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# Farmers-Herders' Conflicts Management for Sustainable Agro-Pastoral Land use in the Guinea-Sudan Zone

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## Abstract

Communal and extensive grazing of natural pastures continues to be the predominant feeding strategy in West Africa. This practice leads to the lack of high quality fodder especially during the dry season and the use of crop residues in fields for livestock feeding. Frequent transborder movements of oxen from neighbouring countries toward Benin potentially provided in fodder and water were observed. In the abroad starting countries (Niger, Burkina Faso, Mali...), the carrying capacity became low because of the increasing number of oxen head and insufficiency of fodder. In the host country (Benin), the migration of the mass of oxen generated overstocking and constituted a major cause of crops damages in fields. Consequently this involved conflicts between herders Fulani and farmers and led to food insecurity and poverty. Research organization in Benin implemented in Guinea-Sudan zone organizational and technical strategies for sustainable resource and conflicts management. The study addresses both organizational and technical bottom-up approach to prevent farmers-herders conflicts through mediation, forum of discussions, negotiations between recipients in order to ensure communication between all resources users and the development of sedentary-based cropping systems approach for sustainable resources management.

Keywords: Conflict management; Extensive grazing; Sedentary-based cropping systems; Sustainable land use; Sustainable resource management; Transhumance

## 1. Introduction

The permanent access to pastoral resources caused conflict in the Guinea-Sudan zone of Benin, indicating an emerging tension in the social–ecological system. Conflicts between farmers and herders were seasonally sporadic and increasingly acute in recent decades relating to competing uses of land and water resources (Agossou et al, 1998; Agossou et al, 2000; Djenontin et al, 2004). Demographic growth combined with environmental change play also substantial roles in conflict intensification. The increasing threat of violent competition over diminishing natural resources has been cited as a potential outcome of climate-change pressures (Barnett and Adger 2007). In order to minimize risks of conflicts between farmers and herders for natural resources use and contribute to sustainable agrarian systems, it was always recommended integration between agriculture, breeding and agroforestry (Onduze et al 2004; Torquebiau 2007). However, in the context of the Guinea-Sudan zone of Benin and neighbouring countries, smallholder farmers seeking to make safe their food and their incomes anarchically, increase the cultivated surfaces especially in shifting cultivation yam-based systems (Dumont and Vernier 1997). This dynamics of crops production was conducted with a negative impact on forests, pasture surfaces and corridors for transhumance.

Results in Benin and elsewhere in Africa revealed that there had successful and no successful experiences in the prevention and management of conflicts and it necessary to privilege training process, forage production for animal feeding and soil fertility improvement.

Sustainable agro-pastoral resources and environment management are highest priority for government/decision makers in Benin and neighbouring countries.

Farmers-herders' conflicts management contribute to consensual and sustainable agro-pastoral resources use through organizational and technical strategies to prevent conflicts and stabilize agricultural spaces.

The step proceeded of a diagnosis to have a collective comprehension of problems. The potential solutions were identified and negotiated by the protagonists and were then tested. Activities formulation to be undertaken, the organization of the rural population to manage conflicts and a critical assessment of measurements tested constituted stages of the step. The determining factors of success appeared being the high interdependence between groups in conflict, the availability of fodder, the existence of delimited and respected corridors for transhumance, a local committee operational and directed by influential people for the conflict management, a communication system between interests groups. Sedentary-based cropping systems and forage legumes integrated into traditional fallow management help improving both forage supply at a time of feed scarcity and soil fertility. This contributes to stabilize agriculture space and prevent agro-pastoral conflicts.

This process is useful for present and future generation through sustainable soil fertility restoration, increase land productivity while generating additional products suitable for consumption or for sale, livestock feeding, transhumance and animal divagation control. This process improves opportunities for food safety and incomes in particular for farmers and herders for their wellbeing.

Research organization has implemented in the Guinea-Sudan zone of Benin organizational and technical experiences. This papers highlighted integrated method for participatory rural development. This addresses both organizational and technical bottom-up approach to prevent farmers-herders' conflicts through mediation, facilitation and development of sedentary-based cropping systems for sustainable agro-pastoral resources management.

## 2. Literature Survey

Soil degradation and depletion mainly caused by an interaction among natural and anthropogenic factors are important biophysical factors responsible for low productivity in agro-pastoral systems in Africa (Djenontin et al 2004). These factors include low and variable rainfalls, high evaporation, increased demographic pressures, inappropriate farming practices of marginal lands, overexploitation

of forest resources and practice of shifting cultivation, deforestation and overgrazing which lead to the decrease of the quality of local communities' life (Mercier 1999).

Environmental degradation in pastoral areas has long been viewed as arising from the common property nature of land tenure in such areas (Abel 1993). In the moist savannah region of West Africa, farming systems are based on bush fallow systems, long term cultivation with minimum external inputs, shorter fallow period due to the increasingly population density which lead to rapid depletion in soil organic matter and plant nutrient reserves.

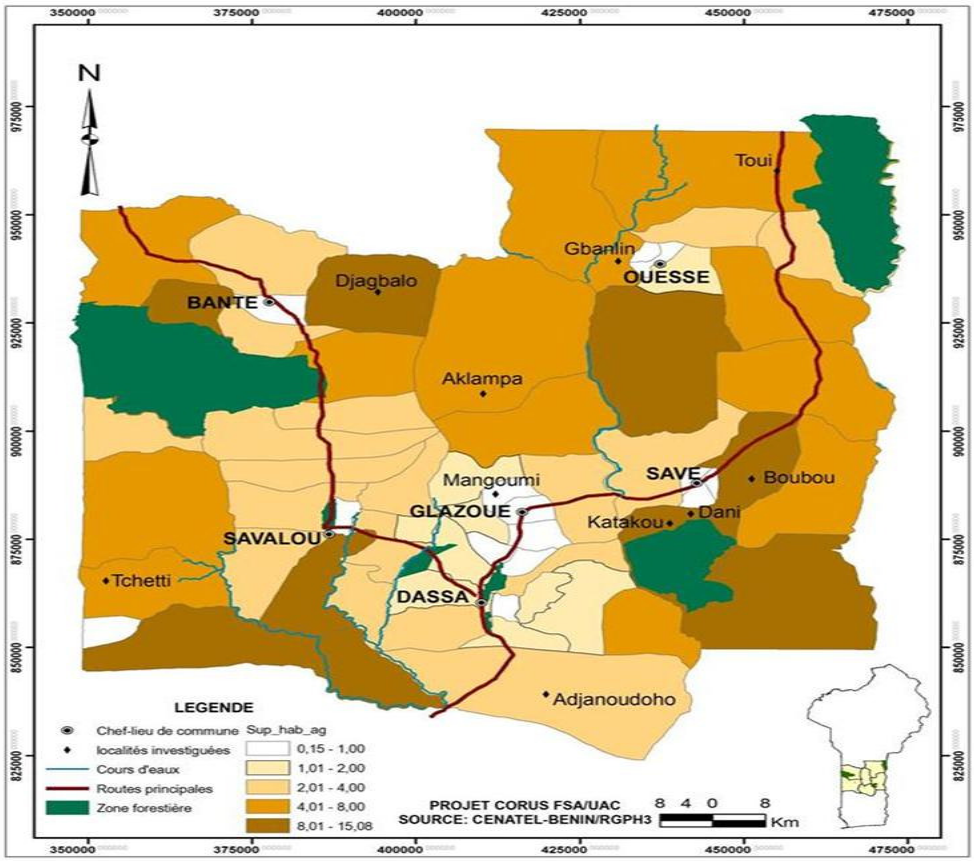
Livestock have long been an integral part of West African farming systems (Boudet 1984; Buterworth 1985 1999). The communal and extensive grazing of natural pastures continues to be the predominant feeding strategy (Oba 1992; Belinke 1994). This practice leads to the lack of high quality fodder especially during the dry season and the use of crop residues in the fields for livestock feeding (FAO 2002; Hesse 2001; Djenontin et al 2004).

Important transborder movements of cattle from bordering countries like Niger, Burkina Faso, Mali or Nigeria were observed toward Benin potentially provided in fodder and water. In the abroad starting countries, the carrying capacity became low because of increasing number of oxens and insufficiency of fodder (Banzhalf et al 2000, Hesse 2001; Baudoux 2003). In the host country (Benin), the migration of the mass of cattle generated overstocking and crops damage (Jarvis, 1991; Coppock 1993; Mentis 1997, Sccones 1999).

## 3. Material and Methods

The study was carried out in Ouessè commune in the Guinea-Sudan zone of Benin (centre of Benin) between latitudes 7°45 ' and 8°40' North and longitudes 2°20 ' and 2°35 ' East (Figure 1).

**Figure 1:** Study area location at Gbanlin in Guinean Sudan zone of Benin (West Africa)



The climate is tropical transitional Guinea-Sudan with a rainfall distribution gradient from bimodal (Southern Benin) to monomodal (Northern Benin). The average annual rainfall during the study period were 1052 mm. The rainfall regime is variable and unequal distribution (i.e. number of rainy days per month) varies from one site to another. Most of the soils are tropical ferruginous soils. There is a rising gradient of fertility from the continuous cropping system on degraded soils towards the forests. Current yam-based cropping systems, which involve shifting cultivation, slash-and-burn or short fallow, often result in deforestation and soil nutrient depletion in the area. This degradation is related to soil organic matter decrease, which leads to nutrient depletion (nutrients removed in the crop harvest, leaching and erosion). Vegetation is a degraded woody savannah type. Forage and water were potentially available. Maize, yam, cassava, groundnut, cowpeas, sorghum, rice are annual cropping systems and the cash crops are cotton and soybean.

Village Gbanlin and neighbouring villages in Ouessè commune with approximately 75 inhabitants per km² were explored in this study. There is ethnic diversity within commune (Nago, Fon, Bariba and Fulani). Villages are mostly ethnically heterogenous because of historical settlement patterns, migratory floods for farm, off-farm and herding activities. Historically there had been sharp ethnic divisions in the human ecology. Fulani in minority from neighbouring countries have historically been transhumant cattle herders, whereas Nago, Fon, Bariba, along with several other ethnicities have been farmers.

Methodological approaches were as follows:

*Survey and organizational approach for agro-pastoral conflict management*

Mapping, transect, individual surveys in 150 farm households and group interviews at villages level were carried out in order to take into account the corridors for transhumance extend and conflicts diversity. Problems structures and strategies for sustainable resources management were analyzed with different socio-professional actors such as farmers, sedentary and transhumant's Fulani herders (Figures 2-5).

**Figure 2:** Agro-pastoral area at Gbanlin village and neighbouring in the Guinea-Soudan zone of Benin (West Africa)

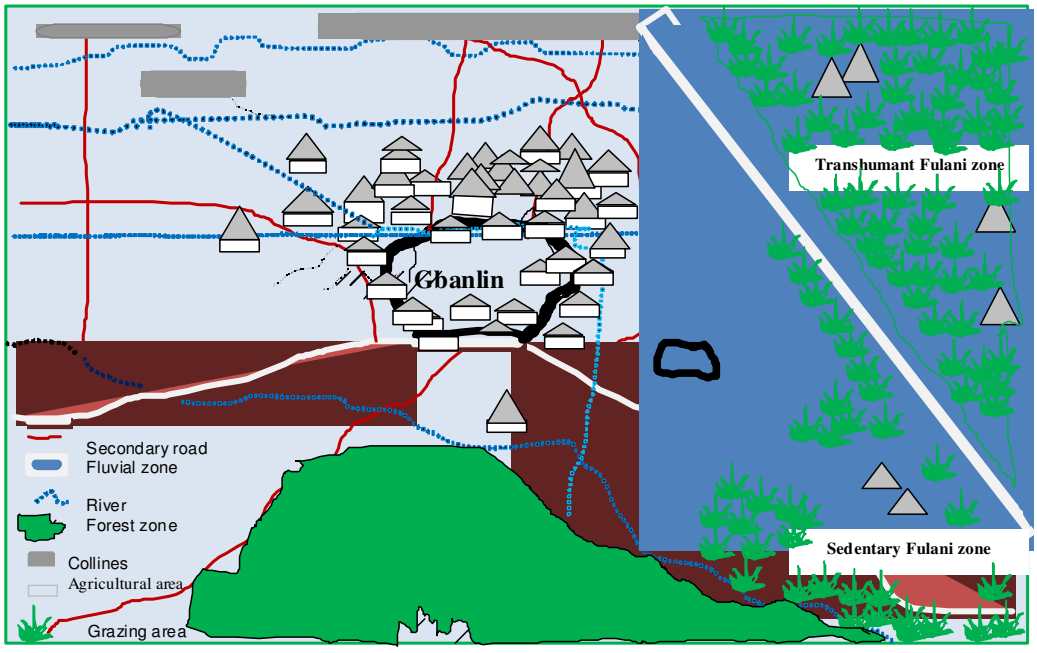
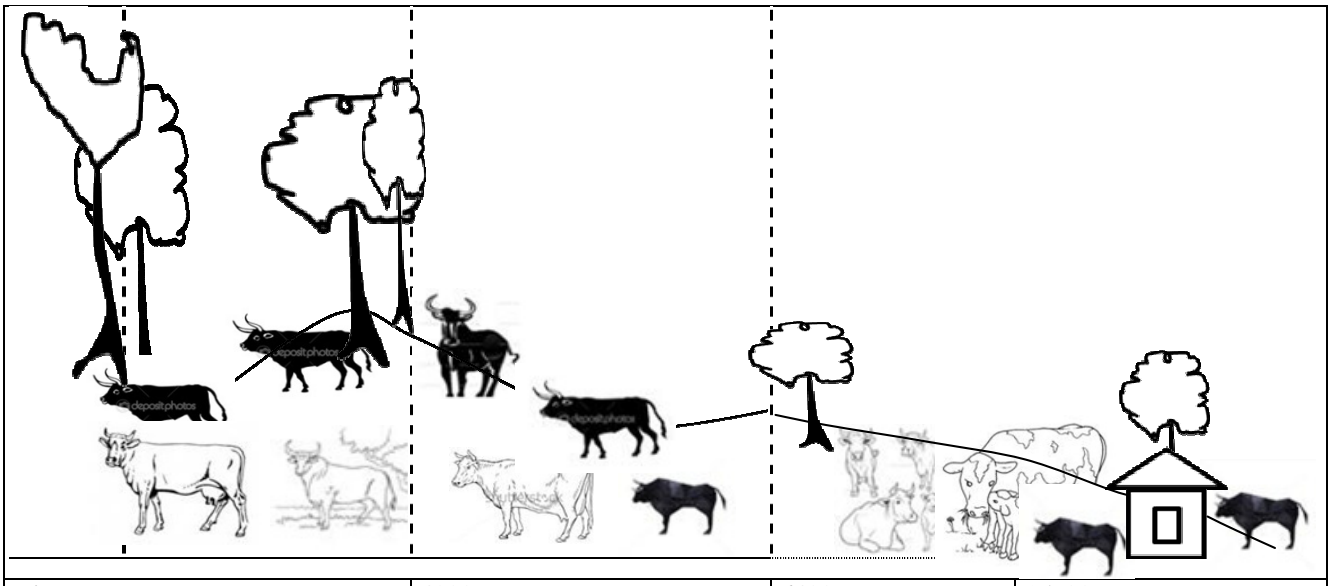


**Figure 3:** Agroecological transect of the study area following different topography-sequences in the Guinea-Soudan zone of Benin (West Africa)



| Distance | 4000 m | 6400 m | 15700 m |
|---|---|---|---|
| Zone | Okodjou | Okpasso | Saagou-Kpozomè |
| Soil | Tropical ferruginous soils (plinthosols), relatively fertile soil | Tropical ferruginous soils (plinthosols), average fertility | Tropical ferruginous soils (plinthosols), low fertility ( poor soil with with concretions) |
| Vegetation | Degraded woody savannah, existence of forest *Daniellia oliveri, Afzelia Africana*; *Vitellaria paradoxa*; *Parkia biglobosa*;, natural fodder… | Degraded woody savannah *Anacardium occidentale, Daniellia oliveri*,, natural fodder,… | Degraded woody savannah *Anacardium occidentale; Daniellia oliveri*, *Senna siamea* ; *Tectona grandis*; *Mangifera indica, Khaya senegalensis,* natural fodder. |
| Crops | Yam, maize… | Maize, goundnut, cassava, yam, sorghum, rice, banana, tomato, pepper, Pigeon pea, cotton | Maize, groundnut, cassava, rice, banana, tomato, Sorghum, soya, pepper, cotton, rice |
| Constraints | Cattle divagation, bush fire, farmers-herders conflict for land use | Cattle divagation, soil water erosion, bush fire, farmers-herders conflict for land use | Cattle divagation, soil water erosion, soil depletion, bush fire, farmers-herders conflict for land use, soil scarcity, |
| Tendancy | Forest degradation | Deforestation and soil degradation | Deforestation and soil degradation; soil depletion |
| Applied solutions | Ploughing perpendicular to the slope, use of grain legumes | Ploughing perpendicular to the slope, use of grain legumes | Ploughing perpendicular to the slope, use of grain legumes, Cassava |
| Alternative solutions | Reforestation, early and controlled fire, sedentary-based cropping systems, Forum of discussions for land use | Early and controlled fire, sedentary-based cropping systems, fence systems, use shrubby legumes, reforestation, Forum of discussions for land use | Early and controlled fire, sedentary-based cropping systems, reforestation, fence systems, use of shrubby legumes, Forum of discussions for land use |

**Figure 4:** Structure of problems analysed with different socio-professional actors (farmers, sedentary and transhumant's Fulani herders) (Focus group survey)

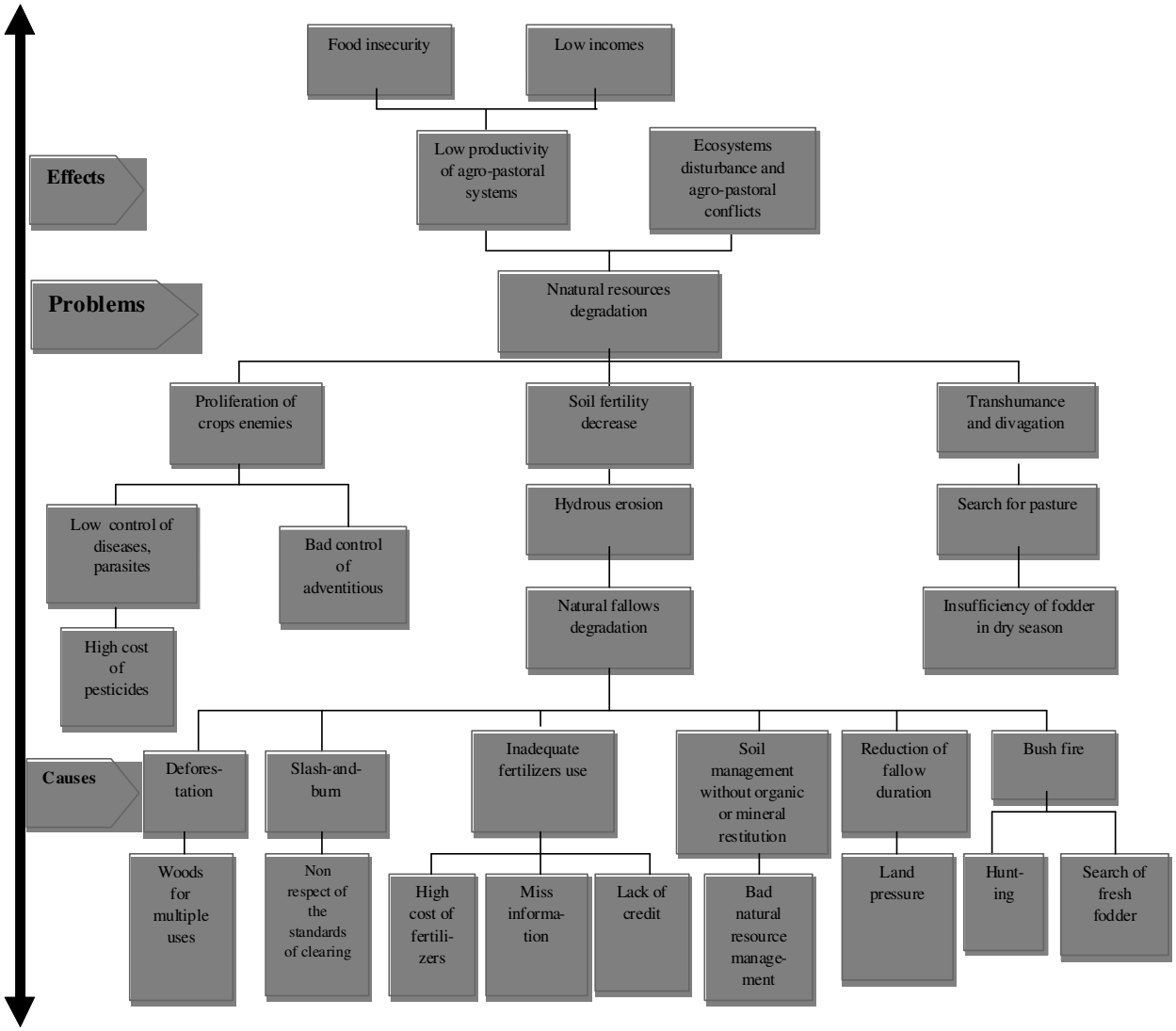
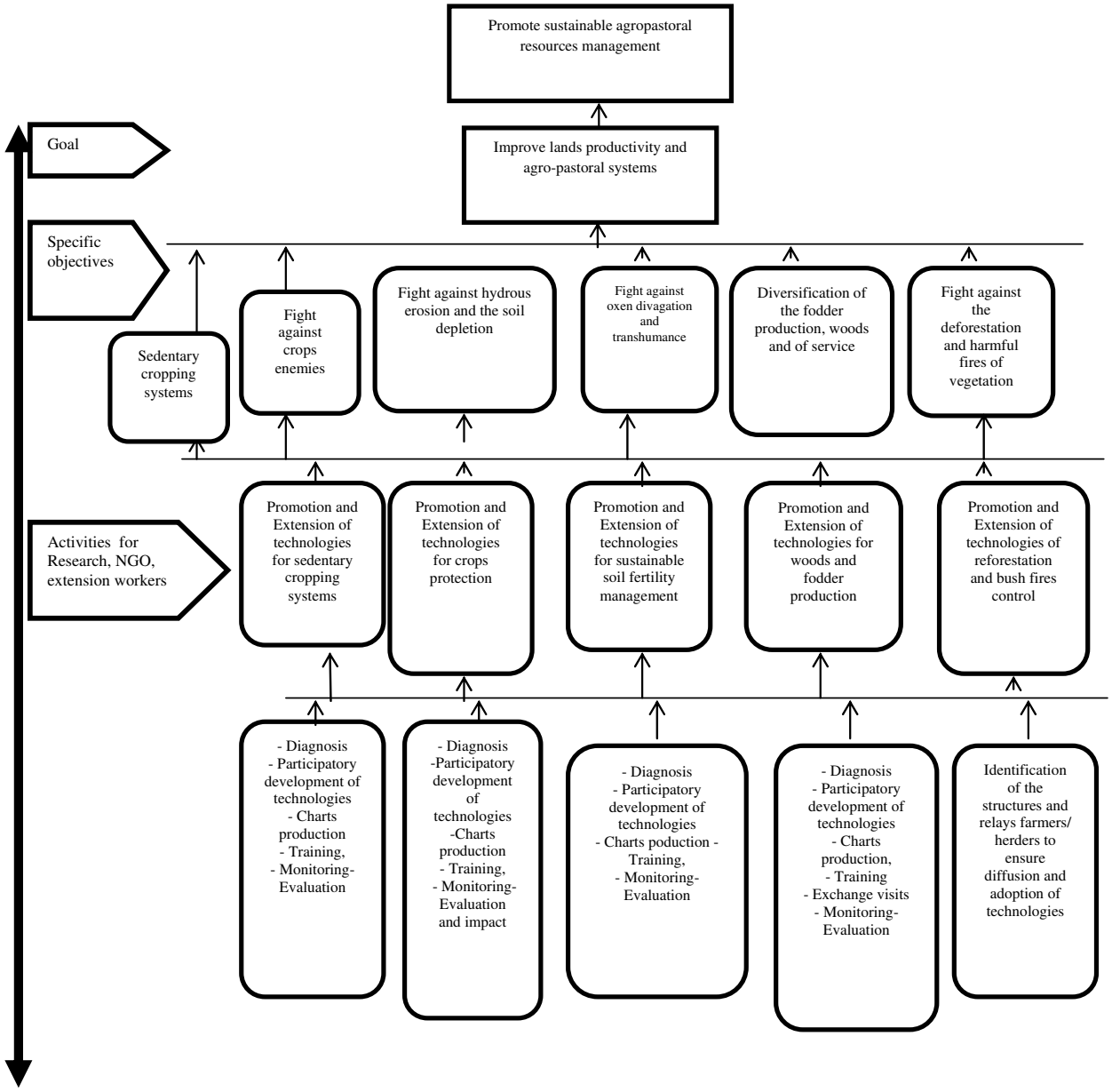


**Figure 5:** Strategies for sustainable agro-pastoral resources management highlighted with different socio-professional actors (farmers, sedentary and transhumant's Fulani herders) (Focus group survey)




Further, farm household's functional characteristics were analysed. Then, a forum of discussions between farmers and herders were organized for the validation of results from surveys. The forum took place with various socio-professional actors participation directly or indirectly concerned by the use of agro-pastoral resources (farmers, sedentary Fulani herders, transhumant Fulani herders, delegates of sedentary and transhumant Fulani herders from Burkina Faso, Niger, Nigeria and Mali, local government, committee of dialogue of the village, persons in charge of traditional worships, persons in charge of lands, persons in charge of herds, village traditional chief, neighbouring villages representatives, young people and adults of villages) and institutions (extension workers, researchers, NGOs, local radios). A number of 300 persons were reached at the forum. Within the framework of the forum organization a committee made up of the representatives of smallholder farmers and herders concerned about the conflict was set up. The role of this committee with the rural radio press coverage contribution was to inform, to sensitize villagers about the forum through various hamlets for their real participation.

During the forum the following stages were adopted:

- communication of the representatives of farmers, sedentary and transhumant's Fulani herders during the first plenary on causes of conflicts and villagers' solutions from former surveys;
- analyzes in session (with each group of farmers and herders) about causes, effects and solutions; perception of each socio-professional group on divergence points;
- communication during the second plenary about session works followed by debates (convergence and divergence points were underlined);
- planning of activities.

*Technical approach for stabilizing agricultural spaces to prevent conflicts*

In order to stabilize agricultural spaces for sustainable agro-pastoral resource and conflicts management, Research organization implementing in the framework of participatory research, integrated forage legumes and sedentary-based cropping systems.

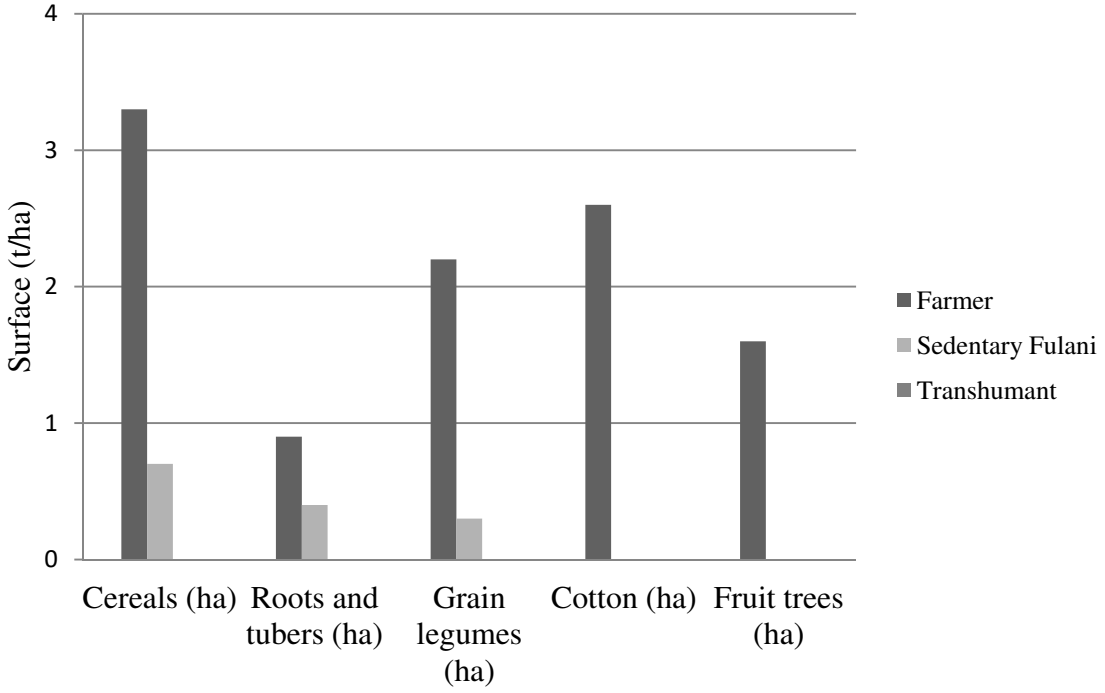
## Results

Table 1 and Figure 6 show farm household's functional characteristics of different socio-professional categories (Farmer, Sedentary Fulani herder and Transhumant).

**Table 1:** Agro-pastoral systems characterization at Gbanlin and neighbouring in the Guinea-Sudan zone of Benin (West Africa)

| Farm characteristics | Farming systems | Sedentary Fulani systems | Transhumant systems | Average |
|---|---|---|---|---|
| Sampling | 105 | 40 | 5 | - |
| Gender | M/F | M | M | - |
| Age | 55.5 | 38.6 | 45.2 | 46.4 |
| Statute | In | Im | Im | - |
| Farm size | 11.5 | 7.8 | 5.6 | 8.3 |
| Number of manpower | 5.5 | 3.5 | 3.0 | 4.0 |
| Number of consumption units | 7.8 | 5.4 | 4.3 | 5.8 |
| Rate of food dependence | 1.4 | 1.5 | 1.4 | 1.4 |
| Land surface available per manpower for agriculture | 2.5 | 0.5 | 0.0 | 1.0 |
| Ruminant size | 2 | 26 | 700 | 243 |
| Number of agroforestry systems practiced | 4 | 1.0 | 0.0 | 2.0 |

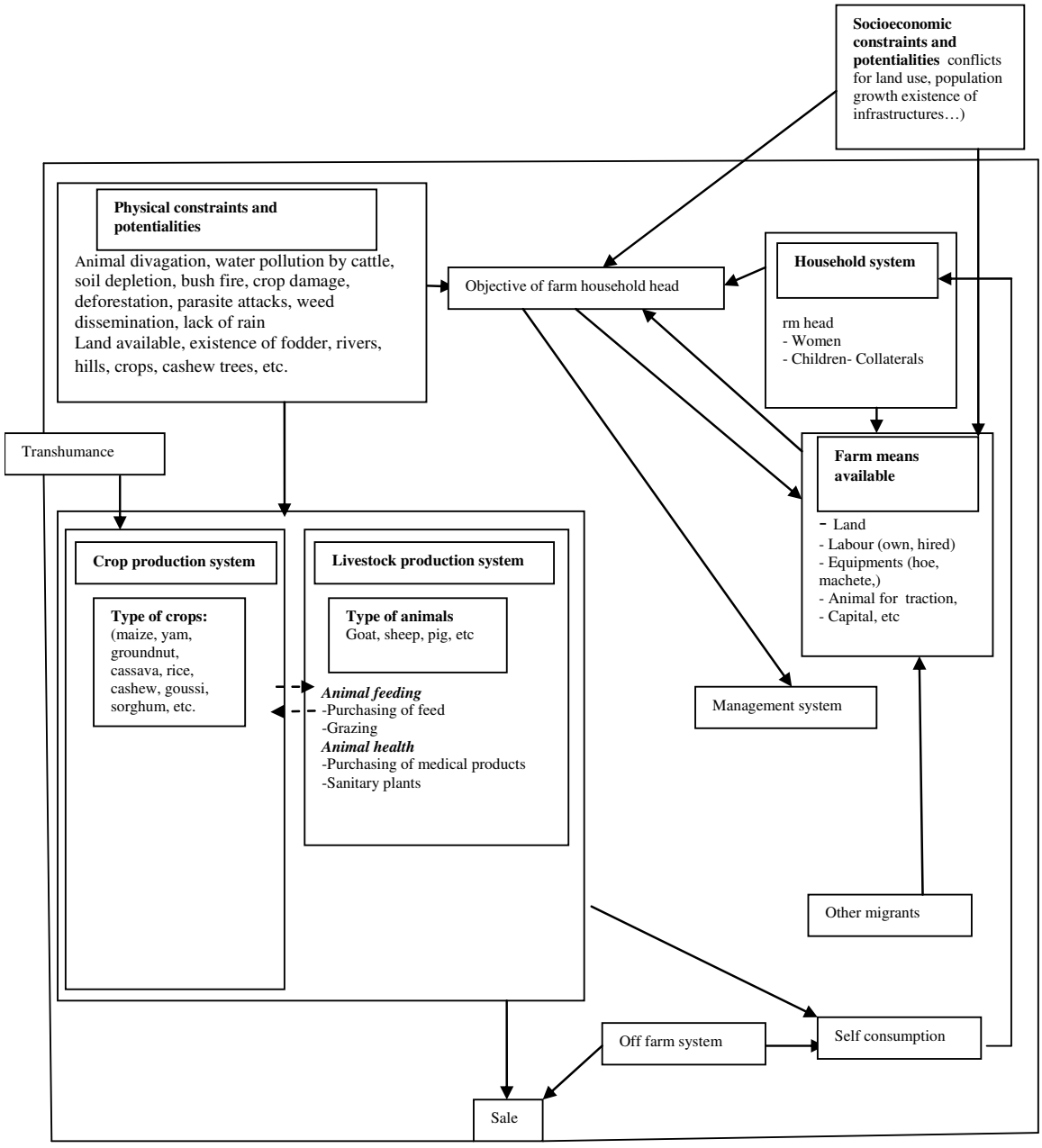
**Figure 6:** Crops surface of different socio-professional actors (farmers, sedentary and transhumant's Fulani herders) in the study area




## Farming Systems

Smallholder farming systems (70% of the sample) were characterized by diversified farm activities such as crop, small animals herding (average size of 2 animals) and off-farm activities to generate food and financial capital for their welfare. Agricultural production was still the main activity around which household life was organized, materially, socially, and symbolically (Figure 7).

**Figure 7:** Farming systems model in the Guinea-Sudan zone of Benin



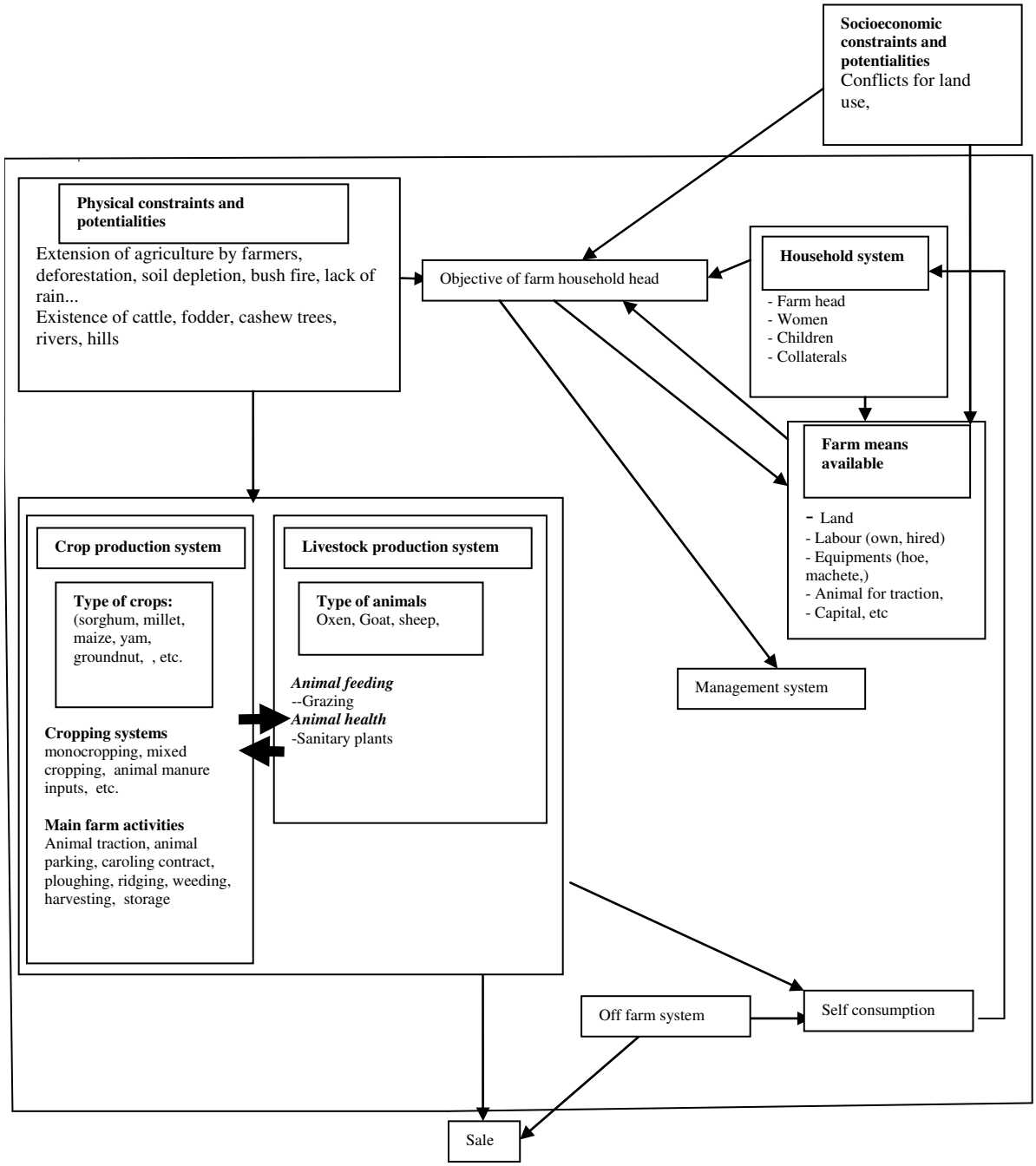

The farm land capital constituted the first factor of production on it was founded their subsistence. The most important model of land distribution was purchasing, inheritance, borrowing, etc. The borrowing land distribution was often made on the basic of contract between native population (land owner) and migrants. Animal traction was slightly used in these systems, and agricultural labour at that time was mostly done manually. Women land statute was deficient; they often cultivated on small plots (0.1 to 0.6 ha) generally obtained from their husband. In the most of the time women helped the household head with their children on the farm land management. Farming systems was based on traditional bush fire cleared fallow systems, long term cultivation with minimum external input and shorter fallow period. The progressive deforestation (swidden for yam) caused grazing area destruction and constituted source of conflicts between farmers and herders. Off-farm activities such as the agro-processing of cassava into cassava flour "*gari*", the wood and coal production, gathering, trade were especially women main farm activities and contributed in farm income while men practiced hunting, carpentry, etc. Small animals (chicken, pigs, goats, sheep...) and the surplus of food crops

notably yam, maize, cassava, groundnut, "*goussi"*, cashew nut, etc. were commercialised. Small animals are seen as good investments because they multiply quickly and can be sold easily to cover sudden and small expenses.

## Sedentary Fulani Herders Systems

Sedentary Fulani herders systems (25% of the sample) have one permanent place of residence in our study area. They have particular households in the villages which they consider as their hosts. The farming system was mainly characterized by animal herding (average size of 26 oxen). Practices of mixing herding and farming activities constituted their livelihood strategies (Figure 8).

**Figure 8:** Sedentary herder Fulani farming systems model in the Guinea-Sudan zone of Benin



The land statute was deficient. The borrowing practice constituted the model of land acquisition for cultivation. Crops were cultivated on small plots neighbouring of the Fulani herders' camps. They cultivate crops (sorghum, millet, groundnut, Soya bean, cowpeas, and a little rice and yam) for feeding and for sale, but have much higher rate of livestock ownership. There was integration between crop-livestock pattern for soil fertility improvement during animal parking after millet and sorghum harvesting. In fact, cattle manure was highly valued as a powerful input which was gathered and spread in fields prior to the agricultural season for soil-fertility maintenance. Animal grazing was practiced during the growing and the dry season in accordance with tracks defined by smallholder farmers' and sedentary Fulani herders on relatively reasonable distance. The livestock herding was Fulani heredity profession. Certain sedentary smallholder farmers confided their flock to Fulani for guarding. In fact, smallholder farmers did not keep cattle, and the only herding in the area was done by neighbouring Fulanis. In feedback, they were remunerated financially or in animals. The management of confided livestock was free. Fulani herders in our study area separated gender roles, with men often taking the tasks that require heavier lifting or are more physically demanding such as fields cultivation, animals leading and going to the forest, and climbing trees to collect fodder in dry season. They would sell occasionally cattle to buy household goods. Women mostly take care of the family, fetching water and preparing meals for the family, collecting milk, producing cheeses, porridge for feeding and sale and buying grain, produce, cloth, etc.. However, in this system, animal divagation was sometimes noticed through nightly and daily grazing and caused conflicts between farmers and herders.

**Transhumant Fulani Herders Systems**

Fulani have historically been transhumant cattle herders. Transhumant Fulani herders systems (5% of the sample) in our study area were characterized by the seasonal migration of livestock and humans from one agro-ecological zone such as Niger, Burkina Faso, Mali or Nigeria because of the lack of grazing land and water for animals to the other (notably Benin) and back. Mobility was key to transhumant Fulani herders systems, enabling herders to move their livestock at different points in time, exploring ecological niches provided by microclimates at different agro-ecological areas. It is one of the main strategies used to access natural resources such as pasture and water. They may have fixed settlements that were revisited every year in a certain season or may cycle through the same general areas each year, but not to established settlements in each area. As mentioned, they move from Mali, Burkina Faso, Niger or Nigeria with average size of 700 oxen, in searching fresh fodder and water during dry seasons. The goal was to help livestock to get at the best moment the best natural pasture. This has the advantage to enable livestock to graze natural pasture grew at different ecological soils. Mobility also takes advantage of diversification options that increase the transhumant' incomes, such as marketing their products (animal, milk…). It was distinguished in our study area seasonable transhumance (4 to 6 months) characterized by oxen movements from above countries through landscapes. This practice prevented oxen from food deficiency. There was also, daily transhumance on short distance in particular with semi-sedentary transhumant herders. Transhumant herders' lifestyle depends on drinking water and pasture availability in the area. During their movement through fields, oxen destroyed food crops and other plants. Certain forage trees were particularly cut for animal feeding, in particular *Afzelia Africana* and contributed to progressive destruction of the specie (Sinsin et al 2004). This situation constituted a major cause of crops destruction and involved to conflicts between transhumant Fulani herders and farmers. Some of these constraints leaded to the human being death. Transhumant Fulani herders without permanent shelter ate essentially cheese and drink oxen's milk. They met occasionally their fellow members and visited local market for social and economic welfare. Transhumant Fulani herders, by virtue of migration through different villages, developed friendships along their way, as well as near their camps.

**Surveys, Forum of Discussion Output and Impacts**

During surveys and forum in our study, it highlighted i) the need for forthwith setting up a local committee of conflicts prevention to redefine corridors limits for transhumance, to inform population and to make respect corridors for transhumance; ii) population contribution and the assistance of local committee of the conflicts prevention, iii) Research, NGO or decisions makers contributions to arrange sites for a better water retention, to inform and put control panels in the water sites for rural provision, iv) the delineation of grazing areas with markings and v) the practices of sedentary-based cropping systems for stabilizing agricultural spaces and prevent conflicts.

Platforms of dialogue showed the setting-up of a Committee of farmers-herders conflicts prevention and management represented by both farmers and herders. In close relationship with research, extension workers and NGO in the study area main actions were focused on the availability of fodder, the existence of delimited and respected corridors for transhumance, a local committee operational and directed by influential people for the conflict management; a communication system between interests groups.

During the process, a draft-agreement of agropastoral land use was elaborated and adopted by the protagonists. A draft-agreement on the local regulation was signed between committees of farmers and herders in the study area.

The Committee developed a concept of friendly and consensual conflicts management. After the forum, agro-pastoral conflicts were reduced according to the rural populations' viewpoints.

*Integrated forage legumes and sedentary cropping systems*

Intercropping systems with herbaceous and shrubby forage legumes were implemented in farmers' fields in order to reduce farmers' traditional shifting cultivation system for yam and cotton production in the Guinea-Sudan zone (main cause of deforestation), to stabilize agriculture space and prevent agro-pastoral conflicts ( Table 2 and Figure 9).

**Table 2:** Types of yam-based cropping systems adopted by smallholder farmers in the Guinean-Sudan zone of Benin

| **Type of legumes** | | **year 1** | **year 2** | **year 3** | **year 4** |
|---|---|---|---|---|---|
| | | **Technical itinerary** | | | |
| Herbaceous legumes (HL) | *Mucuna pruriens var utilis* | Maize+Mucuna | yam | - | - |
| | | Maize+Mucuna | Maize+Mucuna | yam | - |
| | | Mucuna | Mucuna | Maize | yam |
| | | Mucuna | Maize | yam | |
| | | Mucuna | yam | - | - |
| | *Aeschynomene histrix* | Maze+Aeschynomene | yam | - | - |
| | | Maize+Aeschynomene | Maize+Groundnut | yam | |
| | | Maize+Aeschynomene | Aeschynomene | - | yam |
| | *Stylosanthes guianensis* | Maize+Stylosanthes | yam | - | - |
| | | Maize+Stylosanthes | Stylosanthes | - | yam |
| Shrubby legumes(SL) | *Gliricidia sepium* | Maize+Gliricidia | Maize+Gliricidia+HL | yam | - |
| | | Maize+Gliricidia+Groundnut | Maize+Gliricidia+Groundnut | yam | - |
| | | Gliricidia+Maize | Gliricidia+Maize | yam | - |
| | | Gliricidia+Maize | Gliricidia+Andropogon | - | yam |

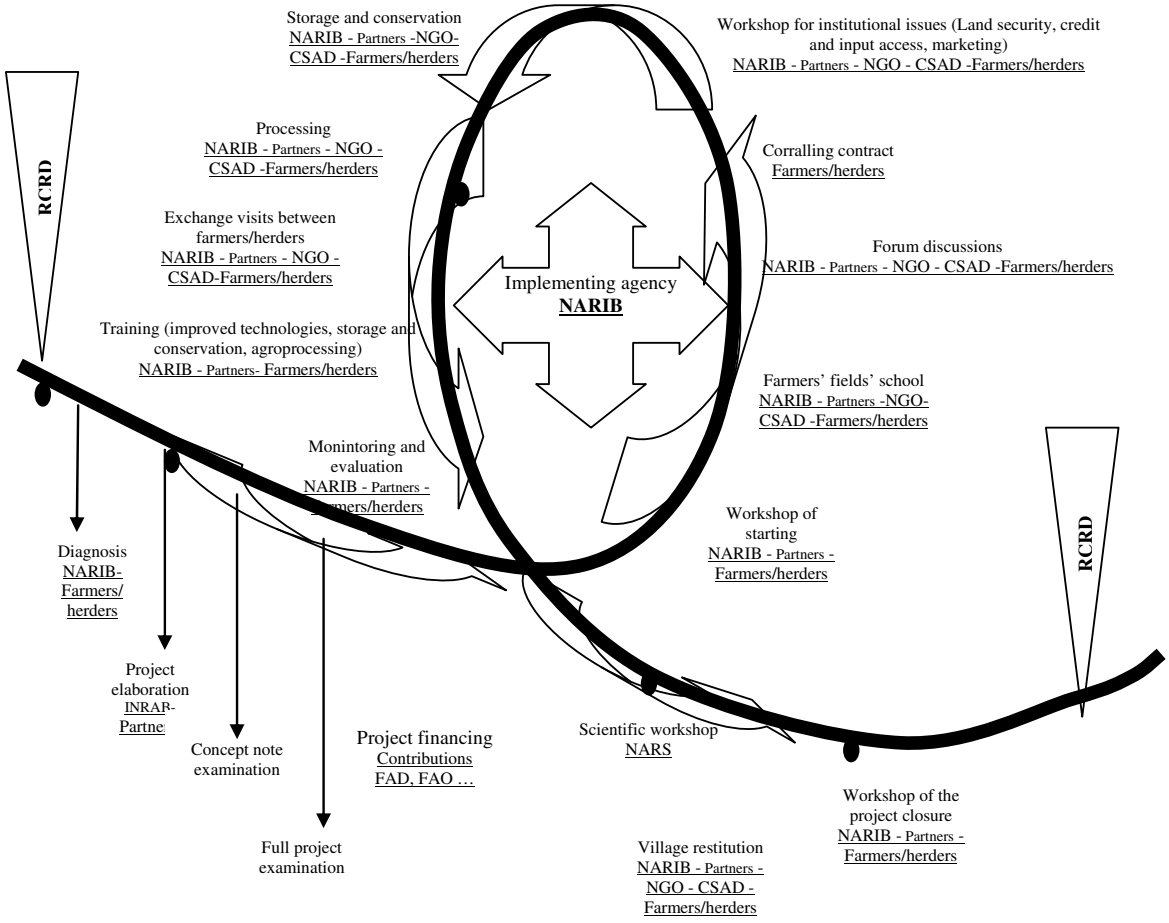
**Figure 9:** A case of sedentary-based cropping system: Both mulching and incorporation of *Aeschynomene histrix* biomass into the soil with the ridges in the yam-based system with the mixed intercropping Glricidia-*Aeschynomene histrix* and maize in the Guinea-Sudan zone of Benin

Three-quarters of *Aeschynomene histrix* biomass manually incorporated into the soil in October-November during ridging, and the remaining quarter left on the surface as mulch in order to reduce the workload related to the biomass incorporation in the soil

*Scaling up and demonstration effects*

Lessons learnt from the action have been extended in the framework of participatory method of trainings, Farmers Fields School (FFS) and visits in close partnership with extension workers (Figure 10).

**Figure 10:** Annual cycle of Research and Development for sustainable agro-pastoral resource management




The results of research were presented in the framework of village restitution. The convincing results observed by each farmer and herder in particular field contributed increasing adhesions of remaining farmers and herders with the large application of technologies adapted in the specific ecologic and socio-economic conditions. Fields trainings and fields' visits were organised to capitalize and document different point of views of farmers and herders, extension workers and researchers. Furthermore, a scientific workshop was organized in the benefit of the researchers from the National Agricultural Research System (NARS) who present the results of their researches followed by fruitful discussions. Then, important findings by researchers were transferred to the Regional Committee of Research and Development (RCRD). The RCRD is a main link of the agricultural research management cycle in Benin. 50% of farmers/herders' and end users of the developed technologies participate to the RCRD and the remaining 50% shared between researchers, intermediate users such as: CSAD (Communal Sector for Agricultural Development), NGO, the development partners and the political decision makers. Research results were presented in simple and accessible terms during the forum and were discussed with farmers and herders' participation. The RCRD forum has the power to transfer the best and affordable results in terms of technical and economic performance to extension service for large promotion of the adopted technologies. Before this transfer is occurred, important discussions from participants mainly from farmers/herders help to fine turn the technologies by assessing the constraints and advantages and the adjustments to give for higher adaptation of the technologies. The further conclusive results led to the elaboration of technique and economic handbook jointly with the farmers/herders, researchers and the extension structures in the frame of multi-field and multi-institutional approach. The document puts forward the technical itinerary with images, comments and the economic issues. The handbooks "the so called RTE "(technical and economic referential)

were elaborated in French and local languages (Fon, Yoruba, Bariba and Peulh...") for farmers/herders, agricultural professionals, extension agents and researchers for mediatisation and a dynamic extension of the new technologies.

## Discussion

Researches carried out in Benin and elsewhere in west Africa (Burkina Faso, Niger, Zimbabwé, Tchad, Kenya…) on farmers-herders conflicts point out that farmers-herders agro-pastoral conflicts management is a permanent training process based on the confidence and negotiation, the spirit of conciliation (Banzhalf et al 2000; Benkahla et al 2003; Baudoux 2003). This confirmed our results and those from Burkina Fasso, Niger, Mali, Somali, Tchad, Kenya and Zimbabwé (Barret 1992; Agossou et al 1998; Banzhalf et al 2000; Kienna 2000; Trebaud 2002; Benkahla et al 2003; Baudoux, 2003). The determining factors of success appeared being the high interdependence between groups in conflict, the availability of fodder, the existence of delimited and respected corridors for transhumance, a local committee operational and directed by influential people for the conflict management; a communication system between interests groups.

In this order, it is necessary to develop with rural population a process of progressive training by the accumulation of experiments through a flexible and dynamic step, susceptible to preserve the social peace and a sustainable agro-pastoral resource management. The step must be able to establish the facilitation of debates through dialogues, integration of the various parts in the process of change, the setting-up of committee for agro-pastoral conflicts prevention in considering a certain balance between all forces and sensitivities, the planning elaboration in short, medium and long term. The complexity of the problem of agro-pastoral conflicts required a great flexibility during the training process and needed to compose with the imponderable ones (Agossou et al 1998).

In Burkina Faso, causes of conflicts between farmers and herders were especially due to the problems of leadership, the agro-pastoral space disorganization, the anarchy in natural resource management and the land problem. Pastors progressively choose the co-management of their natural resources on the basis of training experiment (Banzhalf et al 1998). The committee worked out certain rules as watering place for animals and crops fields' protection, the non conflicting cohabitation and the environment safeguard. The regulation framework was often formalized. There were several assets in particular in the field of conflicts payment between the transhumant Fulani herders and smallholder farmers, an appropriation long term vision for the natural resource management. The committees developed competences as regards negotiation with the technical and financial partners for the mobilization of the resources and the implementation of the micro-projects relative to the protection of the natural resources.

In Niger, Lycklama and Nigeholt (2001) reported, cases of defence of pasture in certain zones in order to avoid the overgrazing. In south-west of Niger, a case of corralling contract was revealed between sedentary agro-breeders and farmers where the latter one profited of a great concentration of organic matter (excrements) in their field based on requirements of crop residues availability in quantity and quality (Neef et al 1998). This practice returned both manure and urine to soil and conserves nutrients. Urine increases the availability of soil phosphorus (P) and crop yields (Powell and Valentin 1998).

In the Semiarid zone of Nigeria for instance, several farmers lease their cowpea fields to herders for in situ grazing after harvesting the pods. The obvious economic benefit is the value of oxen dropping in the field. Thus, this system contributes to the sustainability of mixed crop/ livestock (Powell and Valentin 1998). The adoption of dry-season dual-purpose cowpea has helped to improve farmer/oxen rearer social interactions that contribute to the sustainability of the system through effective crop/livestock integration. In addition, manure from livestock is returned to the field, and animal provides milk, meat, income, and traction for land preparation, weeding, and transport.

Research results also showed that cowpea fodder has higher nutritive values than many legume crops (Tarawali et al 1997; Powell et and Valentin 1998; Manu et al 1998)

In Somalia, Hambly and Angura (1995), Bayer (2002) also reported that the producers developed a whole of indicators for the evaluation of quality, quantity and the availability of natural resources like water, pastures in order to develop more rational management of agro-pastoral resource available. The authors recognized that pastors have indicators of soil degradation such as plants tracers and several devices which enabled them to give a description of the agro-pastoral space state that they crossed.

The experience of the Marsabit Development Project of GTZ in the northern Kenya focussed on program of environmental management committees training addressed both environmental management and conflict management. This occurred because reducing insecurity was identified by communities as a precondition for sustainable natural resource management (Oba 1992; Abel 1993; Galaty 2002). The critical assessment of theses study results revealed that there had successful and no successful experiences in the prevention and management of farmers-herders conflicts for the agro-pastoral resource use and it's necessary to privilege training process, forage production for animal feeding and soil fertility improvement.

**Sedentary Cropping Systems**

Research was undertaken to solve the main problems of arable lands degradation in West Africa and in Benin in particular and especially to increase the adoption of powerful innovations in farming systems. Previously, crop in alley cropping was perceived as the most advantageous agroforestry systems in West Africa. The alley cropping was implemented in several research structures and was transferred in rural areas (Kang and Reynolds, 1986; Kang and Mulongoy, 1987; Floquet *et al*., 2001). Nevertheless, the rate of adoption was low and discouraging. The most important constraints for agroforestry systems adoption, notably alley cropping (Kang and Reynolds, 1986), are its pruning workload as well as competition between shrubs and crops for nutrients and light (Floquet, 2006; Maliki *et al*., 2006).

It is well-known today that smallholders deeply readjust technologies developed in close relationship with researchers when confronted with various constraints (land, soil quality, labour, cash, etc). A first range of adaptations was implemented by smallholders in the Guinea-Sudan zone of Benin. This is focused on alley cropping system but included farmers criticisms and adaptations in order to develop a new range of technologies (Maliki *et al.*, 2012a, b). The shrubs density reduction with shrubby legumes (*Gliricidia sepium, Moringa oleifera,…)* with loose spacing (4m × 4m, so 625 shrubs or less per hectare) were generated in rotation with herbaceous forage legumes (*Aeschynomene histrix, Mucuna sp, Stylosanthes guanensis...*) or graminaceous (*Andropogon gayanus*,...), grain legumes (forage cowpea, groundnut, soya, bean, pigeon pea...). The density of shrubs was reduced in order to reduce the labour required for repeated coppicing and herbaceous (legumes, graminaceous or crops) were included in the rotation cropping systems with yam in order to maintain soil fertility. In the agroforestry-yam based system at the end of the rotation, the plot remains under fallow during a few years before being cleared for yam and *Gliricidia sepium* for example usually grows to medium-sized shrubs.

Forage legumes integrated into traditional fallow management and development of sedentary-based cropping systems help improving both forage supply at a time of feed scarcity and soil fertility. Legumes such as *Aeschynomene, Mucuna, Stylosanthes and Gliricidia* showed their capacity to restore the soil fertility, to maintain the soil humidity and to supplement the ruminants' food (Maliki 2006; Floquet et al 2012; Maliki et al 2012a,b,c; Maliki et al 2016). In addition fence systems with *Cassia siamea*, *Gliricidia sepium*, *Moringa oleifera* have been developed as alternatives to alley cropping systems. The system offers several advantages according to farmers' view points. It contributes to increase maize grains yields and induce fire wood production. The establishment of the edge around the fields between neighboring farmers constitutes an element of land security. The natural screen formed by the fence system is used as breeze wind and also contributes to the hydrous erosion control

and then for soil conservation. The system of edge also limits animals' intrusions in the crop fields. Moreover, the fence system is easier to establish, prune and adapted to the local systems.

Adoption of innovating above systems allows to natural resources better preserved, chemical pollution of the environment to be reduced, agricultural production to be diversified, plant biodiversity to be better conserved, bio fuel to be promoted, access of smallholders to land resources to be improved, as well as their capacity to manage these resources. Consequently, this stabilize agricultural spaces and prevent farmers-herders' conflicts. This influence was strengthened by suitable organizational arrangements to popularize adapted technologies, involving researchers, extension workers, farmers and herders

## Conclusion

Agro-pastoral resource management is a permanent training process based on the confidence and negotiation, the spirit of conciliation to preserve the social peace and a sustainable resource management. This process of training was carried out in the Guinea-Sudan zone of Benin through survey and forum discussions between protagonists in order to identify main causes of conflicts and solutions for sustainable agro-pastoral resource management. The different stages of the step for conflict prevention were discussed. About technical step, forage legumes integrated into traditional fallow management help improving both forage supply at a time of feed scarcity and soil fertility. This contributes to stabilize agriculture space and prevent agro-pastoral conflicts. The critical assessment of the results of the study in Benin and elsewhere in Africa revealed that there had successful and no successful experiences in the prevention and management of farmers-herders conflicts related for the agro-pastoral resource use and it's necessary to privilege training process, forage production for animal feeding and soil fertility improvement. Further, we then propose to promote durable and replicable sedentary-based cropping systems with legumes, through a favorable legislative, economic, and political environment to support local initiatives. Collaborations between farmers, herders, research and extension structures should also be favored to support the development and dissemination of innovations.

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