Ecosystem services management: An analysis of stakeholders' perceptions in Thiou, Yatenga Province, Burkina Faso

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Ecosystem services management: An analysis of stakeholders' perceptions in Thiou, Yatenga Province, Burkina Faso

Viviane Yameogo

International Livestock Research Institute (ILRI)

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Patron: Professor Peter C Doherty AC, FAA, FRS
Animal scientist, Nobel Prize Laureate for Physiology or Medicine–1996

Box 30709, Nairobi 00100 Kenya
Phone +254 20 422 3000
Fax +254 20 422 3001
Email ilri-kenya@cgiar.org

ilri.org
better lives through livestock

ILRI is a member of the CGIAR Consortium

Box 5689, Addis Ababa, Ethiopia
Phone +251 11 617 2000
Fax +251 11 667 6923
Email ilri-ethiopia@cgiar.org

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Acronyms

APESS	Association pour la Promotion de l'Elevage au Sahel et en Savane
CLE	Comité Local de L'eau
EGS	Ecosystem Goods and Services
FNGN	Fédération Nationale des Groupements Naam
ICS	Improved Cooking Stoves
NGO	Non Governmental Organization
UNEP	United Nations Environment Program

Executive summary

The sustainability of the livelihoods of pastoralists and smallholder farmers in rural areas in West Africa is intrinsically linked to the supply of ecosystem services—the benefits provided by the natural environment to human beings (Millennium Ecosystem Assessment, 2005). In dryland areas such as Yatenga province of Burkina Faso, rapid demographic growth together with climate variability, limited opportunities for resource replacement (i.e.: fuelwood versus fossil fuel products), and weak governance, make the rural poor highly dependent upon ecosystem services and thus more vulnerable to decreases in these services (UNEP, 2012).

Communities in the Yatenga province of Burkina Faso are mostly agro-pastoralists and depend on rangeland resources for agricultural and herding activities. Indeed, rangelands provide a vast array of ecosystem services that benefit not only livestock production but also agriculture. However, over the years, the services offered by rangelands have declined, due to factors such as insecure tenure and poor management practices. On analysing the impacts of rangeland degradation on livelihoods, Kassahun et. al (2008) found that mismanagement of rangeland resources have caused severe damage to these resources, leading to a decline in a variety of services that are often unique and difficult to replicate.

For this report, a qualitative assessment of stakeholders' preferences and perceptions of ecosystem services was carried out in Thiou, in Yatenga province. Within the Enhancing the Value of Ecosystem Services in Pastoral Systems (EVESPS) project, we focused on the current state of ecosystem services, the threats to the sustainable use of such resources, the best feasible strategies that can be implemented for a better management of ecosystem services, from the perspective of different stakeholders. This was done through focus group discussions with relevant stakeholder groups, including farmers, herders, vegetable growers, traditional miners, and government extension services. We also looked at the issue from a gender perspective, trying to identify differences in perceptions between men and women. Results from this qualitative assessment showed an increasing awareness of the decline in ecosystem services and the risks associated with certain anthropogenic practices. It also emphasized the importance of water, land and forests in sustaining livelihoods in this community and showed positive attitudes towards conservation of natural resources. However, perceptions and preferences varied among different stakeholder groups. For provisioning services from forests, women put much greater emphasis on non-timber forest products than men. Men tended to rate the provision of forage from pasture areas as the most important ecosystem service provided by rangeland areas; women on the other hand, while recognizing forage as very important, did not assign it the overarching importance that men did. As for preferences related to management options, women prioritized actions to support the provision of water for domestic use, whereas men put more emphasis on water for livestock use and livestock corridors.

Respondents in this study, of all stakeholder groups, had a high level of awareness of the importance of management of ecosystems and looked favourably on the implementation of management actions. However, the needs of livelihoods often trump environmental protection even when the awareness is high. Another challenge relates to tenure and the way in which access to land and permission to clear land is granted. The current system favours the cultivation, and the use of land for grazing, which has the potential to maintain ecosystem services, is subject conversion of land crop agriculture.

Preface

Enhancing the Value of Ecosystem Services in Pastoral Systems (EVESPS) project is implemented by the International Livestock Research Institute (ILRI) under the umbrella of the CGIAR Research Program on Water, Land and Ecosystems, led by the International Water Management Institute (IWMI). The overarching goal of the project is to improve land management planning at the local, landscape and watershed scales through identification of long-term grazing and rangeland management options that will strengthen pastoralists' livelihoods. The project works through participatory engagement to increase information use and stakeholder awareness on role of ecosystems services.

Quantitative modeling of ecosystem services prioritized by stakeholders will be used in the analysis carried out by the project. The intended outcome is for decision-makers from local to landscape and watershed scales to be better informed on implementation of options for improving management and productivity of rangelands that are likely to affect landscape-level delivery of priority ecosystem services. In addition, the project seeks to contribute a livestock and rangelands perspective to ecosystem services analysis, including refinement of existing models, to more adequately capture ecosystem service flows within and from rangelands.

This report describes the findings of a study that assessed the ecosystem services that are most valued within Yatenga Province, Burkina Faso, the options for management of natural resources and ecosystem services that are implemented, and stakeholder preferences and perceptions of management options. The report also evaluates factors that are likely to influence the implementation of the various management options, as well as gender-specific perceptions on all these matters.

Introduction

An ecosystem is a dynamic complex of plant, animal, and microorganism communities and the nonliving environment, interacting as a functional unit. The services provided by ecosystems are the benefits people derive for their livelihoods and have value because they increase or decrease the satisfaction of human needs. The Millennium Ecosystem Assessment (2005) has grouped ecosystem services into four main categories, namely provisioning, regulating, supporting and cultural services (Millennium Ecosystem Assessment 2005).

Rangeland ecosystem services originate from complex social-ecological systems from which goods (eg. livestock and fodder production) and services (e.g. clean water) can be derived. They provide habitat for plant and animal species and as such constitutes an important pool of biodiversity. When rangelands are managed sustainably, they can provide a vast array of services of all four types (Table 1).

Pastoralism, as a system of mobile livestock rearing can play a significant role in maintaining ecosystem services. The herd management practices used by pastoralists have an influence on land through consumption of grasses and other plants, trampling, and breaking up of soil surfaces. This has an impact on the vegetation and fauna which may either increase, decline or change in composition as a result of the actions of herbivores. Moderate livestock grazing affects the diversity of species of flora and fauna in rangelands through trampling and consumption of some dominant species and can contribute to increases in biodiversity if well managed. Particular herd management practices can contribute to soil formation, soil fertility and soil carbon, and conservation of biodiversity.

In the West African Sahel and in Burkina Faso's Yatenga province in particular, subsistence for pastoralist and agropastoralist people depends heavily on the ecosystem services from rangelands, most obviously provisioning services in the form of forage for grazing livestock but other services as well. With a growing population and demand for land for other uses, the diversity of fauna and flora in rangelands is threatened. Open access to resources, associated with uncertainty around land tenure, and lack of strong rules and regulations governing the use of rangeland resources, have had a negative impact on ecosystem services and is threatening the resilience of ecosystem functions. High dependence of smallholder producers on ecosystem services renders their management critical for sustainable livelihoods and resilience in the face of climate change and variability.

Pastoralism plays a major role in the economies of West African countries in general and particularly in the Sahel where it contributes widely in the food security and nutritional diversity of the population and the fight against poverty. This sector contributes to nearly 12% of gross domestic product (GDP) of Burkina Faso, representing 25% of the revenues from exportation (ABC Burkina 2009), and constitutes a major source of revenue for large numbers of people in rural areas. In Burkina Faso, the "Loi n°034-2002/an portant loi d'orientation relative au pastoralisme au Burkina Faso" is a law that lays down the principles and conditions for sustainable development, peaceful and integrated pastoral, agropastoral and silvopastoral activity. The state and local governments guarantee pastoralists the right of access to grazing land, the right to equitable use of natural resources and herd mobility, and takes measures to improve productivity and quality of livestock and contributes to the identification, preservation and management of traditional grazing areas. Herders exploit natural resources in compliance with laws and regulations, including those relating to the environment and ensuring the integrity of others properties. In consultation with state and local authorities, their organizations are involved in the sustainable management of pastoral resources and safeguarding the environment. In areas allocated for pastures, herders have free access to rangeland resources. Yet, in local communities, in collaboration with herder's association and farmers' umbrella associations, they can be asked to

establish local rules for the management of resources. On paper, there are clear rules governing the use of rangelands yet reality on the ground is completely different. Grazing areas are occupied by expanding cropping fields and clearing of land for urbanization purpose (house construction, schools).

Table 1:Rangeland ecosystem services by category

Type of related ecological process	Tangible extracted goods	Tangible in situ services (and disservices)	Intangible in situ services (primarily perceptual)
Primarily biologic processes	Food for human consumption Food for livestock consumption Fiber Biofuels, feedstocks Fish and wildlife to catch and hunt Biochemicals Germ plasm	Ecologically transmitted diseases Ecologically transmitted pests	Wildlife and habitats to observe
Primarily hydrologic processes	Water for household use Water for human use in economic production	Floods affecting humans	Water bodies for recreation and tourism
Primarily atmospheric processes		Air humans breathe Air temperature and humidity Precipitation on humans	
Multiple processes	Ornamental resources Ceremonial items		Views and scenes to observe Culturally or spiritually signifcant sites to observe Historically or archeologically signifcant sites to observe Sites/areas for recreation and tourism. Scientifcally signifcant sites to observe
Type of related ecological process	Tangible extracted goods	Tangible in situ services (and disservices)	Intangible in situ services (primarily perceptual)
Physical processes			
Geologic	Minerals	Earth movements and volcanic eruptions affecting humans	
Atmospheric	Wind energy	Wind directly affecting humans Atmospherically transported chemicals and particulates	
Hydrologic	Hydropower		
Miscellaneous	Solar energy	Insolation for human tanning	

Source: Maczo et al. 2011

Problem statement

Managing natural resources and ecosystem services is not merely a technical exercise. Demand for ecosystem services varies from one stakeholder group to the other and the perceived benefits derived from a particular ecosystem will vary from one person to the other, and from one time to the other based on individual and social values. Also, what people perceive about the condition of the services is important, as it may influence their attitudes and behaviour towards such services. Attitudes about management options can also vary. Implementing management options that will be effective and viable requires a better understanding of the perceptions of diverse stakeholders about the resources and the importance they each attach to different resources, as well as their perceptions of different management options. An improved understanding of these perceptions can help inform better policy and strategies for resources management in the communities. The involvement of stakeholders at an early stage of the development of management options is crucial to creating a conducive environment for acceptance and adoption of best practices, critical for a sound and sustainable management of ecosystem services. This study seeks to identify the preferences, perspectives and interests of farmers, livestock herders, women, extension service workers and local administrators, and traditional miners in relation to different ecosystem services and management options in order to better inform decision making for the management of pastoral systems in Yatenga.

Specific objectives of this study were: i) to examine stakeholders' perceptions of and interests in different types of ecosystem services derived from rangelands, ii) to examine stakeholders' preferences for different management options for rangeland resources and ecosystem services, and iii) to identify and analyse differences in preferences, perceptions, and interests among various social groups. Ultimately, the study aims to contribute to effective management of natural resources and ecosystem services at the local level and to the scaling-up of the best management and cost-effective options at the provincial level.

Study site and methods

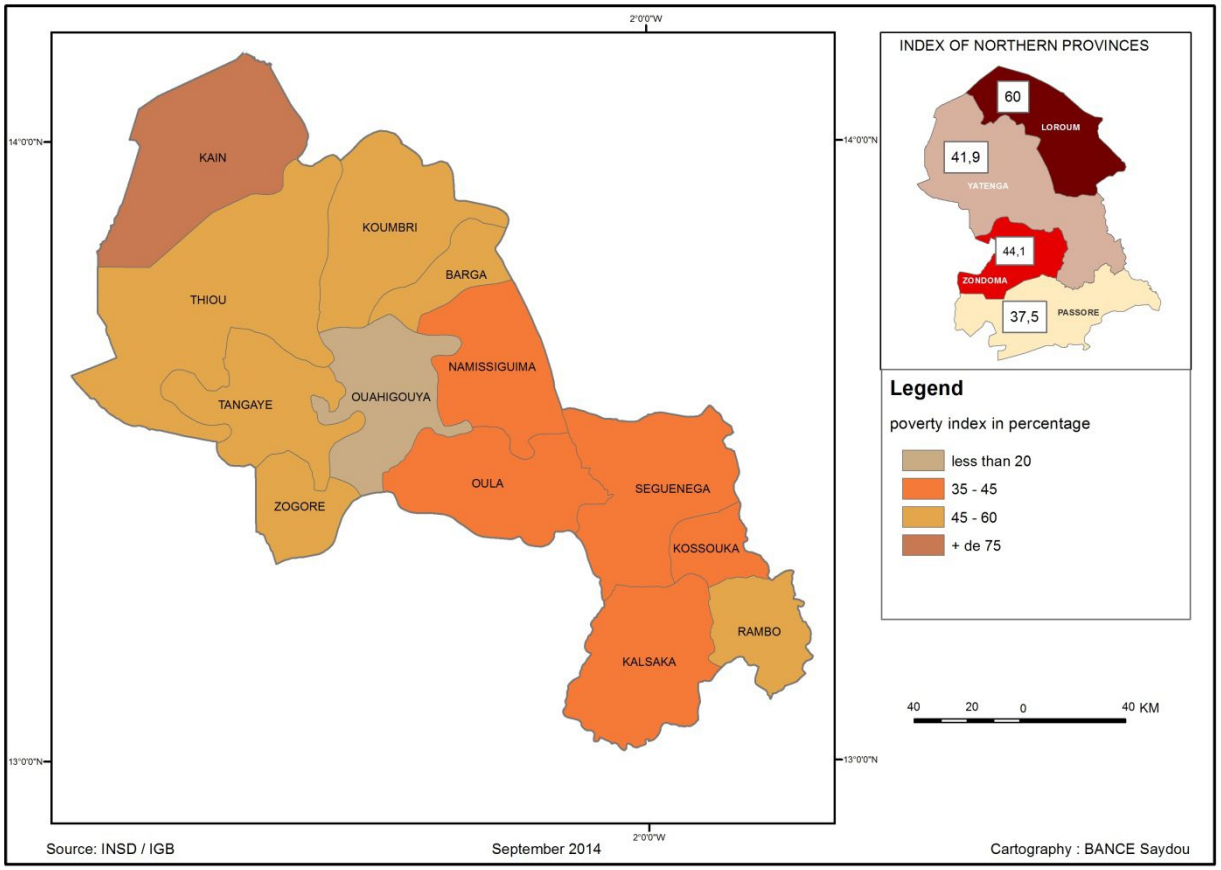
Study site

Yatenga province (Figure 1), located in the northern region of Burkina Faso, about 180 km from the capital, was selected as the study site for our analysis. The climate in this province is characterized by a dry season from October to May and a rainy season spanning between June and September. With an annual rainfall ranging from 400 to 600 mm, and an erratic spatio-temporal distribution of the rain, the province is facing major challenges in terms of natural resources productivity and ecosystem services protection. Considering that agriculture is mostly rainfed, the lack of water due to low rainfalls constitutes a major constraint to production and sustainable livelihoods in the province.

Cultivated land is relatively poor, with low-water retention capacity. The adverse effects of overgrazing, combined with hydrological and wind erosion, have contributed to a decline in soil fertility, and a reduction in the ecosystem services derived from the environment thus leading to a reduction in the vegetation cover. Agriculture, inappropriate herding practices, and excessive tree felling are believed to be major factors of land degradation.

Cohabiting in this changing environment are three major socio-ethnic groups comprising the Mossi, the Fulani and the Dogon. Thiou is predominantly occupied by the Mossi who represent the largest proportion of the population in the community. On a traditional basis, the Mossi and Dogon are mainly farmers and the Fulani are mainly pastoralists. Nowadays, uncertainty about rainfall, combined with demographic pressure and climate variability have changed these patterns. The Mossi, the Dogon and the Fulani gradually moved from an exclusively agricultural or livestock system to coupling crop

Figure 1: Poverty index in Yatenga Province (showing the location of Thiou).



Source: INSD/IGB (2014).

production and livestock rearing. This is an adaptation strategy developed by local communities in response to potential losses associated with drought incidence and animal disease outbreak. Yet, the degree of involvement in each activity vary among these ethnic groups, with the Fulani investing more in livestock rearing and the Mossi and Dogon in agriculture. In terms of livestock size, the Fulani own the largest number of livestock heads, including cattle, sheep and goats. Cattle are highly valued in the Fulani community, both as a sign of social status but also for their milk. The Mossi and Dogon own fewer cattle and a few small ruminants, meant for fattening in most cases. Quite often, livestock, especially cattle, are given to a Fulani herder to manage them during the rainy season to avoid damages to cropping fields. There are also arrangements made with some Fulani herders to settle on some cropping fields during the dry season to fertilize soils with manure. These arrangements either entail monetary payments or "manure for food" agreements.

Discussions with community members during focus groups revealed that the three ethnic groups cohabit peacefully in the community. Some conflicts do arise from damages caused by livestock into cropping fields but they are settled amicably or at a higher level (chief of village or commune officer) depending on the extent of the dispute.

This study was carried out in the Thiou commune of Yatenga province, where pastoralism plays an important role in people's livelihoods and where ecosystem services are threatened by increased exploitation and pressure from anthropic actions. In this study, we assessed the views and perceptions of local people leaving around the pastoral zone, in Thiou, in the Yatenga province, in the northern region of Burkina Faso, with special focus on the ecosystem services and the benefits derived by local populations from these services.

The importance of the pastoral zone in Thiou, Yatenga province

Livestock plays a critical role in sustaining livelihoods in Thiou but the scarcity of livestock feed combined with the lack of water, constitutes a major constraint to livestock productivity in the commune. Established in 2003, the pastoral zone was created to address issues relating to fodder availability and livestock management during the rainy season. With an area of 19,000 ha, the pastoral zone was created under the initiative of Association pour la Promotion de l'Elevage au Sahel et en Savane (APESS) with the support of the government of Burkina Faso through the Ministry of Livestock Resources. All stakeholders, including farmers, herders, government officials and traditional leaders were associated for the creation of the pastoral zone and this ensured consensus among all actors affected by establishment of the pastoral zone.

This area, exclusively allocated for pastoral activities, has one vaccination park and one functioning borehole for water supply. APESS in collaboration with local communities has initiated the rehabilitation of the pastoral area through soil restoration techniques, including stone bunds and small water harvesting pits for planting (zai), reseeding and fencing of areas of land to allow regeneration of vegetation. The pastoral zone is also important for livestock management during cropping season and reduces conflicts between livestock keepers and farmers. The presence of the pastoral area in Thiou, thus informed our choice of this community for investigation of stakeholders' perceptions on ecosystem services.

Methods

The data collected in the course of this study are based on a series of focus group discussions, individual interviews, and a workshop with relevant stakeholders. The main target groups considered for this study were farmers, livestock keepers, women and traditional miners.

The workshop gathered representatives from the ministries of livestock, environment and agriculture as well as 35 participants from farmers' and herders' associations, Fédération Nationale des Groupements Naam (FNGN) and APESS. Participants from extension services and local administration also attended the meeting.

Four focus groups were conducted, each representing a different stakeholder group. The identification of types of stakeholder groups was guided by the main activities that were observed around the pastoral zone and which may have an impact on the sustainability of ecosystem services in the area, and benefited from advice from local administration and extension officers on the relevant stakeholders to interview on the issue of natural resources management. It is important to note that unlike in some parts of Africa where communities are either pastoralists or farmers, the case in Yatenga province is different. Here, livestock rearing and cultivation are integrated, with most people involved in both. The focus groups were organized based on the degree of involvement in a given activity, be it livestock rearing or farming. Therefore, for this study the main social clusters we investigated were the farmers, livestock keepers, women and the traditional miners (Table 2). A separate focus group for women was held to ensure their active participation during the discussions and to capture gender-based differences. About ten participants from each stakeholder group were invited to take part in the focus group discussions. Participant in each stakeholder group were selected based on their local ecological knowledge, their membership to a farmers' or livestock association, their role and/or importance in the community (traditional leader, local administrative representative at the village scale), and their degree of involvement in a given activity. The focus groups were mixed, including participants from the main ethnic groups, the Mossi, the Fulani and the Dogon.

Table 2: Stakeholder groups represented in the study

Focus Group	Date	Number of participants
Male farmers	14/03/2016	10
Women	14/03/2016	10
Male livestock keepers	15/03/2016	12
Traditional miners	15/03/2016	10

The group of livestock stakeholders consisted of members of APESS, a well-established herders' umbrella association, which provides advice and guidance with regard to livestock keeping and natural resource management. The organization played a critical role in the establishment of the pastoral zone in Thiou.

The group of farmers brought together members of FNGN, a farmers' umbrella organization for the promotion of new agricultural technologies and guidance and training on specific agricultural practices. Farmers who practiced off-season activities (like vegetable production) also took part in this focus group discussion.

Traditional miners are an important social group in this community. It was important to capture their perceptions and their views on the ecosystem services and how their activities may influence the sustainability of these resources.

In order to get a perspective from local government and extension services, interviews were conducted with representatives of the ministries of livestock resources and Environment. Subsequently, individual interviews were conducted with relevant stakeholders to get a better insight into some of the issues and to avoid bias. Some of the subjects covered were the current state of natural resources and future vision, the role that local stakeholders can play in achieving the future vision, the potential constraints to implementation of management and the role of policy makers in ensuring that proposed management options arising from stakeholders discussions are carried out effectively. A total of 11 semi-structured interviews were conducted with two farmers in Mossi (one wealthy, one poor), two farmers in Fulani (one wealthy and one poor), one farmer in Dogon, the president of APESS, two members of the Koglweogo (literally meaning "forest protectors"), one technical agent from the ministries of Environment, one technical agent from the ministry of livestock resources, and the local administrative representative.

Findings

Stakeholder identification of ecosystem services

The workshop and focus group discussions provided a ground for discussions on the current state of ecosystem services as perceived by stake` a summary of the discussions during the workshop and during focus group discussions with clusters of stakeholders.

Table 3: Ecosystem services and drivers of change

Millennium ecosystem assessment category	Ecosystem Resource	Ecosystem Goods & Services	Drivers of change
Provisioning services	Forests	Food Fuelwood Fiber Fodder Non-timber forest products Habitat for wildlife Construction Medicinal products	Intensive tree cutting Bush fires Population growth Climate change and variability
	Land	Mining Crop production Habitat Livestock corridors	Climate change Mining Expansion of cropping fields Livestock mobility Pollution Land use patterns Erosion
	Water	Livestock watering Vegetable production Fishing Household shores Brick manufacturing	Deforestation Pollution Erosion
	Pastures	Fodder Habitat Biodiversity	Overgrazing Free ranging Deforestation Bush fires

Millennium ecosystem assessment category	Ecosystem Resource	Ecosystem Goods & Services	Drivers of change
Regulatory services	Forests	Climate modulation Rainfall regulation Carbon sequestration Water and air purification Waste treatment Flood control	Deforestation Climate change Bush fires Pruning
	Pastures	Water regulation Flood control	Deforestation Livestock mobility
	Land	Water regulation Groundwater recharge	Climate change Pollution Deforestation Erosion
	Water	Flood and disease control	Siltation Pollution Deforestation
Supporting services	Forests	Erosion control Soil formation Nutrient cycling Pollination Flood regulation	Erosion Deforestation Agricultural practices Intensive tree cutting Bush fires
	Land	Nutrient cycling Soil formation Flood regulation Accumulation of organic matter	Grazing patterns Land use patterns Pollution (plastic bags) Deforestation Erosion
	Pastures	Nutrient cycling	Livestock mobility Deforestation
Cultural services	Forests	Handicraft Cultural practices (shrines) Medicinal products Aesthetic	Deforestation Urbanization
	Pastures	Aesthetic Cultural practices	Deforestation Erosion
	Water	Recreation	Deforestation

Forests present economic/utilitarian values in the sense that it provides services such as non-timber forest products or medicinal products which can be used by community members as supplementary foods and as a source of protein. These resources are also important for women as they are dependent upon forests for households energy needs. Religious and spiritual values are also attached to forests. Indeed some people believe that forests are habitats to an invisible world and before cutting some trees you have to show respect to the ancestors. In addition, the aesthetic value of forests was mentioned by stakeholders as a desirable benefit.

The role that forests play in regulating the climate has been highlighted during discussions with participants at the different focus groups discussions. They reported that forests have impact on rainfall patterns and that efforts should be made to conserve such resources. In addition, leaves that fall from trees are enriching the soil and contributes to nutrient cycling and improvements in soil fertility. This in turn increases the production of biomass in the forests areas and maintains soil formation.

The role of forests in regulating water flows in the community has also been emphasized by respondents. By constituting barriers to runoffs, forests are maintaining the sediments and nutrients in the soils and decelerate water movement, thus reducing hydrological related erosion.

Pastures play a critical role in sustaining agro-pastoral systems in Thiou. By providing resources for livestock production, such as fodder, herbaceous and ligneous biomass for livestock consumption, pastures were highly valued by stakeholders, especially herders. The administrative officer and extension service agents of livestock and environment have stressed the importance of pastures in providing habitat for fauna and diverse flora species. Stakeholders also reported that pastures are contributing to regulation of water flows in the community and water infiltration into the soil. The main services provided by the pastoral zone were: fodder, leaves, water for livestock watering, dugouts as well as biodiversity of flora and fauna. The significance of this zone in providing habitat for livestock during the rainy season has been reported by stakeholders.

Land was also cited as a resource in the community. With growing population, land has become scarce leading to increased pressure on land resources; there is little fallow land and the quality of cultivated land is low. Stakeholders mapping of ecosystem resources revealed that degraded land was occupying a large surface in the community. They attributed this to wind and water related erosion. Farmers and herders revealed preferences for land and highlighted the importance of this resource in sustaining their livelihoods through agricultural production. Traditional miners also exhibited preference for land resources as it is their source of revenue through mining activities. Stakeholders highlighted the importance of land in providing habitat for micronutrients which contributes to soil fertility.

Finally, stakeholders mapped water resources in the community. These included small reservoirs, boreholes, traditional wells, standing pools and a few dugouts. The services offered by these water resources ranged from economic services (e.g. vegetable production) to ecological and socio-cultural services (e.g. flood control). These resources play a critical role in households activities such as laundry, dish washing, cleaning but also contributes to income provision through activities such as vegetable production and fishing. It also provided recreational service, especially for children who sometimes swim.

Table 4 below depicts stakeholders' interests of various ecosystem services. There were little differences between stakeholders interests considering that most of them are agro-pastoralists. As already discussed the main ecosystem resources identified during focus group discussions were land, water, pasture and forests.

Table 4: Summary of stakeholders' interests for identified ecosystem resources

Stakeholder group	Forests	Water	Land	Pasture
Herders	✓	✓	✓	✓
Farmers	✓	✓	✓	
Traditional miners			✓	✓
Women	✓	✓		✓
Farmers' and herders' associations	✓	✓		
Livestock extension service		✓		✓
Local administration	✓			
Environment extension service	✓	✓		

Stakeholders preferences

Integrating stakeholder preferences into management of ecosystem services is a critical issue in planning and decision making processes for sound implementation of management options. Our study highlighted disparities and similarities in preferences for various ecosystem resource among different stakeholder groups. These differences/similarities were mainly determined by the perceived benefits that the preferred ecosystem service offered to the stakeholder group.

Farmers

Farmers reported that land was the ecosystem resource that held the most value to them. By providing a ground for food production, which their subsistence highly depend upon, land represents a central component in livelihood sustainability for farmers. The supporting services offered by land, including soil formation and nutrient cycling are essential for crop production and productivity. Management options that contribute to enhancing services offered by land such as water harvesting techniques such as zai and stone-bunds as well as sustainable intensification practices are most preferred by farmers as a strategy.

Water was the second most preferred ecosystem resource identified by farmers. Agriculture in Yatenga province being mostly rainfed, rainfall patterns and distribution are critical to crop production. Farmers involved in off-season activities such as vegetable production also value water for the economic service it provides. Farming activities around water pans have contributed to generating extra cash for communities in Thiou. The other services provided by water, including fish, clean water for drinking and water for livestock, have been mentioned by farmers as important services that contribute to sustaining their livelihood.

Forests are the third most valued ecosystem resource identified by farmers. Farmers highlighted the importance of forests in regulating the climate, i.e. rainfall pattern and distribution and recognized the impact that forests played in supporting services by contributing to soil formation and soil fertility. Many farmers are involved in agroforestry practices such as farmer managed natural regeneration practices and the benefit of such practices have been highlighted by farmers, including soil fertility improvement, and water retention capacity. In addition to the regulating services provided by forests, farmers stressed the importance of this resource in food provision and other non-timber forest products which benefit communities. The aesthetic value of forests was also reported by respondents.

Herders

Like farmers, herders identified land as the most preferred ecosystem resource. Farmers, herders and traditional miners identified land as the most preferred resource. Women on the other hand reported water as their most preferred ecosystem resource.

Water is the second most preferred resource for livestock herders, and was identified as a major constraint to livestock production. Herders reported that lack of water resources influenced their decision to invest in livestock resources. Access to water points is restricted and often few sources of water are available for livestock watering throughout the year. Management options identified by this stakeholder group was influenced by water accessibility and availability. Dugouts and pastoral wells were identified as the most preferred water sources for livestock watering.

The choice of pasture is influenced by water availability around grazing areas. Pastures were the third most important resource for herders. They highlighted the provisioning services offered by pastures including palatable biomass for livestock consumption such as fodder.

Traditional miners and women

Traditional miners also reported land as their most preferred ecosystem resource. By providing ground for mineral production, this resource is crucial to maintaining their livelihoods. Water was also identified as a valued resource by traditional mining. This serves to clean the sand in search for gold. Women identified water, forests, and pastures as the most preferred ecosystem resources respectively. In subsequent sections we will provide details of women's perceptions of ecosystem resources and their management.

Threats to ecosystem services in Thiou

Both natural and anthropogenic factors have been identified as threats to the sustainability of ecosystem services in Thiou. Participants stressed the consequences of human action on ecosystem services available in the commune and highlighted the impact of some of the practices that contribute to the decline in the services offered by existing ecosystems. The main challenges and practices undermining the sustainability of ecosystem services in Thiou are described below.

Deforestation

Communities in Thiou heavily depend on wood fuel as a source of energy and rely on available forests to meet these needs. Over the years, tree felling has been a common practice in these communities and the decline in available forests has worsened the situation. Moreover, high demographic growth not only induced higher demand for wood fuel, but also increased the need for larger cropping fields to meet the food needs of a higher number of individuals. The clearing of forest areas to expand cropping fields has significantly reduced the vegetation cover in Thiou.

'Farmers are causing severe damage to the forests. They get permits for clearing from the environment extension service but the underlying motive is to sell the wood collected and make money. However, a herder will be fined if he is found pruning a tree.'

A livestock herder

This view point was supported by the APESS president who is also the chief of Thiou. He asserts that permits issued by the environment extension service allowing some farmers to clear land to expand agricultural fields, have adverse effects on the environment. There is no clarity around the number of trees that can or should be cut and even though it may be clearly stated, the authorization only refers to dry wood, but people cut enormous quantities of fresh wood that they would eventually sell.

'Sensitization has not proved effective in reducing tree cutting in Thiou. The government should use coercive methods and promote the use of alternative sources of energy, like gas and bio digesters'

President of APESS

Pollution

The use of cyanide in mining quarries has adverse consequences on the environment and the surrounding ecosystem services. Land surrounding such quarries are polluted and standing water points, and the water table are being contaminated by toxic products. The consequence is high mortality of livestock and risks of diseases caused by chemical products.

We are conscious that our activities, and more importantly the use of cyanide, are causing some damage to the environment but we do not have any alternative chemical product. Besides, this is a major source of revenue for our families and giving up on this activity will jeopardize our livelihoods.

A participant during discussions with traditional miners

Plastic bags have been identified as a huge threat to the ecosystem services in Thiou. Many plastic sachets are drained into existing water points and even clogs some of the draining pipes. Livestock herders also reported that plastic bags are a major cause of livestock mortality in the village.

'The widespread use of plastic bags in the village has considerably changed the landscape in the village and causes lots of damage and pollution to the environment. Our animals are dying because they are swallowing these plastic bags.'

A livestock herder

Siltation/pollution of water pans

Sources of water in Yatenga province are diverse. Stakeholders have identified wells, dug-outs, small reservoirs and boreholes as sources of water for human consumption and livestock watering. However, the past years have been characterized by some entropic activities that contributed significantly to the deterioration/depletion of these natural resources. Among others, the use of pesticides for agriculture, manufacturing of mud bricks around rivers banks, vegetable production in the river bed, are all factors that reduce the storage capacity of water resources, thus increasing the scarcity of water. It must be noted that in the case of small reservoirs, livestock can cause damage while walking on the banks of the water.

'Vegetable producers are not respecting the minimum distance from the reservoir's banks. They are literally producing in the river beds and this reduces the amount of water available every year. If the status quo remains, this small reservoir will dry up.'

A farmer from the farmers focus group

Land degradation/ erosion

Over the years, populations in Yatenga province have experienced rapid land degradation mainly attributed to wind and hydrological erosion. The spectacular forms of erosion are the current result of a long spiral of degradation. With increasing demographic growth and rise in livestock size in the community over the years, there was a need to expand cropping fields, clear increasingly fragile land, and reduce fallows and rangelands. This led to overgrazing, which reduces the biomass necessary for humidification and compacts the soil. Overgrazing represents a major concern for rangelands sustainability in Yatenga province, and in Thiou in particular. Existing traditional rules do not define clear rules on the use of pastures and no well-established rangeland management system exists in the community. Stakeholders have acknowledged that reduction of the vegetation cover has increased wind and water related erosion as most soils are now bare lands with little water retention capacity. Runoffs are causing decline in soil nutrients leading to reduced soil fertility.

Options for management of rangeland resources and ecosystem services

Ecosystem services management requires participation of all stakeholders and the definition of clear management options to ensure compliance by relevant actors and enforcement of rules and regulations that emerge from stakeholders interactions.

Sound measures should be taken to enhance the positive impacts of stakeholders' actions on ecosystem services and to mitigate consequences of the decline in the services offered by ecosystems. Some of the cross-cutting interventions identified by stakeholders for the improvement of ecosystem services in Thiou are listed below.

Sensitization of communities/relevant stakeholders

Sensitization was raised by all stakeholders and emerged as a cross-cutting strategy towards implementation and ownership of identified ecosystem management options. Many respondents feel that the implementation of sound ecosystem management options should be preceded by campaigns to sensitize populations on the issues of ecosystem conservation and management. Pictures or images comparing current state of resources to former states over past years can also be used as instruments of sensitization, including images showing examples where unsustainable practices have led to a loss of natural resources and biodiversity.

Payment for ecosystem services

Restricting the use of natural resources in exchange of a monetary payment could lead to behaviour change towards use of ecosystem services. The president of APESS argues that the public nature of

'Sensitizing communities is a prerequisite to ensuring a sustainable ecosystem management. Until people understand the need and the emergency to protect the resources they derive benefits from, other actions taken in this regard will be useless.'

Extension service agent, Livestock Resources.

some of the ecosystem services hinders actions aimed at protecting these services. Several respondents are concerned about free riding and people not understanding the value of some of the resources, and suggested that people should be required to know the need to contribute something to be allowed access to such resources.

'The use of some ecosystem services should be conditioned by payment of a certain amount of money. I believe this will contribute to a rational use of these resources.'

President of APESS

Compared to ten or twenty years ago, stakeholders recognize the huge difference that exists in terms of available natural resources.

The president of APESS suggested that payments for ecosystem services be used as a mechanism for supporting natural resources management and conservation of ecosystem resources.

Rehabilitation/establishment of livestock corridors

Many of the livestock corridors were established on a consensual basis but are now occupied by cropping fields. The rehabilitation of livestock corridors will improve livestock mobility and reduce conflicts between herders and farmers. Stakeholders suggested the involvement of land owners in the negotiation process to ensure that delineations are well

respected. Better livestock mobility is believed to increase biodiversity through transport of species from one place to the other. By breaking the surface of the soil, livestock also contribute to improving supporting services.

Promotion of alternative sources of energy

Tree felling constitutes a major challenge for local authorities and despite the efforts employed towards raising awareness on the adverse consequences of uncontrolled tree felling, the practice has not stopped in the community. In an effort to reduce abusive tree cutting, government has encouraged the use of alternative sources of energy, such as gas stoves, which have not yet received strong adhesion by the population.

An alternative option for reducing wood consumption is the promotion of improved stoves, which have proven effective in optimizing the use of wood and has also reduced women's burden for wood collection.

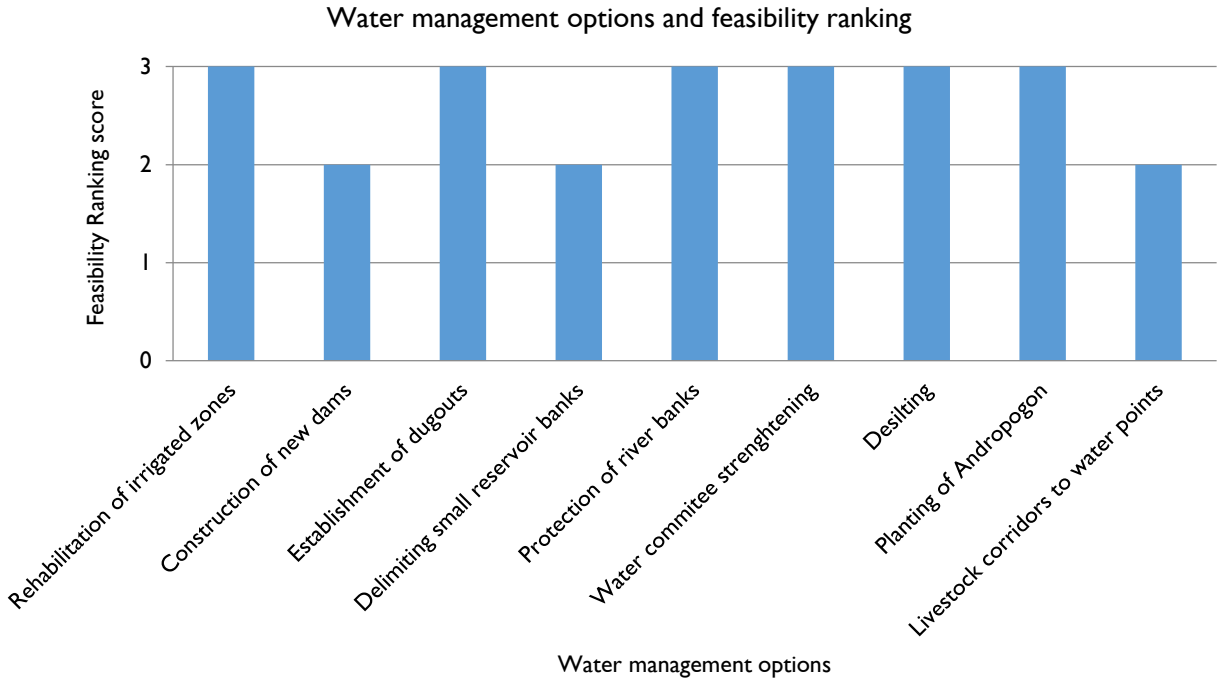
Implementation/strengthening of management committees

Existing water committees like CLEs (Comité Local de l'Eau) and local forest management committees like the Koglweogo (literally meaning "forests protectors") have been inefficient so far in assuring sustainable use of resources in the community. Low capacity in terms of resources and knowledge restrains these committees in their daily activities. The CLEs recognize they are powerless in enforcing the rules and regulations governing the use and management of water resources. Providing such organizations with sufficient skills and empowering them can contribute to sustainable use of water resources and preservation of biodiversity.

Management options and feasibility scoring

The graphs below provide an overview of stakeholders proposed management options for each category of ecosystem services with corresponding feasibility scoring on a scale of 3 where 0 indicates "impossible to implement" and 3 indicates "easy to implement" .

Figure 2: Water management options and feasibility scoring.



Water

Water was identified as a critical resource for livelihood sustainability in the community. Lack of water for livestock watering constitutes a major constraint for livestock herders especially during the dry season when most water sources have dried up. Off-season activities, characterized mainly by vegetable production around small reservoirs, have caused some damage to these water pans. We observe adverse behaviours, with people producing in the river beds. Moreover, livestock access to these water points is restricted as routes to water points are occupied by cropping fields. Water management requires involvement of local communities. Rehabilitation and protection of water catchments is believed to enhance vegetable production and thus the food provisioning capacity of the resource. This type of water catchment are also important for providing fish for local communities and can create employment for youth.

Construction of new dams will create opportunities for clean water supply for people in the community and increase provisioning services such as fisheries. Dugouts are an important source of water for livestock. Establishing sufficient dugouts in the community will reduce the burden for watering animals and will help enhance provisioning services by limiting overstocking of livestock around scarce water points.

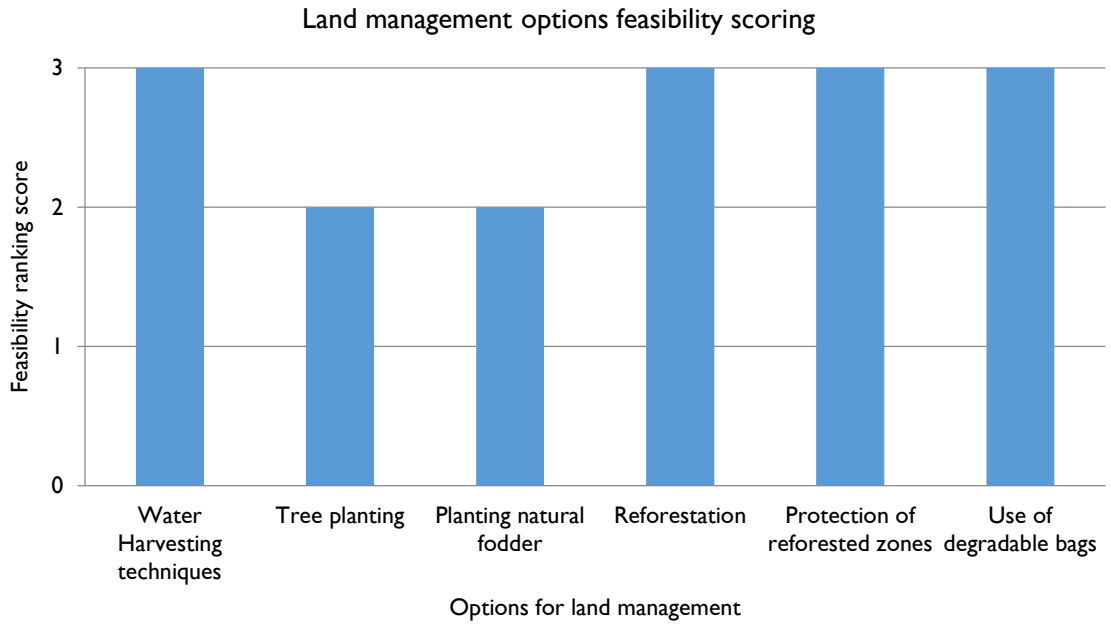
Discussion with herders on the issues of small reservoir siltation has raised the importance of protecting the water's banks. They suggested planting anti-erosive Andropogon live hedges around the reservoir's banks and believe this will in addition to reduced siltation, create habitat for some form of fauna and regulate water flows. By stopping the draining of sand into the reservoir, these live hedges will contribute to improved nutrient cycling and help in the water storage capacity of established reservoirs.

Pastures

Fodder scarcity for livestock feeding, and availability of water constitute major constraints for livestock production in Thiou. Lack of feed causes high pressure on the few resources left in the community with most livestock grazing on the same area. Besides, many livestock corridors that were created in the early independence are now occupied by farm cropping fields. This restricts livestock mobility in the villages and constitutes a major source of conflicts between herders and farm owners. During the dry season, livestock are kept around cropping fields, or no far than 1 to 2 kilometers from homesteads, but the rainy season is a great challenge for livestock management.

On the issue of pasture management, stakeholders stressed the importance of fodder production in improving services offered by pastures. Fodder production is linked to conservation techniques. By providing supplementary food to animals, pressure on grazing land is reduced and the biomass from pastures can replenish. APESS is already training farmers and herders on the techniques of fodder production and conservation methods. It also promotes the use of feed supplements to reduce demand for fresh biomass and reduce excessive pruning which can jeopardize the sustainability of forests resources. Both provisioning and cultural services are preserved and pastures resources can attain their reproduction capacity, enhancing regulating services and nutrient cycling. Rotational grazing was also presented as an ecosystem services management strategy (especially for pastures). Herders recognized the difficulty in implementing such management strategy considering that grazing areas are scarce in the community. Yet, they believe that such actions will allow parcels of grazing fields to replenish by reducing overstocking and enhancing nutrient cycling in spared areas.

Figure 3: Pasture management options and feasibility scoring.



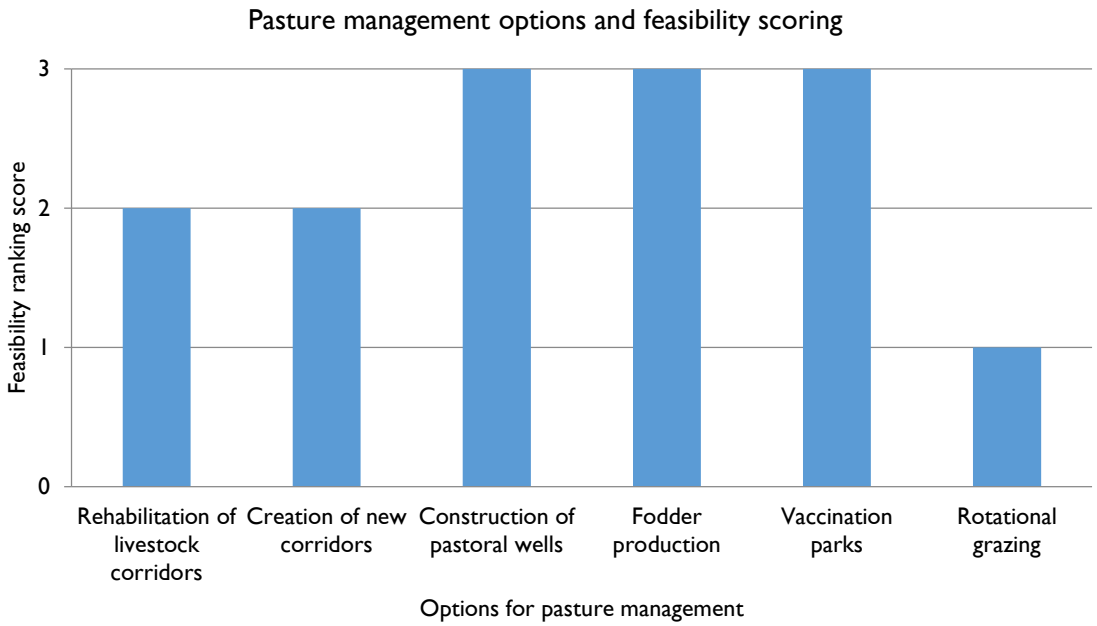
Land

Water harvesting techniques including zai (small water harvesting pits where planting can take place) and stone-bunds were said to improve water infiltration by providing barriers to runoffs. Stone bunds have already proved effective in influencing provisioning and supporting services with grass and shrubs growing around bunds and improvement in soil fertility through reduction in hydrological related soil erosion. By retaining soil nutriments in situ, stone bunds are improving nutrient cycling in the soil.

Stakeholders suggested the practice of fallowing as a strategy for reducing pressure on land. This will allow land to regenerate and increase supporting services by increasing the nutriments of the soil.

Improved fallowing, which involves fallow associated with planting of indigenous shrubs can also contribute to regulating soil formation and improving provisioning services.

Figure 4: Land management options and feasibility scoring



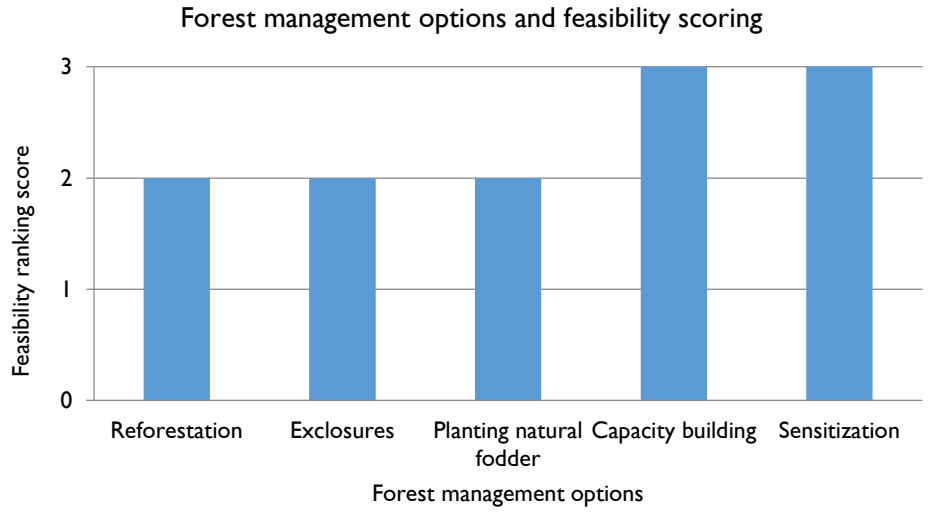
Forests

Tree planting to improve vegetation cover has been identified as important in improving ecosystem services through improved rainfall and increasing supply of fruits, non-timber forest products and providing recreational benefits and medicinal products in the community.

The use of improved cooking stoves (ICS) was also reported as a critical component of any forest conservation strategy. Wood fuel constitutes an important source of energy for households in the community and current prices of alternative sources of energy (like GLP) have not yet received widespread adoption by local communities. Introducing ICS in the community and encouraging/promoting the use of these technologies will reduce pressure on available forests resources and increase provisioning and regulating services by allowing forest to attain their replenishing capacity.

Women also suggested that land be allocated for establishment of Eucalyptus trees. This fast growing tree can be used as fuel for energy by households and thus reduce the burden on local species, some of which are threatened by extinction.

Figure 5: Forest management options and feasibility scoring.



The use of plastic bags, in addition to altering the landscape in the community has a negative impact on ecosystem services by emitting toxic products into the soil and restricted water flows in the community. Stakeholders have suggested the introduction of biodegradable bags associated with awareness raising on littering to limit the impact of plastic use on water flows and nutrient cycling.

Proposed management interventions and actors to involve in their implementation

The table below gives a summary of the proposed interventions and identifies the actors that should be responsible for their implementation.

Value that stakeholders attached to a given resource will depend on the benefits that they derive from their resource. Identifying potential beneficiaries of improvements in ecosystem services is therefore important for sound implementation of these interventions.

The perceived benefits associated with ecosystem management options proposed by stakeholders including the beneficiaries of such services and weight attached to each intervention are displayed below (Table 6)

Table 5: Roles and responsibilities of actors

Ecosystem resource	Proposed interventions	Actors to involve
Water -Small reservoirs -Boreholes -Wells	• Construction of new small reservoirs • Desilting existing small reservoirs • Protection of river banks • Establishment of pastoral wells • Strengthen capacity of local water committee • Construct dugouts • Promote the development of the water resources in Niende • Create livestock corridors from grazing fields to water points	• Government • Water management committees • NGOs
Pastures	• Improve access to dual purpose varieties • Collection and conservation of crop residues • Training on fodder conservation • Construction of fodder conservation infrastructures • Fodder production • Rehabilitate existing livestock corridors and delineate new ones • Establish vaccination parks • Stabulation	• Government • Local communities • NGOs • Extension services • Land owners

Ecosystem resource	Proposed interventions	Actors to involve
Forests	• Reforestation • Creation of nurseries • Farmer managed natural regeneration • Establishment of stone bunds at the macro level • Promote the use of improved stoves • Introduce alternative sources of energy, i.e gas. • Create buffer zones • Sensitization for monitoring of resources • Strengthen capacity of government extension service agents • Collective action	• Local communities • Government • NGOs • Landowners
Land	• Water harvesting techniques such as zai and stone bunds. • Promote the use of biodegradable bags • Delineate land for mining activities • Promote the use of alternative chemical products for treatment of metal • Fodder production	• Local communities • NGOs • Government

Table 6: Perceived benefits of interventions for better management of ecosystem services

Intervention	Benefits	Beneficiaries[1]
Establishment of livestock corridors	• Reduced conflict between livestock keepers and farmers • Improved livestock mobility	• Herders^{+++} • Farmers^{+}
Construction of dugouts/small reservoirs/boreholes	• Improved water availability/ accessibility • Increased revenues through vegetable production • Forage production • Livestock watering • Reduction in the burden of women	• Farmers^{+++} • Herders^{+++} • Women^{+++} • Vegetable producers^{+++}
Dual purpose varieties and vaccination parks	• Improved livestock productivity • Improved livestock health	• Herders^{+++}
Reforestation	• Increased vegetation cover • Improved/diversified nutrition • More wildlife animals • Improved water regulation	• Farmers^{++} • Herders^{+++} • Women^{+++}
Water harvesting techniques (zai, dugouts)	• Improved soil fertility • Improved water infiltration • Increased vegetation cover • Reduction in erosion	• Farmers^{+++} • Herders^{++}

[1]+++ Highly Beneficial ++Beneficial +Beneficial to some extent

Opportunities and constraints to the implementation of ecosystem management options

Consensus and acceptance are prerequisites for a smooth implementation of ecosystem services management options. Other factors, beyond the will of stakeholders are also to be taken under consideration. There should be a conducive environment for implementation of management options, as well as a political will and financial means. The following factors have been determined by stakeholders as important to the success in the implementation of the best ecosystem management options.

Governance

In general, local people perceptions on governance was rather critical. Land issues are a very sensitive topic in Burkina Faso at large, and in Thiou in particular. Land use management follows traditional rules and the existence of a strong land tenure system that makes decision regarding land use management, rather difficult.

The local administrative agent admits that government sometimes faces strong opposition from rural populations when it comes to issues relating to land. '*There have been cases of land disputes, where government favored one party at the expense of the other and this created an unsafe environment both for the local administrative agent and for the party that won the case* he asserts. According to the livestock extension service agent, until issues on land ownership are solved, with clear rules and regulations on land use, any strategy aiming at implementing management options, is deemed to fail. Landowners should be involved in all stages of the decision making process to ensure effective implementation of options that may arise.

'Local administrative agents are helpless on issues relating to land. Government often enacts laws that are difficult to implement in some contexts.'

Local administrative officer

Most of the rules and regulations governing the use of natural resources in Thiou are verbal. There exists no well-established local conventions guiding the management of natural resources and trespassers often go scot free after breaking the rules.

'Everyone knows each other in this community. It makes it difficult to report trespassers as they could be your cousin, brother, sister or mother. Reporting him would portray you as the bad person'.

A farmer during the focus group

Even for cases where trespassers are reported, fines are not high enough to create negative incentives for preventing such behaviours.

In addition, local traditional leaders should not be marginalized in the process of decision making. They play a critical role in the community and can influence behaviour change among community members. There have been cases where excluded traditional leaders in a dispute settlement have encouraged members of the community not to respect the decision taken by administration.

One key success tool is the involvement of traditional leaders in the community. In general, people respect their leaders, and they can influence behaviour/attitude change among stakeholders'.

Administrative officer

In addition, on the issue of governance, stakeholders highlighted the importance of enforcing laws and regulations passed in consensus in the community. This starts with written and signed conventions by all stakeholders and the establishment of coercive action for respect of established laws. Success in the implementation of management options will be determined by strong administrative power and clear definitions of the roles and responsibilities of all actors involved in the process.

Finally, the political economy of resource use should be closely considered. The strategies and decision taken at the country level can affect the use of natural resources. For instance creating property rights that would ensure efficient use of natural resources requires a coercive state that is capable of overcoming market failures and opportunistic behaviours. Political will is therefore a prerequisite for ensuring effective implementation of ecosystem goods and services management.

Mindset/behaviour change

Many stakeholders asserted that changing the mindset of people towards natural resources is critical to ensuring adoption of best management practices. First of all, there should be a sense of belonging for the natural resources available in the district. Until people understand or accept that these resources are a common heritage that should be treated sustainably, both for current and future generations, efforts to mitigate adverse behaviours will be vain.

We should also consider cultural habits. For many individuals in such communities, cooking with wood has a cultural value. They argued that the taste of some types of food cooked with fuelwood is better than the taste of food cooked with gas. This mindset that food would taste better if cooked with woodfuel is difficult, if not impossible, to change. But they suggested the use of improved stoves to optimize the use of fuelwood for cooking purposes. Women in particular have stressed the importance of such tool in improving their lives; not only does it reduce consumption of wood, but it also reduces health risks associated with emissions of smoke from firewood.

Obviously, poverty considerably affects people behaviour towards natural resources and serious consideration should be given to reducing poverty incidence in these communities. Women suggested the development of income generating activities, like Shea butter production, and employment opportunities for the youth.

'For ages, we have been cooking with fuelwood. We are not collecting wood for the sake of collecting wood, we just have no means for purchasing alternative sources of energy, like gas'.

A woman farmer

Often, in rural areas, like in Thiou, Yatenga province of Burkina Faso, decision making is made on short term basis. It is important to consider the trade-offs between long term benefits of sustainable practices and short term benefits of actual practices. This will help tailor interventions in such a way to reduce the opportunity costs of the management options that will be implemented.

Funding

Availability of funds can constitute a serious impediment to implementation of proposed management options. No matter the will of stakeholders, lack of funds can slow the process in the implementation of these resources. Most of the interventions proposed by stakeholders during discussions require funds for their realization. Yet, financial resources allocated for the functioning of the community are insufficient to implement such activities. One herder suggested that producers organize themselves into strong cooperatives to lobby for sponsoring of their activities. NGOs and development organizations have also been identified as possible fund raisers for successful implementation of project activities.

Stakeholder empowerment/capacity building

Successful implementation and long term efficiency of ecosystem management options, requires a level of understanding and knowledge from local stakeholders. If it fails to ensure that communities are trained effectively and acquire the necessary skills needed for maintenance of some of the infrastructures constructed, the likelihood of sustaining these infrastructures in the long run is very low. Stakeholders mentioned the case of tree nursery. Creation of nurseries for tree planting can be a good option for reforestation in Thiou. Involving communities in the establishment of such nurseries can instill a sense of belonging in them and increase the will to protect and maintain/ conserve such resources.

Collective action and stakeholder involvement

Often, the benefits of improvements in ecosystem services are reaped by the community at large. The public nature of such services can create an environment of free riding where some individuals will stay aside of all efforts aiming at improving supply of ecosystem services and still benefit from positive changes. Collective action is necessary to make things change and all stakeholders should participate in the process for implementation of best management practices.

Technical expertise

Many management options like construction of dams, dugouts, require technical expertise beyond the capacity of local communities. Stakeholders during the workshop highlighted that communities are willing to provide labour for the establishment of such infrastructures but until they get support from the experts and specialists in these field of activity, they cannot realize such plants.

Interest groups

Discussions with the local administrative officer and livestock technical agent have highlighted that some socio-economic groups may be more reluctant than others to some interventions especially in relation to pasture management. Livestock keepers are very enthusiastic on the issue of establishment of livestock corridors and will probably welcome any project working towards this end. However, *'willingness on the part of farmers to allocate parts of their cropping fields for the rehabilitation and/or establishment of livestock corridors is quite low',* says the livestock agent. Convincing farm holders of the necessity and relevance of reducing the size of their farm to allow for corridors to pass through will require strong sensitization. Such sensitization should be accompanied with introduction of technologies for sustainable agricultural intensification to compensate for loss in land size.

Vegetable producers could also be reluctant to some of the interventions proposed for water management, especially management of small reservoirs. Though they understand the drawbacks of some of the practices, like producing into the river beds, sensitization so far has not prevented them from continuing their negative practices. Discussions with herders highlighted that this group may be reluctant to allocating parcels of land for the establishment of livestock corridors. They suggest that vegetable producers be sensitized and coerced into respecting the rules and guidelines.

Gender dimensions in management of ecosystem services

In the rural settings in the West African Sahel, and in Yatenga province in particular, women are the main providers of water, food and energy for the households and are highly dependent upon supply of natural resources to sustain their livelihoods and that of their families. In such a situation, they are easily affected by changes in the provision of such goods and services. Even though women may have responsibilities for management of natural resources, they have no rights over them. Women's role in the management of natural resources have often been undervalued and their restricted access to land (which also provides rights to the use of other natural resources), reduces their participation in the decision making process relating to management of natural resources.

Quite often, women have little opportunities to participate in the decision regarding resources management. Their rights to access land and other natural resources is influenced by socio-economic, institutional and religious factors. Such restrictions have limited women's capacity to express their perceptions (ideas, views and suggestions) on many issues relating to environmental resource management. Thus, in order to ensure sound implementation of management options, women should be included in the decision making processes at all levels.

Women in Thiou are involved in all the stages of the production chain and play a very important role in food provisioning. Yet, they have little decision making power on the distribution of the benefits from such production.

'I have no control over the harvest products. I am just responsible for preparing the food..'

Woman farmer

Our discussions with women in Thiou, revealed that water was the most important ecosystem service for women. They highlighted the importance of this resource in daily household shores and reported that they have to travel long distances to fetch water. There are a few water points in the community, including wells, boreholes, but there is no tap water to meet demand for water. Wells sometimes dry up and the only source of water is boreholes which are located quite a long walk distance from homestead.

'How do we live without water? Cooking, washing, watering animals, drinking. This activity of water fetching is taking much of our time and reduces our opportunities to engage in activities to generate more revenues'.

Woman herder

Some women are also involved in off-season activities, like vegetable production and as such value water as an important element in sustaining them in this activity.

The second most valued ecosystem resource identified by women are forests. As the main providers of food and energy for the family, women are very much involved in the exploitation of forests for the subsistence of the households. These last years, they have observed a decline in the availability of forests resources and have to walk long distance to get wood for household energy consumption. Women have often been criticized for collecting wood in the forests and also for collecting some crop residues on farm lands for cooking purposes. Energy demand at the household level is very high and this increases the work burden of women on a daily basis as they spend hours collecting wood.

Forests are also important for women because they are a source of food like non timber forests products but also a source of medicinal products for health caring of their families. Women reported that they treat their children from the plants they find in the forests and as such understand the value of such a resource in sustaining their livelihoods. Products such as shea are used for production of oil and shea butter and can contribute significantly to increasing their revenues.

'The money we get from the sale of shea butter contributes to sending our children to school.'

Women farmer

Land was mentioned as the third most important ecosystem resource for women. Though they have no access to this resource, they argue that it is important for their cropping activities and as such for their livelihood sustainability. Some women are also involved in the search of gold and value the contribution of this activity in providing extra revenues for the households.

Women's perceptions of best ecosystem services management options

As active users, women have a critical role to play in the management of resources in the province. The following management options were identified to ensure that women's preferences are taken into account in the implementation process of management options.

For women not to be set aside in the decision making process regarding ecosystem services management, some conditions have to be met. These include:

- Train women on the management of ecosystem services, as often, men are the ones involved in such trainings.
- Empower women with necessary skills regarding the use of some technologies such as improved stoves.
- Engage women in income generating activities such as handicraft, vegetable production, livestock rearing/fattening.
- Provide education to women and girls.
- Organize women in groups and associations to provide ground for discussion on issues relating to resource management and for the promotion of best bet technologies.
- Change attitudes towards women land ownership.

Table 7: Women's preferred management options

Ecosystem Resource	Preferred Management Intervention
Water	• Construction of dug-outs, wells, boreholes, small reservoirs, tap water • Rehabilitation of livestock corridors • Protection of the small reservoirs banks • Training of women on optimized water use. • Macro and micro water catchments: zai, stone bunds, half moon
Forests	• Reforestation • Provision of trees for reforestation • Strengthen capacity for tree management
Land	• Soil rehabilitation techniques: zai, stone bunds • Fodder production • Review women access to land
Pasture	• Dual purpose varieties • Fodder production • Planting of multipurpose trees i.e. Baobab

Women's knowledge, attitudes and behaviours are central to finding sound strategies for management of ecosystem services and as such should be included in all stages of the decision process of natural resources management. Thus, any project aiming at enhancing the value of ecosystem services should make sure women rights are not diminished in the process of the implementation of its activities.

Discussion

Our study sought to identify the perspective of different actors on the best management options for long term sustainability of ecosystem resources in Yatenga province. The results suggest that stakeholders' knowledge and attitudes can affect their perceptions of ecosystem services management options. It also highlighted the most preferred ecosystem services and goods from the stakeholders' perceptions.

Stakeholders and their preferences

Stakeholders exhibited various preferences towards management of ecosystem services and highlighted the need to change and/or improve current resource management practices to ensure sustainability of resources in the community but also the livelihoods of community members surrounding those resources. Preferences and perceptions for various ecosystem services though similar among stakeholders in many aspects also revealed differences in interests and values attached to given services.

The following observations were made regarding actors' perceptions and preferences in relation to ecosystem services and their management:

- While women viewed forests benefits from the perspective of the non-timber forest products and traditional medicine they provide, men in general valued forests for the habit they offer for wild animals and the religious characteristic it entails. As providers of food and nutrition in the household, women attach high value to products that will help them improve nutrients intake and health of their family members, especially children. These products also constitute a source of revenue through the sale of the products harvested or transformed, like shea butter.
- Women and men's perceptions also differed with regard to pastures. Though women considered that pastures were important in the community, they did not rank it among the top three preferred resources. This may be explained by the fact that women mostly engage in the rearing of small ruminant for fattening purposes. This activity often requires corralling of livestock and feeding with crop residues or other feed sources. Men on the other hand, especially men herders, engaged in cattle rearing consider pasture as critical to the sustainability of their activity. Their management preference are therefore geared towards actions that would improve their livestock mobility and that will improve pasture services, including water and quality fodder for their animals. Though farmers view this option as a solution that would reduce conflicts with herders, we observed some little reluctance from the part of some farmers to the idea of allocating part of their cropping fields for the purpose of corridors establishment. This observation was confirmed by the livestock extension agent.
- Different stakeholders expressed various views on the importance they attach to each ecosystem resource. Men, be it herders or farmers, ranked land as their most important ecosystem resource, while water was cited as the second most important ecosystem resource for men, pastures came third for herders while forest was identified as the most important to farmers. As opposed to men herders and farmers who cited land as the most preferred ecosystem resource, women ranked water as the most important resource. Thus, management options that would improve water availability, thus reducing the burden of fetching water, through construction of new boreholes and establishment of tap water in homesteads, were preferred by women. Water resources were important to men

from the perspective of livestock watering. Men therefore advocated options that would increase availability and accessibility of water points, like construction of dugouts and establishment of livestock corridors.

- Beliefs in relation to access to resources differed slightly among stakeholders groups, especially between farmers and herders. Though herders acknowledge having access to forest resources they criticize the behaviour of the environment extension agents towards herders. In their view, farmers have far more rights to these resources considering that they are issued permits to clear land for expansion of cropping fields, while herders are often fined for "minor" damage to the environment, such as pruning.
- The two koglweogo members interviewed showed preference for repressive actions, as opposed to other groups of stakeholders who were in favour of more sensitization. The latter's argument is that actions that involved repression have not succeeded in changing people's behaviour towards ecosystem resources.

Insights for ecosystem services managers

Investigation into stakeholders' perceptions of ecosystem services management demonstrated that there were similarities across social groups regarding the main factors that threatened the sustainability of natural resources in Thiou, Yatenga province. Farmers, herders, traditional miners and women, as well as administrative officers reported the overexploitation of resources with little regard to the replenishing capacity of these resources, as the main threats to the sustainability of ecosystem services. In addition, stakeholders attributed the decline in the vegetation cover to intensive tree cutting for expansion of cropping fields. This demonstrates that stakeholders have a good understanding of the threats facing ecosystem services in the province.

The attitude towards conservation of ecosystem services is positive in general. However, positive attitude does not always translate into positive actions. For example, even though people understand the dangers associated with uncontrolled tree cutting, they are still practicing this activity. Stakeholders acknowledged the need to find sources of revenue for populations in the community through empowerment of local population (especially women) with income generating activities. There is also a need to seek for and promote the use of alternative sources of energy and/or rational resources consumption by households by optimizing their use.

Many of the EGS reported as important by stakeholders were related to water forests and land. These valued services ranged from clean water to wood-fuel, non-timber forest products, medicinal products, fodder, wood for construction, vegetable production mining, etc. This shows the critical role that these resources play in the livelihoods of the communities in this province and highlighted the need for action to be taken to maintain existing water resources and/or increase its availability in the community.

From the perspective of stakeholders, management options would provide benefits to the whole community, including improved water provisioning and conservation, improved water infiltration, reduced wind and hydrological erosion, better vegetation cover. Educating local populations on optimizing water resources use and encouraging the application of sustainable agricultural practices can help mitigate the impacts of entropic factors on ecosystem services. Farmers' umbrella organizations like FNGN and APESS are already raising awareness on some of the best practices through farmer's field exchange visits and trainings. This suggests that the perceived costs and benefits as well as the trade-offs entailed in the implementation of ecosystem services management should be closely scrutinized to capture stakeholders expectations prior to design of project activities.

Recommendations for policy directions

Many policies regarding the management of natural resources and land use systems are developed without prior interaction with the actors directly affected by the changes involved. The administrative officers and extension services agents interviewed criticized this strategy which often leaves them helpless with the populations on the ground. One good example of the weakness of government policies is the issue of land tenure. Stakeholders have recognized the importance of defining clear land tenure systems, through issuing of title deeds to facilitate implementation of management options, such as the establishment of livestock corridors in the community.

Policy makers can build upon stakeholders' perceptions to initiate extension programs that target services that are mostly valued by community people in the community, including water, forests and land. It is therefore critical to advocate practices that are in accordance with stakeholders' preferences, which may be more appealing to stakeholders, rather than just imposing to them. Besides, measures taken at the national level should not be treated as a one size fits all strategy. The environment, stakeholders 'attitudes, knowledge and behaviour, should be looked at closely to identify the best strategies that will be more appealing to stakeholders.

Finally, ecologically sound measures may not be socially or economically sound and thus may be deemed to fail if not accepted by communities affected. In order to tackle this issue, policies should encourage the promotion of management options that are locally accepted, such as establishment of dugouts, the promotion of alternative sources of energy through subsidizing of such resources, and the use of local resources, including labour, for the development of best technologies such as improved stoves and bio-digesters.

The way forward

It is clear from all stakeholders that management options will be implemented only if the issues on funding, capacity strengthening and governance are solved. Some organizations have already set the pace towards sustainable management of resources. APESS, an umbrella organization for herders, has already facilitated the establishment of the pastoral zone in Thiou and local administration officers, including government extension services are sensitizing communities on the sustainable exploitation of resources in the community.

Conclusion

This study provided an insight to stakeholders' perceptions of ecosystem services and their management in Thiou, Yatenga province. It provided a ground for participatory assessment of the current state of natural resources in Thiou as perceived by local stakeholders, the threats facing such resources and the management plan for ensuring sustainability of these resources. This study examined perceptions towards ecosystem services among relevant stakeholder groups including farmers, herders, women, local administrative officers, extension services and traditional miners.

The results indicated that the most preferred ecosystem services reported by stakeholders were relating to land, water, forests and pastures. They exhibited positive attitudes towards conservation of ecosystem services and provided an array of ecosystem management options which they deemed are important for sustaining the resources in the community. Yet, this study shows that attitudes towards land tenure for women are negative and restrict women's opportunities to make decisions about the use of land and resources even though they play a critical role in the production system.

Issues on governance, capacity building, funding, and awareness raising were brought up as critical components for any strategy aiming at inducing positive behaviours towards ecosystem services in the community and translating good attitudes towards these services into actions that are beneficial to the environment at large and to local people.

Our results showed that an assessment of people's perceptions and views on ecosystem services can provide useful insights and guide the decision making process at the local and landscape level and demonstrated that it is possible to align stakeholders' expectations to benefit the goals for conservation of ecosystem services in Yatenga province. In as much as populations in Yatenga province are willing to see changes occur in their community with regards to ecosystem services, they have to be supported by policies that create a conducive environment for application of good practices towards these services.

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Annex: Interview guide

Enhancing the value of ecosystem services in pastoral systems (evesps)

Yatenga province

March 2016

- Self introduction
- Introduction to the project
- Permission to record discussions
- Introduction of participants
- Participant consent

GUIDING QUESTIONS

THEME 1

Ecosystem services and their value to different stakeholders

1 What ecosystem services are known in the county? By:

- Government/Administration
- NGOs
- Community a) Herders b) Women c)Traditional miners d) Farmers
- [Ask which natural resources their livelihoods depend on more, is there any way nature is important in your culture, benefits derived from natural resources]
- Gender a) Men b) Women

2 What efforts have the Government, NGOs and CBOs put towards sensitizing the community regarding the importance of the ecosystem and its services?

3 What ecosystem services are considered most important or best preferred by the Stakeholders?

- Government/administration
- NGOs
- Community a) Herders b) Women c) Traditional miners d)Farmers
- Gender based preferences a) Men b) Women

THEME 2

Available Practices and Pastoralist activities –Beneficial and Detrimental

1•. What are the beneficial practices of the community that improve the ecosystem and promote sustainable use of the natural resources?

2•. What are the beneficial practices of the administrative bodies that improve the ecosystem and promote sustainable use of the natural resources?

3•. What are some of the practices of the community that endanger the ecosystem/ overuse the natural resources?

4•. What are the practices administrative bodies participate in that endanger the ecosystem/ over-use the natural resources?

THEME 3

Existing Interventions and 'on the radar' Management Options

5 What management options are in place or are being considered to preserve the integrity of the ecosystem and its services? And which of these management options are best preferred or not preferred at all?

NB:

[Once we identify the management options being proposed or already in implementation phase, then we can identify the options that are not on their radar]

- Government/administration
- NGOs
- Community a) Herders b) Women c) Traditional miners d)Farmers
- Gender based interventions a) Men b) Women

6 What factors influence implementation of key management options? / What are the challenges being faced or are expected to be faced in the implementation of these management options?

- Government/administration
- NGOs
- Community a) Herders b) Women c) Traditional miners d)Farmers
- Gender based challenges a) Men b) Women

7 What in your opinion are the most promising and cost effective interventions?

NB

[This will help answer the most feasible management options both politically and institutionally]

- Government/administration
- NGOs
- Community a) Herders b) Women c) Traditional miners d)Farmers

- Gender based opinions a) Men b) Women

8 How are you able to ascertain that the interventions selected are the better choices?

- Government/administration
- NGOs
- Community a) Herders b) Women c) Traditional miners d)Farmers
- Gender based opinions a) Men b) Women

9 What are the expected benefits that will arise from the various interventions?

- Government/administration
- NGOs
- Community a) Herders b) Women c) Traditional miners d)Farmers
- Gender based opinions a) Men b) Women

Thank you for your participation

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