Sambouali</b>	<b>Diamanga</b>	<b>Tanyelle</b>	<b>Bounou</b>
<b>Bush land</b>				
Rights to manage <sup>1</sup>	Village chief and lineage heads		Village chief (=land chief) and lineage heads	
Rights to use <sup>2</sup>	Village residents Residents of neighbouring villages		Village residents have priority access Residents of neighbouring villages (for home consumption only)	
<b>Long term uncultivated land (&gt;15 years)</b>				
Rights to manage	Compound heads, except for Shea tree that are managed by compound's women	Village chief	Compound heads, except for Shea tree that are managed by the compound's women	Responsible Administratif Villageois (administrative delegate)
Rights to use	Village residents and residents of neighbouring villages (for home consumption only) Land holder for market purposes	Village residents	Family members Residents of neighbouring villages are allowed to harvest shea nuts.	Village residents and residents of neighbouring villages
<b>Agricultural fields and fallow land</b>				
Rights to manage	Landholder	Landholder	Landholder	Landholder, except for African locust bean that are managed by the wife/wives of landholder
Rights to use	Village residents for home consumption, except for Ronier Landholder for market purposes	Landholder, his wife/wives and children	Landholder, his wife/wives and children	Village residents for home consumption, except for Ronier Land holder for market purposes

<sup>1</sup> Rights to manage refer to rights to regulate, supervise, represent in outside relations and to allocate property.

<sup>2</sup> Rights to use refer to rights to exploit NTFP resources

## 5 AGRICULTURAL PRODUCTION

To identify the main crops grown in the research villages and for what purposes, the technique of matrix-ranking was used in all research villages. In Appendix 2 and 3 the results of the ranking exercises are presented. Below, the main findings are described.

### 5.1 Field types and the organisation of agricultural work

Three main field types can be discerned. The compound fields immediately bordering the compound, the village fields lying in between those compound fields and the bush fields found at some distance from the village.<sup>12</sup> Bush fields are generally larger than the compound or village fields. Farmers said that this type of field is more fertile than village fields, except those village fields that were manured with kitchen refuse. The natural vegetation that is found on a field is a factor for farmers to judge the soil fertility and to know when to leave a field in fallow. An indicator mentioned by farmers is the occurrence *Ipomoea enocarpa*. In Sambouali, farmers said that the fields of Mossi immigrants are often larger than those of the Gourmantché because they are able to contract labourers.

It is a man's responsibility to feed his family. Married men have one or more fields where cereals are grown. Their wives and children are expected to work on these fields during the main part of the day. Women also work on personal fields that are generally much smaller than the fields of the household. Women said that it is difficult to find time to work on their own fields. Men may also have their own fields.

### 5.2 Crops

Cereals are the basic food products in all research villages. Millet, white sorghum and maize are the cereals most often consumed in Diamanga, Tanyelle and Bounou, whereas in Sambouali maize is the most popular one. Other major crops grown in the area are: cowpea, groundnuts, red sorghum, soya and sesame. Cowpea is often grown as an intercrop on millet and sorghum fields. Sesame is also a typical intercrop, often grown with groundnuts<sup>13</sup>. Cowpea and groundnuts, either raw or transformed in cooking oil or paste, are very popular in the research villages for cash generation, especially among women. Red sorghum is used for making local beer (*dolo*) and also represents a very important source of money income for women in all villages. Soya transformed in *soumbala* is a very popular sauce ingredient and commonly sold by women in the area.

Other crops grown in the research villages are vegetables such as okra, *vandzou* and *oseille* (Fr.) and tobacco. Women in the area commonly sell these crops at local markets.

Minor crops are rice, sweet potato, cassava, and cotton. Rice is typically grown in bottomlands.<sup>14</sup> Rice is little valued by farmers for its contribution to food, except of farmers living in Diamanga. Farmers mainly considered rice as food for well-off or rich people because its major complement is meat. In Diamanga, rice production is also an important cash generating activity. In Diamanga, especially men mainly grow sweet

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<sup>12</sup> Cf. Mazzucato and Niemeijer, 2000: 87

<sup>13</sup> Ibid, 2000:91.

<sup>14</sup> Ibid, 2000:91.

potato for the market. Cotton is grown in Sambouali only. Here, cotton growing was highly valued as a cash generating activity by both men and women.

### 5.3 Agricultural calendar

There is a single cropping season in the area in the period running from April until August. In this period men and women devote most of their labour time to the cultivation of the fields. Farmers said that the agricultural tasks of women have grown over the years because of declining rainfalls, and the subsequent necessity to cultivate larger fields in order to produce enough food.

In the end of March or the beginning of April farmers start to prepare their fields, which mainly consist of cleaning the field of crop residues that are left after the last harvest and clearing natural regrowth of trees and shrubs. The number and particular species that are spared vary according to the growing methods and food preferences of individual farmers. Some tree species, however, are locally protected throughout the area: Baobab (*Adansonia digitata*), Neré (*Parkia biglobosa*) and Karité (*Vitellaria paradoxa*) (see also 5.2). Mossi farmers seem to clear more trees and shrubs when preparing their fields compared to Gourmantché and Yamaa farmers.

Fields are mainly manured by livestock dung and kitchen refuse. In Bounou, farmers said to use fertiliser for maize production. Ploughing is practised in the area, but it seems that this is an exception rather than the rule. Farmers said that the investment in a plough with animal traction is too high for most of them. It was also said that working with a plough improves the survival of crops, in particular during dry spells, than cultivating by hand, which scratches only at the surface of the soil.

When the first rains have moistened the soil in May, farmers sow their fields first with cereals (i.e. millet, sorghum, maize and rice). Hereafter, other crops such as groundnuts, cowpea, soya and vegetables are sown. Tobacco is sown in August. As soon as the plants are impeded by the growth of weed the farmers start weeding. This is a very laborious part of the cropping cycle, especially when farmers are still occupied with sowing. Weeding is done with a hoe. When the first weeding cycle has finished, a second follows and sometimes a third.

If all goes well in August the first millet can be harvested, followed by maize and red sorghum in September. It seems that livestock that damage fields poses a problem in all research villages. The harvest period of the main crops lasts until December.

The availability of labour is an important determinant for crop production. It seems that farmers are not able to work all their land due to labour constraints. Rich or well-off farmers organise collective working parties<sup>15</sup> or contract labourers.

### 5.4 Marketing of crops

It is common in the area to sell surplus produce of cereals and cowpea at local markets or to traders coming from Kompienga, Fada Ngourma and Togo. However, farmers said that due to the droughts in recent years, they only produce enough food to feed their

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<sup>15</sup> These working parties are named *Papwogu* by the Gourmantché, *Pusoko* by the Yamaa and *Koposem* by the Mossi.



families. It was also said, that difficult market access mainly due to poor transportation infrastructure is an important constraint for agricultural development. Women commonly sell soya, raw or transformed in *soumbala* at local markets only. This is also the case for groundnuts, raw or transformed in cooking oil or paste.

## 6 EXPLOITATION AND MANAGEMENT OF NON-TIMBER FOREST PRODUCTS<sup>16</sup>

To identify the most valued non-timber forest product species among village residents and the way they rank these species (according to local criteria), the technique of matrix-ranking was used in all research villages.<sup>17</sup> Non-structured interviews were held to identify primary and secondary actors in harvesting, processing and marketing of locally most valued NTFP species. In Appendix IV the results of the ranking exercises are presented.

### 6.1 The diversity of non-timber forest products (NTFPs)

Participating villagers cited in total 24 NTFP species. Table 5.1 presents an overview of the types and intensities of NTFP exploitation and commercialisation in the four research villages. Below different forest products and their most important plant sources are presented.

#### 6.1.1 Food products

In all research villages Shea tree (*Vitellaria paradoxa*), African locust bean or Neré (Fr.) (*Parkia biglobosa*) and Baobab (*Adansonia digitata*) were highly valued as a source of food for people. Nuts of the Shea tree are used for the preparation of cooking fat (shea butter) and the pulp, that covers the seeds, is transformed in a juice. The fermented seeds of the African locust bean serve as a spice (*soumbala*) and the pulp is also transformed in a juice. The leaves of the Baobab are used in soups and sauces and as a vegetable. Its roots are cooked and eaten and its fruits are eaten as snacks. Important other tree species that produce edible fruits are *Lannea microcarpa* (*Raisinier*) and *Vitex doniana* and *Borassus sp.*(*Ronier*)

#### 6.1.2 Medicinal products

In all research villages the Violet tree (*Securidaca longipedunculata*) was highly valued as a source of medicines. Its leaves and roots are commonly used to treat ailments. In three villages (except of Sambouali) the *Khaya senegalensis* (leaves, bark and roots) was mentioned as very important species for medicinal purposes. The Shea tree (*Vitellaria paradoxa*) and African locust bean (*Parkia biglobosa*) were cited as an important source for medicines in Diamanga and Bounou. Other sources of medicines are *Adansonia digitata*, *Vitex doniana*, *Ziziphus mauritiana*, *Tamarindus indica* and *Strychnos icunocua*.

#### 6.1.3 Fodder

In Sambouali, the Violet tree (*Securidaca longipedunculata*), *Strychnos icunocua* and Baobab (*Adansonia digitata*) were cited as important sources of fodder for livestock. In Tanyelle, the Baobab is also used to feed domestic animals. It is not clear whether fodder is collected for livestock or that they are allowed to forage freely.

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<sup>16</sup> Wood used locally on a non-industrial base is considered a non-timber forest product.

<sup>17</sup> To elicit local criteria to evaluate the social-economic value of different NTFP species, for each NTFP species was asked "What is good about this NTFP species? And what is bad?".

### 6.1.4 Non-edible plant products

Wood is used for the construction of houses, manufacturing of furniture and household and agricultural equipment. For these purposes different species are used, among which the Shea tree (*Vitellaria paradoxa*), *Lonchocarpus laxiflorus*, *Diospyros mespiliformis*, *Terminalia avicnioides* and *Vitex domania*. In all research villages, *Borasuss sp.* (Ronier Fr.) is highly valued as a timber species. Mossi farmers for blacksmith activities use *Tamarindus indica*.

Wood also provides an important source of energy for the villagers. The favourite sources of fuel wood vary among the research villages, but the Shea tree (*Vitellaria paradoxa*) is highly valued in all research villages. It is not clear whether substitutes such as petrol are available and/or affordable in the villages.

### 6.2 Social-cultural value of NTFP species

NTFP species are also valued locally for their social-cultural value. For instance, wood of the Shea tree (*Vitellaria paradoxa*) and *Ficus sp.* is commonly used to close tombs. Other species with high social-cultural value are: African Locust Bean (*Parkia biglobosa*), the Baobab (*Adansonia digitata*), *Borasuss sp.*, *Scerocarya birrea* and *Diospyros mespiliformis*.

Table 4 Overview of the types and intensities of NTFP exploitation and commercialisation in the four research villages.

Species	Product	Sambouali		Diamanga		Tanyelle		Bounou	
		Expl.	Com.	Expl.	Com.	Expl.	Com.	Expl.	Com.
<i>Vitellaria paradoxa</i>	Nuts	++	++	++	++	+	+-	+	++
	Pulp	++	-	++	-	+	-	+	-
	Leaves	+-	-	++	-	+-	-	++	-
	Bark	+-	-	++	-	+-	-	++	-
	Roots	+-	-	++	-	+-	-	++	-
	Wood	+	n.a.	++	n.a.	++	n.a.	++	n.a.
	<i>Parkia biglobosa</i>	Seeds	++	++	++	++	++	+	++
Powder		++	-	++	-	++	-	++	-
Leaves		+-	-	++	-	+-	-	++	-
Bark		+-	-	++	-	+-	-	++	-
Roots		+-	-	++	-	+-	-	++	-
Wood		+-	n.a.	+-	n.a.	++	n.a.	+	n.a.
<i>Adansonia digitata</i>		Fruit	++	n.a.	++	n.a.	+	+-	++
	Leaves	++	+	++	++	++	-	++	+-
	Bark	+-	-	n.a.	-	++	-	+-	-
	Roots	+-	-	n.a.	-	++	-	+-	-
<i>Bombax costatum</i>	Flowers	++	+-	+	+-	n.a.	n.a.	+	+-
	Rubber	+-	-	n.a.	-	n.a.	-	+-	-
	Wood	-	-	+	n.a.	n.a.	n.a.	+-	n.a.

Species	Product	Sambouali		Diamanga		Tanyelle		Bounou	
		Expl.	Com.	Expl.	Com.	Expl.	Com.	Expl.	Com.
<i>Vitex doniana</i>	Fruit	++	+-	+	+-	+-	-	+	-
	Leaves	++	n.a	+	+-	+-	-	+	-
	Bark	+-	-	n.a	-	+-	-	+-	-
	Wood	+-	n.a	++	n.a	+-	n.a	++	n.a
<i>Annona senegalensis</i>	Flowers	+-	+-	+-	+-				
	Leaves	+	-	n.a	-				
	Roots	+	-	n.a	-				
	Wood	n.a	n.a	+-	-				
<i>Ziziphus Mauritania</i>	Fruit	+-	+-						
	Leaves	++	-						
	Roots	++	-						
<i>Tamarindus indica</i>	Fruit	+-	+-	+-	+	+-	+-	+	+
	Leaves	+-	n.a	n.a	-	+-	+-	++	-
	Bark	+-	-	n.a	-	+-	-	++	-
	Roots	+-	-	n.a	-	+-	-	++	-
	Wood	++ Mossi	n.a	+	n.a	++	n.a	++	n.a
<i>Lannea microcarpa</i>	Fruit	+-	+-	++	+-	+-	-	++	-
	Leaves	+	-	n.a	-	+-	-	+-	-
	Bark	+	-	n.a	-	+-	-	+-	-
	Wood	n.a	n.a	n.a	n.a	+-	-	+	n.a
<i>Securidaca longipedunculata</i>	Leaves	++	-	++	n.a	+	-	++	-
	Roots	++	-	++	n.a	+	-	++	-
	Wood	n.a	n.a	+	n.a	-	-	++	n.a
<i>Strychnos icunocua</i>	Fruit	+-	-	+-	+-				
	Leaves	++	-	+-	+-				
	Bark	++	-	n.a	-				
	Roots	++	-	n.a	-				
	Wood	+	n.a	+	n.a				
<i>Sclerocarya birrea</i>	Nuts			+-	-			+-	-
	Leaves			n.a	-			+-	-
	Wood			+	n.a			++	n.a
<i>Ceiba pentandra</i>	Fruit					+-	-		
	Leaves					+-	-		
	Bark					+-	-		
	Roots					+-	-		
	Wood					+-	n.a		
<i>Maerua crassifolia</i>	Leaves					+	-		
	Bark					+	-		
	Roots					+	-		
	Wood					++	n.a		
<i>Borassus sp.</i>	Fruit							++	++
	Sprouts							++	++
	Leaves							+-	++
	Roots							+-	-
	Wood							++	++

Species	Product	Sambouali		Diamanga		Tanyelle		Bounou	
		Expl.	Com.	Expl.	Com.	Expl.	Com.	Expl.	Com.
<i>Diospyros mespiliformis</i>	Fruits			+/-	-			+	-
	Leaves			n.a.	-			+/-	-
	Bark			n.a.	-			+/-	-
	Wood			++	n.a.			++	n.a.
<i>Khaya senegalensis</i>	Leaves			++	-	++	-	++	-
	Bark			++	-	++	-	++	-
	Roots			++	-	++	-	++	-
	Wood			+/-	-	+/-	n.a.	+/-	n.a.
<i>Ficus sp.</i>	Fruits			+/-	-	+/-	-	+/-	-
	Leaves			n.a.	-	+/-	-	+	-
	Bark			n.a.	-	+/-	-	+	-
	Wood			+/-	-	++	n.a.	+	n.a.
<i>Piliostigma sp.</i>	Fibre			++	+/-				
	Wood			+	-				
<i>Corchorus tridens</i>	Leaves	++	+/-						
<i>Gardenia erubescens</i>	Fruits			+	-				
	Wood			++	-				
<i>Terminalia avicenniorde s</i>	Wood			++	n.a.				
<i>Lonchocarpus laxiflorus</i>	Leaves					++	-		
	Wood					++	n.a.		
<i>Xomania Americana</i>	Fruits			+/-	+/-				
	Wood			++	-				

Intensity of commercialisation as a function of contribution to monetary income according to villagers. Intensity of exploitation as a function of contribution to food according to villagers.

- = not

+/- = rare

+

++ = often

n.a. = no data available

### 6.3 Commercialisation of NTFPs

In general, women are involved in the commercialisation of food products. Children and poor people to a very lesser extent sell fruit, such as for example those of *Lannea microcarpa* or Raisinier (Fr.), *Vitex doniana* and *Xemenia Americana* to fellow villagers and on local markets.

The nuts of the Shea tree (*Vitellaria paradoxa*), raw or transformed in butter or soap, are commonly sold on local markets in the area. The selling of products derived from the Shea tree represents a very important source of income for women, though an irregularly one because of its seasonal character. This is also the case for the seeds of the African locust bean (*Parkia biglobosa*), raw or transformed in *soumbala*. In Diamanga these products are also being sold to traders coming from the cities (e.g. Komienga and Pama), and from Togo, next to their commercialisation on local markets. Economically less important forest products commonly sold on local markets are: leaves of Baobab (fresh, dried or pounded) and fruit and leaves of *Tamarindus indica*. In some villages, such as Diamanga, the fruit and leaves of *Vitex doniana* and the flowers of *Annona*

*senegalensis* (a shrub) and *Bombax costatum* (Fr. *Kapokier*) are being sold as a sauce ingredient.

The timber derived of *Borassus sp.* (*Ronier* Fr.) is destined for the large markets in the cities and abroad (e.g. Niger). Its commercialisation is restricted to men who sell the timber to traders visiting the area. Fibres, such as derived from *Piliostigma sp.* (a shrub) is sold in very little amounts by old men.

#### **6.4 Sources of exploitation, availability and management techniques of eight NTFP species**

Eight locally valued NTFP species occur and are commonly exploited in the four research villages. An overview of their availability, sources of exploitation and management techniques is given in Table 5.2

##### **6.4.1 Sources of exploitation and availability**

Shea tree (*Vitellaria paradoxa*) and African locust bean (*Parkia biglobosa*) are very commonly found in all research villages. There, they are extracted from both natural and agricultural lands, whereas in Diamanga and Bounou they are exploited in the valley bottoms also. Also *Lannea micorcarpa* (*Raisinier* Fr.) and *Bombax costatum* (*Kapokier* Fr.) occur commonly in these villages, although to a slightly lesser extent compared to the first two named. *Lannea micorcarpa* (*Raisinier* Fr.) is found on both agricultural and natural lands. *Bombax costatum* occur mainly on natural lands, but in Diamanga, this species is also exploited on agricultural lands.

The availability and localisation of the following four NTFP species differ among the research villages: Baobab (*Adansonia digitata*); *Vitex doniana*; *Tamarindus indica*; and Violet tree (*Securidaca longipedunculata*).

In Diamanga, the Baobab (*Adansonia digitata*) occurs very rarely and is found on agricultural land only. In Tanyelle and Bounou, this species is also exploited on agricultural lands, but here their appearance is more commonly. In Bounou, this species is also found on natural lands, whereas in Sambouali it commonly occurs on natural lands only.

*Vitex doniana* represents a very rare species in Diamanga, whereas in Sambouali, Tanyelle and Bounou it occurs from very often to moderately. In Bounou and Sambouali, this species is found in valleys bottoms only, whereas in Diamanga it occurs also on natural lands. In Tanyelle, this species is found on both agricultural and natural lands.

In Sambouali, *Tamarindus indica* occurs rarely, whereas in the other villages this species is more common. In Sambouali it can be found on natural lands, as well as the valley bottom. In the other villages, this species is found on agricultural lands also.

The Violet tree (*Securidaca longipedunculata*) occurs in Diamanga and Bounou, respectively very rarely and rarely. In contrast, in Tanyelle and Sambouali it is found more commonly. In Sambouali, Tanyelle and Bounou this species is found on natural lands, whereas in Diamanga it also occurs on agricultural lands.

## 6.4.2 Management techniques

In all research villages, the application of harvesting and management techniques is little developed and generally restricted to species that are locally highly valued for their contribution to food and/or money income. There are also tree species that are locally regarded to have a negative impact on agricultural production, in particular the African locust bean (*Parkia biglobosa*), *Tamarindus indica* and *Ficus sp.* The Baobab (*Adansonia digitata*), African locust bean (*Parkia biglobosa*) and Shea tree (*Vitellaria paradoxa*) are species that are frequently protected when clearing land for agricultural purposes. Restrictions on harvesting firewood are applied for the latter two species, as well for *Tamarindus indica*. Only is harvesting of branches is allowed for these species, instead of cutting entire trees. Transplanting of seedlings or direct sowing of seeds is applied for Baobab (*Adansonia digitata*), *Tamarindus indica* and African locust bean (*Parkia biglobosa*).

Table 5 Sources of exploitation, management techniques and availability of eight NTFP species

	Sambouali	Diamanga	Tanyelle	Bounou
<i>Vitellaria paradoxa</i>				
Source of exploitation:				
Natural land:	Yes	Yes	Yes	Yes
Fallow land:	Yes	Yes	Yes	Yes
Fields:	Yes	Yes	Yes	Yes
Valley bottom	n.a.	Yes	n.a.	Yes
Applied management techniques:	n.a.	Protection	Cutting branches	Protection
Availability:	High	Very high	High	Very high
<i>Parkia biglobosa</i>				
Source of exploitation:				
Natural land:	Yes	Yes	Yes	Yes
Fallow land:	Yes	Yes	Yes	Yes
Fields:	Yes	Yes	Yes	Yes
Valley bottom	Yes	Dry areas only	n.a.	Yes
Applied management techniques:	Transplanting seedlings	Protection, sawing	Cutting branches, sawing	Protection
Availability:	High	High	High	Very High

	<b>Sambouali</b>	<b>Diamanga</b>	<b>Tanyelle</b>	<b>Bounou</b>
<i>Adansonia digitata</i>				
Source of exploitation:				
Natural land:	Yes	Yes	No	Yes
Fallow land:	No	Yes	Yes	Yes
Fields:	No	Yes	Yes	Yes
Valley bottom	No	n.a.	n.a.	n.a.
Applied management techniques:	Transplanting seedlings	Protection, sawing	Sawing, transplanting seedlings	Protection
Availability:	High	Not/rare	Moderate	Moderate
<i>Bombax costatum</i>				
Source of exploitation:				
Natural land:	Yes	Yes		Yes
Fallow land:	No	Yes		No
Fields:	No	Yes		No
Valley bottom	n.a.	n.a.		n.a.
Applied management techniques:	None	None		None
Availability:	High	Moderate		Moderate
<i>Vitex doniana</i>				
Source of exploitation:				
Natural land:	No	Yes	Yes	No
Fallow land:	No	No	Yes	No
Fields:	No	No	Yes	No
Valley bottom	Yes	Yes	n.a.	Yes
Applied management techniques:	None	None	None	None
Availability:	High	Not/rare	High	Moderate
<i>Tamarindus indica</i>				
Source of exploitation:				
Natural land:	Yes	Yes	Yes	Yes
Fallow land:	Yes	Yes	Yes	Yes
Fields:	Yes	Yes	Yes	Yes
Valley bottom	n.a.	n.a.	n.a.	n.a.
Applied management techniques:	None	None	None	None
Availability:	High	Moderate	Moderate	Moderate



	<b>Sambouali</b>	<b>Diamanga</b>	<b>Tanyelle</b>	<b>Bounou</b>
<i>Securidaca longipedunculata</i>				
Source of exploitation:				
Natural land:	Yes	Yes	Yes	Yes
Fallow land:	No	Yes	No	No
Fields:	No	Yes	No	No
Valley bottom	No	n.a.	n.a.	n.a.
Applied management techniques:	None	None	None	None
Availability:	High	Not/rare	High	Not/rare

n.a. = no data available

## **7 CONCLUSIONS: ISSUES FOR THE PROGRAMMED SOCIO-ECONOMIC SURVEY AND A NEW RESEARCH LINE**

### **7.1 Issues for the programmed socio-economic survey**

#### **Relations between different ethnic groups**

The main ethnic groups represented in the area are the Gourmantché, Yamaa, Mossi and Fulbe. The socio-economic survey needs to capture information on:

- Main sources of income for each ethnic group
- Inter-ethnic social and cultural relations
- Employment relations

#### **Relations between farmers and agro-pastoralists**

Special attention is required to the relations between farmers and Fulbe agro-pastoralists. Livestock is an important economic activity in the research villages, except of Sambouali. It is to be expected that Fulbe households take care of livestock belonging to other village residents. Furthermore fields are manured by livestock dung.

#### **Household income structure**

Income data should not only be collected to show different income levels between households, but also between individual household members.

Possible useful (but overlapping) categories are:

- New Mossi immigrants and established Mossi immigrants;
- Seasonal labourers from other part of Burkina Faso and from abroad;
- Irrigated vegetable growers;
- Cotton growers;
- Inhabitants who depend for their income on fishing in lake Kompienga;
- High income, middle income and low income inhabitants;
- Male and female inhabitants;
- Age groups.

#### **Land security among Mossi immigrants and Fulbe agro-pastoralists**

Mossi immigrants and Fulbe agro-pastoralist have indirect entitlements to land and other natural resources that stem from the initial right of appropriation by indigenous village communities. The survey needs to capture information on the kind of tenure arrangements between Mossi immigrants and host villages and villagers and how these are changing, in order to get a better understanding of the issue of land security among immigrants.

#### **Land availability**

The survey needs to capture information on land availability in the area. The RDA results show that land is a crucial resource in the area. It is to be expected that population dynamics, in particular changes due to immigration, will have important effects on land availability in the near future, and with this on agricultural development. Another factor that influences land availability is the expansion of the size of fields due to the droughts in recent years.

### **Ethnic differences in agricultural production**

The RDA results show that there are differences between Gourmantché and Yamaa farmers on the one hand, and Mossi farmers on the other in agricultural production. For example, Mossi farmers seem to be more market oriented and cultivate larger plots compared to the Gourmantché and Yamaa. In addition, Mossi seem to spare less of the natural vegetation when preparing their fields for cultivation. The socio-economic survey should capture information on inter-ethnic differences with regard to:

- Agricultural assets and expertise;
- Overall production;
- Cropping practices (e.g. crops and seeds, intercropping, crop-livestock integration, manure);
- Field size.

### **Seasonality of NTFP production**

People in the area collect many forest products for a wide range of purposes. Most NTFP resources have more than use. Women are the primary harvesters, processors and marketers of economic important NTFPs, such as for instance shea nuts and seeds of the African locust bean. The commercial potential of a particular NTFP is at least partly determined by seasonality of production. In the survey variables need to be included that record both biological seasonality and seasonality due to climatic, accessibility, technological, labour availability or other determinants.

## **6.2 A new research line: Relations between customary tenure systems and state laws and policies**

Sustainable natural resource management depends to a large extent on the security of tenurial arrangements between the local populations and the state. Many studies have shown that people are willing to invest more in land and resources over which they have secure control. National and local tenure arrangements, however, are often based on contradictory views as to the ownership of land and other natural resources. Also in the research area it is to be expected that state laws and policies affect the ways in which the local populations use and manage land and other resources. For example, in Sambouali, the management regime of Wildlife Reserve of Pama includes strict regulations on local land and NTFP exploitation. The social economic part of the VINVAL Burkina Faso project therefore needs to capture information on whether or not different laws and policies are applied in the area, and what kind of effect they have on agricultural and NTFP production. In addition information needs to be gathered on trends in state intervention over the last ten years.

Another major area of state policy that influences land management and that of other natural resources is local people's ownership claims on uncultivated land and legal recognition of these claims. The project needs to capture this type of information, as well as to record information about whether the legal recognition has changed, and in what direction, over the past ten years.

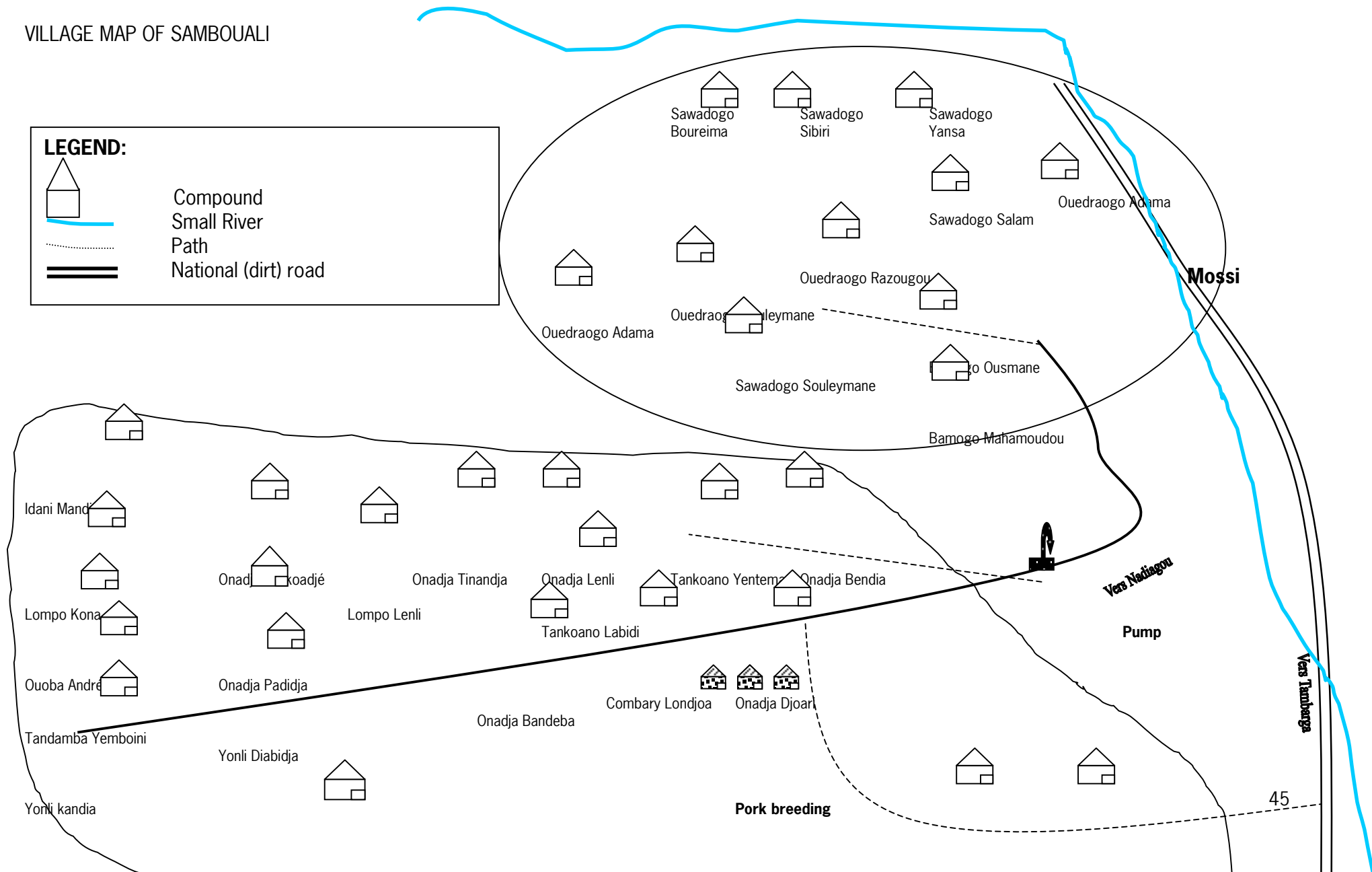
## **8 REFERENCES**

Booth, F.E.M. and G.E. Wickens (1988). *Non-timber uses of selected arid zone trees and shrubs in Africa*. FAO, Rome, Italy.

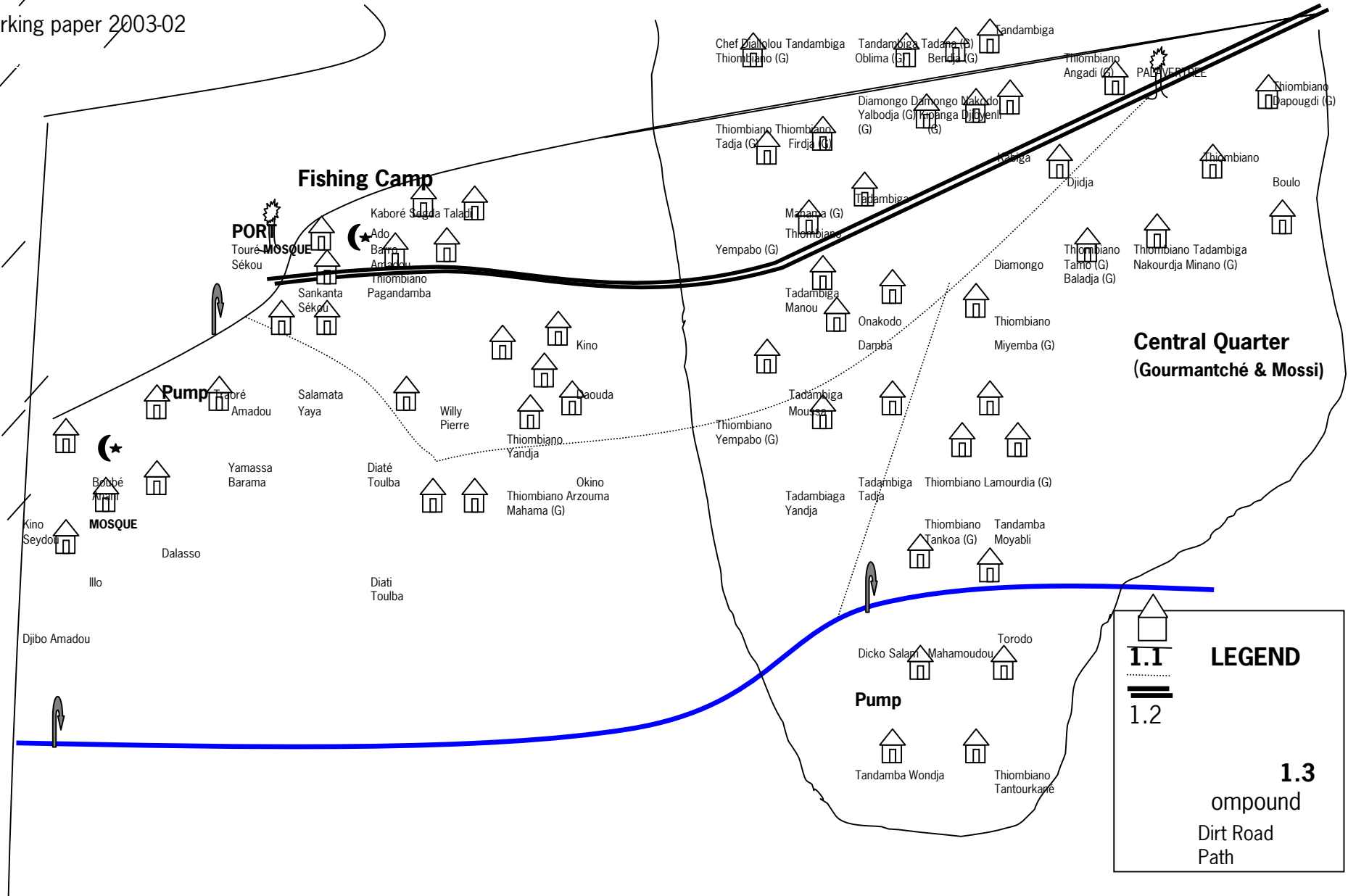
Mazzucato, V. and D. Niemeijer (2000). *Rethinking soil and water conservation in a changing society: a case study in eastern Burkina Faso*. Tropical Resource Management Papers 32, Wageningen, the Netherlands.

## 9 APPENDIX I SOCIAL MAPS OF THE RESEARCH VILLAGES

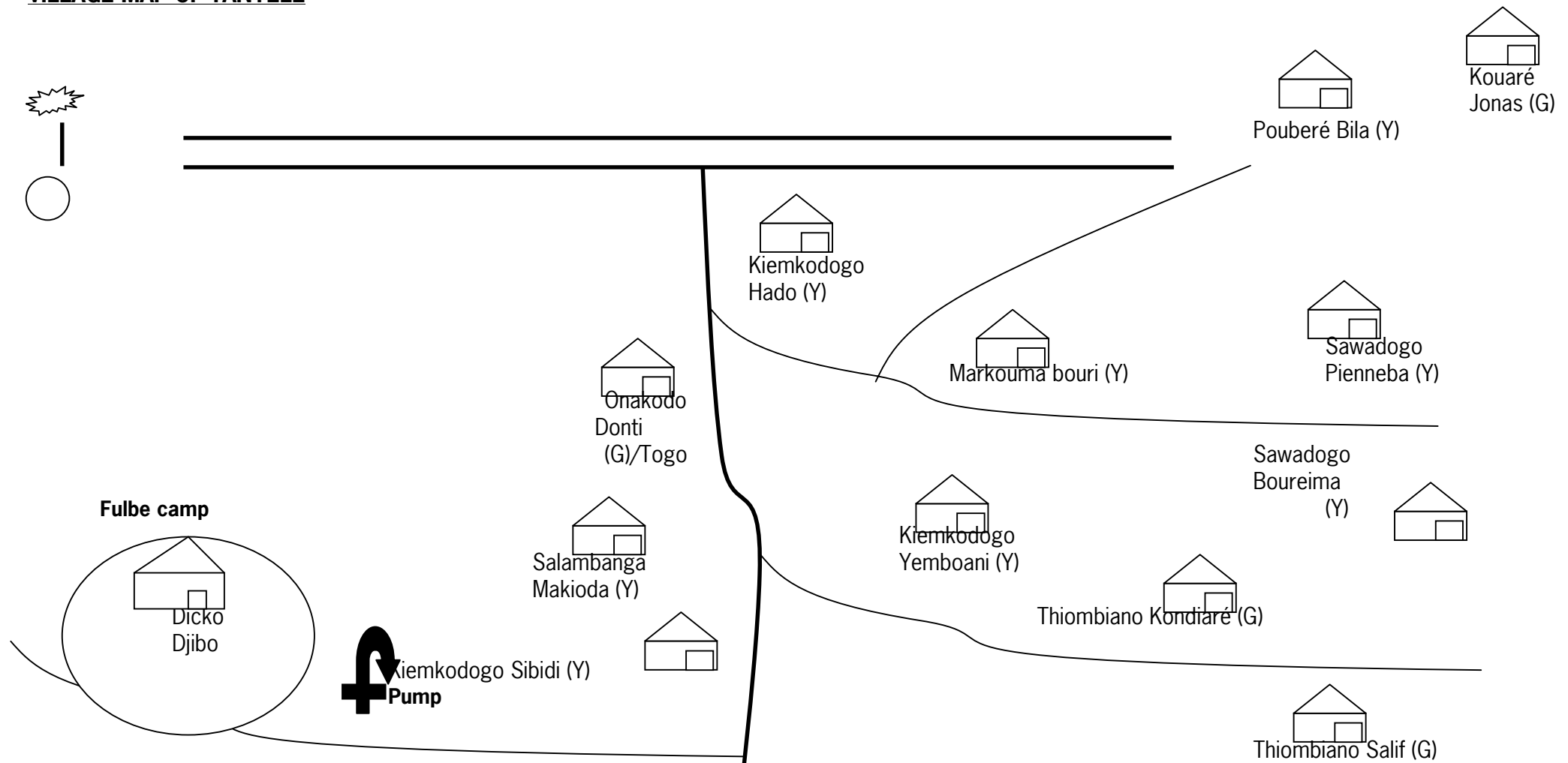
VILLAGE MAP OF SAMBOUALI



Barrage



**VILLAGE MAP OF TANYELE**



**LEGEND:**

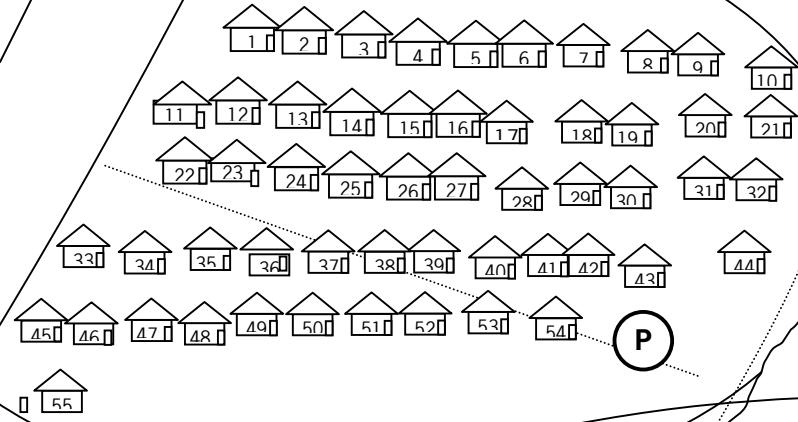
- Village road
- Path
- National (dirt) road
- Compound
- G Gourmantché
- Y Yamaa
- P Fulbe

Kiemkodogo Sadou (Y)

Thiombiano Bindaogo (G)

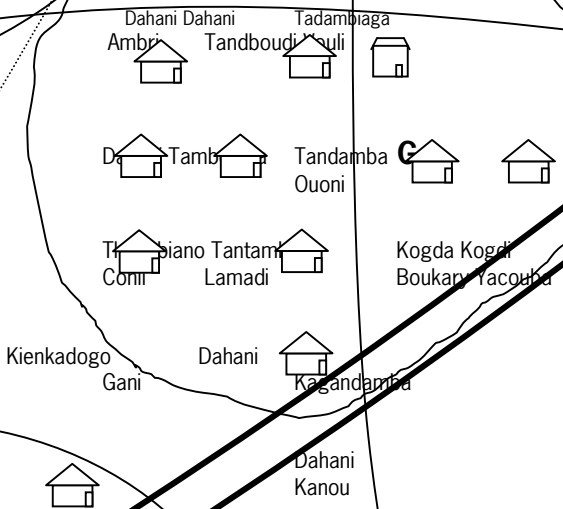
VILLAGE MAP OF BOUNOU

**Namisoargui**



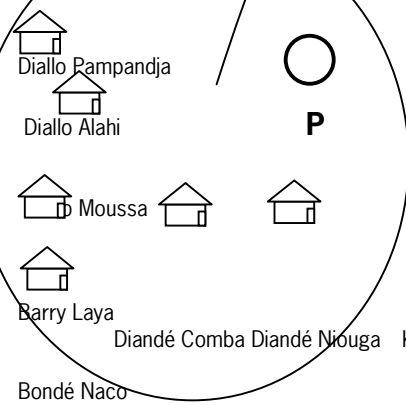
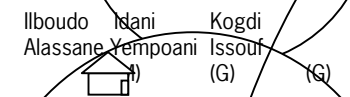
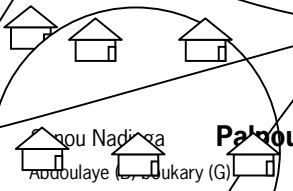
Barrage

**Yensiga (Village chief)**

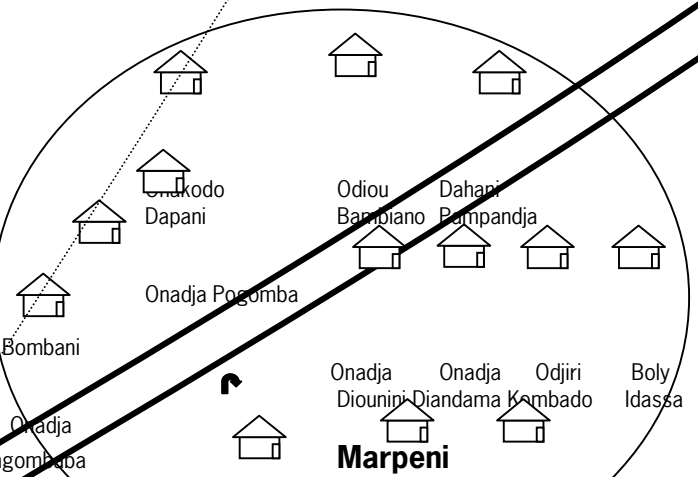


**Pakousonni**

(fishing camp)



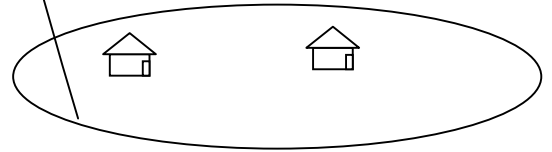
**Bapienga**



**Marpeni**

**LEGEND:**

- Compound
- Dirt road
- Path
- National (dirt) road
- P** Electricity
- M** Mossi
- G** Gourmantché
- P** Fulbe
- B** Bobo





## 10 APPENDIX II MATRIX RANKING FOR LOCALLY VALUED ECONOMIC ACTIVITIES

Table 6 Matrix ranking for five locally most five most important economic activities in Sambouali by Mossi women

(15 Mossi women)

Activities/ criteria	Cash crops	NTFP production	Food products	Pig raising	<i>Petty trade</i>
Time consumption	2	1	6	5	1
Monetary income	4	2	1	10	2
Distance	1	1	1	1	1
Drought resistance	1	8	1	1	5
Labour (number of people)	3	2	1	5	1
Hard work	4	2	6	5	1
Social-cultural value	1	3	3	1	1

The maximum score of each cell was 10

Table 7 Matrix ranking for three locally most five most important economic activities in Sambouali by Gourmantché and Mossi men

(30 men)

Activities/ <b>Criteria</b>	<b><i>Production of cereals</i></b>	Cash crops	NTFP production
<b>Monetary income</b>	2	7	5
Credit	1	5	0
Distance	1	5	5
Time consumption	8	10	3
<b>Labour (number of people)</b>	6	10	1
Hard work	1	10	5
Social-cultural value	7	8	8
Drought resistance	10	7	5
<b>Contribution to health</b>	7	3	10
Disease resistance	5	2	1

The maximum score of each cell was 10

Table 8 Matrix ranking for eighteen economic activities in Tanyelle by Gourmantché and Yamaa women

(13 Gourmantché and Yamaa women)

Criteria/ Activities	Monetary Income	Food Contr.	Medicinal Purposes	Socio- Cultural value	Labour (number of people)	Diseas e resist.	Drought Resist.	Social status
Millet	5	5	3	9	10	10	10	10
Maize	5	5	-	-	8	6	4	7
Sorghum	5	5	4	9	7	9	10	8
<i>Vegetables</i>	1	9	2	8	3	8	4	9
Groundnuts	5	5	-	4	6	7	3	8
<i>Cowpea</i>	5	5	3	7	5	6	6	9
<i>Soya</i>	4	6	-	4	7	10	3	7
Rice	4	6	2	3	9	8	3	8
Sheep	10	-	-	5	5	8	9	10
Goats	5	-	6	6	5	7	8	8
<i>Poultry</i>	6	-	7	8	3	4	1	7
Néré	10	10	6	10	10			9
Karité	10	10	8	10	6			10
Katrepoaga	-	4	2	-	4			3
Baobab	8	8	10	6	8			8
Vitex	-	5	2	-	2			2
Kapokier	7	7	2	2	9			8
Wild vegetables	6	8	1	2	1			7

The maximum score of each cell was 10

Table 9 Matrix ranking for thirteen economic activities in Tanyelle by Gourmantché and Yamaa men

(Group discussion with Gourmantché and Yamaa men)

Criteria/ Activities	Monetary Income	Food Contr.	Medicinal Purposes	Socio- Cultural value	Labour (number of people/ hard work)	Diseas e resist.	Drought resist.	Social status
Millet	3	7	2	1	10	10	10	10
Maize	3	7	2	1	6	1	1	8
Rice	6	4	1	1	6	6	6	6
<i>Sorghum</i>	2	8	3	5	10	6	4	6
Groundnuts	10	3	1	1	3	4	6	8
<i>Watermelon</i>	10	2	1	1	10	1	10	2
<i>Cowpea</i>	4	2	4	3	4	5	5	4
<i>Soya</i>	3	1	1	1	2	2	5	2
Cattle	10	2	2	2	10	8	2	9
Sheep	5	4	2	2	5	8	2	7
<i>Poultry</i>	4	5	10	10	4	8	1	5
NTFPs*	2**	7	10	6	1	7	7	2
Fishing***	1	7	3	1	2	-	3	2

The maximum score of each cell was 10

\* Two village residents are involved in NTFP harvesting for medicinal purposes. Five men are involved in harvesting wood for timber.

\*\* Timber

\*\*\* 2-3 villagers are involved in fishing

Table 10 Matrix ranking for seven economic activities in Diamanga by Gourmantché and Mossi men

(group discussion with Gourmantché and Mossi men)

Criteria/ Activities	Monetary Income	Food Contr.	Medicinal Purposes	Socio- cultural value	Distance	Credit
Agriculture	5	10	1	2	-	10
Livestock	10	6	4	9	10	9
Fishing	10	8	-	-	10	7
NTFP production	5	4	10	2	2	-
<i>Commerce</i>	10	9	-	-	1	2
<i>Artisan</i>	10	1	-	5	10	-
<i>Hunting</i>	1	1	-	-	-	1

The maximum score of each cell was 10

Table 11 Matrix ranking for nine economic activities in Diamanga by Gourmantché women  
(3 Gourmantché women)

Criteria/ Activities	Mon. Income	Food Contr.	Hard labour	<i>Diseases resist.</i>	Drought resistance
Local beer ( <i>dolo</i> )	9	9	10	10	7
Selling fish	9	9	-	-	-
Rice	9	9	9	10	8
Sauce ingredients ( <i>Gombo</i> )	5	9	2	10	9
Néré & Karité	9	9	5*	-	-
<i>Spining</i> (cotton)	1	-	-	10	7
Small rudiments	9	-	-	-	-
Selling jams & Meal of cassava	2	2	-	-	-
<i>Petty trade</i>	5	-	-	-	-

The maximum score of each cell was 10

\* Preparation of shea butter and *soumbala* takes a lot of work.

Table 12 Matrix ranking for seven economic activities in Bounou by Mossi men

(5 Mossi men)

Activities/ Criteria	Irrigated vegetable growing	Artisan <sup>*</sup>	Commerce	Agriculture	Ground-nuts	Livestock	Fishing	NTFP production
Monetary Income	Varies according to seasons	-	1	5	5	10	-	-
Food Contribution	Varies according to seasons	-	-	10	5	1	3 <sup>*****</sup>	10 <sup>*****</sup>
Social- cultural value	-	10	-	+++ <sup>***</sup>	0,5	10 (chickens)	1	5
Medicinal purposes	-	2	-	6	3	6	3	10
<i>Labour</i> (number of people)	10	2	<sup>1</sup>	10	10	7	-	5
Hard work	10	10	-	10	10	9	-	2
<i>Time</i> consumption	10	4	3	10 <sup>****</sup>	5	10	-	-
Social prestige	10	1	8	10	5	10	-	-
Access to equipment	2	10	10 <sup>*</sup>	2	2	1	1	-
Disease resistance	1	-	-	5	9	2	-	10
Drought resistance	1	-	-	5	6	1	-	5

The maximum score of each cell was 10

<sup>\*</sup> Old Gourmantché men make mats; Old Mossi men (old) make *seckos* (made from cotton) for burial rites

<sup>\*\*</sup> All depends of the available of money

<sup>\*\*\*</sup> *Vandzou* and cowpea

<sup>\*\*\*\*</sup> For the participating men agricultural activities have "top priority"

<sup>\*\*\*\*\*</sup> The participating men do not fish themselves

<sup>\*\*\*\*\*</sup> *Boulvaka*; *Baobab* (not resistant to drought at all); *Kapokier* (women and children)

Table 13 Matrix ranking for five economic activities in Bounou by men  
(Village meeting with men)

Activities/ criteria	Agriculture	Husbandry	Fishing	Commerce	NTFP production
Monetary income	10	9	7	3	5
Food contribution	10	2	7	0,5	8
Social-Cultural value	10	9	-	-	6
Medicinal purposes	8	3	-	-	10
<i>Labour</i> (number of people)	10	8	4	1	7
Hard work	10	9	7	1	4
Social prestige	10	10	7	3	5

The maximum score of each cell was 10

Table 14 Matrix ranking for eleven economic activities in Bounou by Gourmantché and Mossi men

(Group discussion with Gourmantché and Mossi men)

Criteria/ Activities	Monetary Income	Food Contr	Medicinal Purpose	Socio- cultural value	Labour (number of people)	Hard Work	Disease resist.	Drought Resist.	Social status
<i>Cow pea</i>	8	3	-	+	3	7	3	10	2
Groundnuts	10	1	-	+	3	7	10	6	3
Maize	5	8	-	+	10	5	6	2	9
Millet	3	10	8	+	10	8	10	10	10**
Rice*	3	7	-	+	10	10	?	1	?
Sorghum (red)	8	2	10	+	10	5	10	8	5
Sorghum (white)	4	6	-	+	10	8	10	8	10**
<i>Poultry</i>	9	2	10	10	3	3	1	1	5
<i>Sheep</i>	10	-	3	3	8	8	2	4	9
Goats	10	-	7	8	4	4	4	10	8
Cows	10	-	-	2	10	10	2	7	10

The maximum score of each cell was 10

\* The participating men want to cultivate more rice, but do not have enough space to do so.

\*\* All depends on soil quality

## 11 APPENDIX III MATRIX RANKING FOR CROPS

Table 15 Matrix ranking for eleven crops in Sambouali by Gourmantché and Mossi women  
(group discussion with Gourmantché and Mossi women)

Criteria/ Crops	Monetary Income	Food contribution	Credit	Socio- cultural value	Labour (number of people)	Disease resistance	Drought resistance	Growth duration
Cotton	10	1	10	10	10	1	8	10
Cowpea	8	3	1	8	8	1	5	7
Groundnuts	3	1	1	8	4	10	5	5
Maize	5	10	1	1	4	10	8	1
Okra	-	10	1	8	8	8	8	5
Peppers	5	10	1	8	5	10	10	?
Rice	1	3	1	8	8	9	1	5
Sesame	4	1	1	8	9	10	5	6
Soya	5	10	1	8	8	10	1	7
Tobacco	-	10	1	8	4	10	5	?
<i>Vandzou</i>	5	3	1	8	4	10	5	5

The maximum score of each cell was 10

Table 16 Matrix ranking for twelve crops in Diamanga by Gourmantché and Mossi men  
(group discussion with Gourmantché and Mossi men)

Criteria/ Crops	Mon. Income	Food Contr	Hard labour	Time cons.	Socio- Cultural Value	Labour (number of people)	<i>Striga</i> resist.	Drought resist.	Credit
Calabash	10	-	1	1	6	1	1	10	-
Cassava	-	2	1	3	-	1	10	10	-
Cowpea	7	3	3	4	4	3	1	8	-
Groundnuts	9	1	6	4	2	3	10	4	-
Maize	5	5	6	4	8	8	1	7	8
Millet	1	10	8	10	10	10	9	10	-
Rice	2	8	10	5	1	5	10	1	10
Sesame	-	1	1	1	4	3	2	9	-
Sorghum	1	10	5	10	7	10	10	10	-
Sweet potatoes	5	1	1	3	-	1	10	3	-
Tobacco	9	0.5	4	4	5	3	10	10	-
<i>Vandzou</i>	7	3	3	4	-	2	10	3	-

The maximum score of each cell was 10

Table 17 Matrix ranking for six crops in Bounou by Gourmantché woman  
(Discussion with a Gourmantché woman)

Criteria/ crops	Contribution to money income	Food contribution
Millet	3	10
Okra	1	10
Soya	5	10
Maize	-	2
<i>Vandzou</i>	-	1
Rice	10	2



## 12 APPENDIX IV MATRIX RANKING FOR NTFP SPECIES

Table 18 Matrix ranking for ntfp species in Sambouali (village meeting)

Criteria/ NTFP species	Monetary income	Food	Medicinal purposes	Timber	Firewood	Forage	Soil fertiliser
Baobab	6	8	3	-	-	10	10
Barkoudi	1	4	5	-	-	-	10
Boulvaka	3	8	1	-	-	10	10
Jujubier	1	4	10	-	5	10	10
Kapokier	6	8	3	-	-	3	10
Karité	10	10	3	7	7	1	10
Katrepoanga	1	2	10*	3	5	10	10
Néré	10	8	3	-	2	-	-***
Pelga	1	1	10	3	-	10	10
Raisinier	1	4	5	4	5	2	-***
Tamarinier	3	3	5	10**	-	3	10
Vitex	1	8	7	-	5	3	10

Maximum score for each cell is 10

\* In the Katrepoanga a parasite plant can be found that cures all illnesses. This parasite plant has a mystical origin and only occurs very rarely and for some moments only.

\*\* Only the Mossi immigrants of the village of Sambouali use the Tamarinier for its wood (*forgerie*).

\*\*\*Negative impact on agricultural production (according to participating villagers).

Table 19 Matrix ranking for ntfp species in Tanyelle (village meeting)

Criteria/ NTFP species	Mon. Incom e	Food	Medic. purpose s	Social- Cultur al value	Fire- wood	Timbe r	Forag e	Drought Resist. r	Soil fertilise r
Baobab	2	5	8	-	-	-	7	2	7
Cailcedrat	-	-	10	-	1	4	6	6	8
Figuier*	-	1	2	9	8	5	4	8	2
Ganka	-	2	1	-	4	8	-	8	7
Gounga	-	-	3	-	4	2	-	6	1
Karité	4	7	2	8	9	6	-	9	5
Néré	5	8	2	8	8	1	-	8	1
Noinga	-	-	-	-	10	9	10	7	8
Pelga	-	-	7	-	-	-	-	4	10
Raisinier	-	1	1	-	3	2	-	8	7
Ronier	10	4	-	-	1	10	2	10	10
Tamarinier	1	1	2	6	9	6	-	9	1
Vitex	-	2	2	-	3	4	5	8	9
Yilga	-	-	5	-	9	9	-	8	6

Maximum score for each cell is 10

\* Kankaga is often used to close *tombes* (in stead off Karité)

Table 20 Matrix ranking for ntfp species in Diamanga (village meeting)

Criteria/ NTFP species	Monetary income	Food	Social- Cultural value	Medicinal Purposes *	Timber	Fire Wood**	Forage
Bagandé	1	-	-	+	-	5	-
Baobab	8	10	10	+	-	-	-
Barkoudi	2	3	-	+	-	3	-
Cailcedrat	-	-	-	10	1	9 (very rare)	0,5
Figuir	-	2	10	+	-	1	10
Kapokier	4	5	-	+	5	-	9
Karité	10	10	10	10	8	9	-
Katrepoanga	2	2	-	+	6	1	7
Laïgha	1	2	-	+	-	9	-
Néré	10	10	10	10	4	9	-
Noisetier	-	3	-	+	5	2	-
Ogabu (Goanka)	-	3	10	+	10	-	-
Ossesegbo	-	-	-	+	10	9	-
Pelga	-	-	-	10	5	0,5	-
Raisinier	1	10	-	+	8	1	-
Ronier	9	5	-	+	10	-	-
Sibiga	-	6	-	+	-	10	2
Tamarinier	7	4	-	+	6	6	-
Vitex	4	5	-	+	4	8	8

Maximum score for each cell is 10

\* All cited NTFP species are used for medicinal purposes. The most valued species are marked with 10. \*\* Participating villagers told that they only use the most valued firewood as wood is very abundant.

Table 21 Matrix ranking for ntfp species in Bounou

Criteria/ NTFP species	Monetary income	Food	Social- Cultural value	Medicinal Purposes	Timber	Firewood	Forage	Soil Fertiliser
Bangandé	-	-	-	5	1	8	-	10
Baobab	2	8	6	4	-	-	-	10
Cailcedrat	-	-	-	8	-	2	10	10
Figuir	-	4	10	6	-	5	5	1
Ganka	-	5	6	3	8	3	-	10
Kapokier	3	6	-	3	3	-	-	10
Karité	9	5	2	8	2	10	-	10
Néré	10	10	10	8	-	6	-	1
Onamambou	-	3	10	2	4	8	-	10
Pelga	-	-	-	10	-	-	-	10
Raisinier	-	8	-	4	-	5	-	10
Ronier	10	10	10	3	10	-	-	10
Tamarinier	5	5	3	7	7	8	-	10
Vitex	-	6	-	4	8	2	-	10

Maximum score for each cell is 10