

TAI Project - WP4 Workshops report

April 2016: Practices, social value of places and stakes linked to water related ecosystems services
December 2016: Synthesis of results

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Fieldworks:

April, 23 -May, 3rd and Dec, 9-16, 2016 (Ouagadougou, Bolgatanga and Zebilla)

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Introduction

The project on Targeting Agricultural Innovation and Ecosystem Service Management in the northern Volta Basin (TAI), funded by the Water Land and Ecosystems (WLE) Innovation Funds, from 2015 to 2016, aims at increasing the capacity of communities, NGOs and extension services (private and public actors) in the northern Volta basin “to target irrigated and rainfed technologies to increase adaptability and transformability of local livelihoods and to close yield, nutrition and ecosystem service gaps”. This project is divided into five work-packages. The TAI project focuses on two sub-catchments of the White Volta (or Nakanbé) River Basin, lying within the Centre-East region of Burkina Faso and Upper-East Region of Ghana (downstream of Bagré dam, which includes the watershed where the CPWF V4 project had previously conducted its activities). The activities presented in this report are developing within the WP4 “Enhancing institutional capacity” in the districts of Zebilla, Bawku Municipal and Binduri in the Ghanaian site.

1. Objectives

The TAI project follows the first investigations realized in the CPWF V4 project (2011-2013). The two last fieldworks were organized upon the results of a first workshop held in June 2015, where the Bawkudo role playing game (RPG) was used to discuss at the community and district scale the range of choices between different land uses and to explicit key issues relatives to water needs, crops production and support to these activities at the district level. But, as Bawkudo RPG was designed to mainly focus on water resources use (Volta river, main tributaries and small reservoirs), further investigations were needed to characterize more precisely how the use of water resources depends on other used elements of ecosystems, their functions, their location, and their respective social values given by stakeholders (cf. report MSP1, 2015). Therefore, TAI partners proposed to model several Ecosystem Services (ES) as benefits in order to identify the economic and technical conditions under which water related agricultural interventions may increase significantly and sustainably food security in the area. Generally, these ES are mainly assessed through quantitative approaches developed from biophysical scientists’ points of view (Invest, NatCap, ...), with analyses that give little room to social and cultural determinants of ES; The values associated to particular services which are generally linked to specific places can impact the response to the proposed interventions, and they are to be considered.

The social and cultural determinants of ES (eg. because of their history, their connectivity within landscape components) are of major concern for people’s livelihood. So we developed a participatory exercise based on a ComMod approach¹ to identify and characterize the social

¹ ComMod for companion modeling <http://www.commod.org/>

values that stakeholders give to the specific places. Doing so, we proposed to refine the ES definition (which is “the benefits that society derived from nature use and management”) as the interactions between a location/a place, specific practices and their stakes/values for the stakeholders .

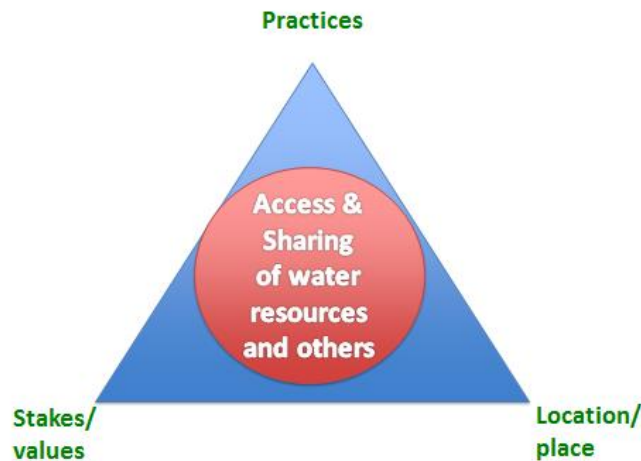


Fig 1: the analytical framework of ES

3 types of objectives were assigned to this fieldwork:

- **The scientific objective** is (i) to characterize the diversity of values that communities attribute to different places and they associate to specific ES; (ii) and identify the choices of trade-offs they operate between services that are related to specific practices and places.
- **Implication for development:** In development programs, which do not take into account the specific values – especially social values- that communities attribute to specific places hampered, the ownership and appropriation by communities had been hampered and has led to failure in many cases of investment interventions (small reservoirs, or others). Indeed, trade-offs between services is a major issue: if the most suitable place for building a dam is a chief’s grave, what value will dominate? By highlighting the values that communities associated to the different places in their territory, we aimed at improving our understanding of these trade-offs. Then, the discussion of these trade-off with rural development actors at the district level – notably with the Water Resource Commission and district assembly members – aims at increasing their awareness of communities attempts in terms of development related to water access and use (bottom-up rather than top-down).
- **Methodological objective** was to design a participatory method/exercise to reach these two scientific objectives
 - Characterize the places that are crucial for communities’ livelihoods, and the diversity of values associated to these places.

- Highlight how these values play a role in the land use choices and in the trade-offs between the different ES.

2. Method : the participatory exercises

The method has been developed into two main participatory workshops. The first one was organized in April 2016 to test in three communities and with the district our definition of ES as a combination of location, practices and stakes/values, regardless any dynamics. The second one, organized in December 2016, was held to give feedbacks on the previous results to these stakeholders, and to put them in dynamics with the help of a first model developed on Netlogo platform.

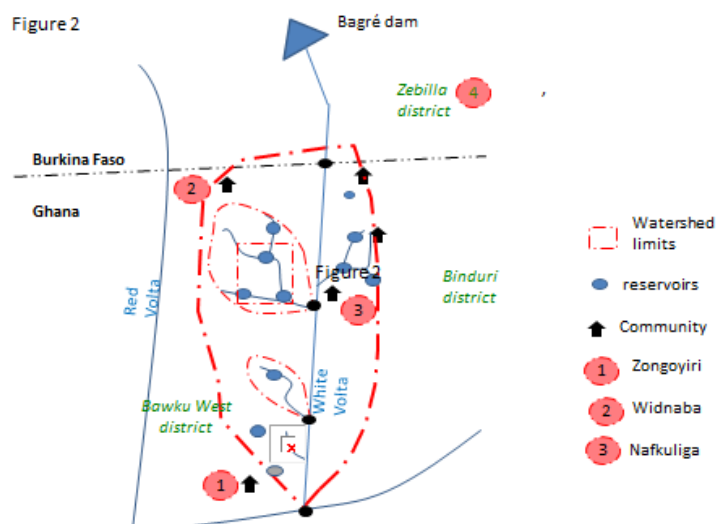
2.1 : Elicitation of the ES components

Selected Communities and Districts

We conducted a participatory exercise to reach the objectives in three of the 8 communities and in one of the 3 districts previously involved in the CPWF V4 project: Zongoyiri, Widnaba (in Zebilla District) and Nafkuliga (in Binduri District), and Zebilla district (figure 2.). The three communities present differences in terms of access to water as indicated by the number of boreholes and wells, the number of functional small reservoirs, and the proximity from the White Volta :

- *Zongoyiri* presents the most limited access to water: the White Volta is located fairly far (about 9 Km) and there are only 5 boreholes in the community. There is one reservoir, but it is dry during the dry season and unfunctional since the beginning.
- *Widnaba* has no access to the river, but it has a large number of wells (11) and boreholes (12). The reservoir is also dry during the dry season (degraded).
- *Nafkuliga* has access to the White Volta and to a large number of boreholes (9) and wells (4). It has a reservoir, but it can be used only for animals and not for irrigation (degraded).

These communities also presented differences in terms of ecological environment, *Zongoiri* being surrounded by forest, while the two other communities presented more limited forest and bush areas (for a full description see table 2, page11)



Specific objectives

The same exercise was conducted with each of the 3 communities and with Zebilla district members. With each of the 3 communities, the specific objective was to discuss about the conditions and social values of access, uses, and management of water according to the location. With the district representatives, the objective was to see how the actions of the district could enhance different public services according to the locations. With these two levels of actors, the overall objective was to see how the lessons emerging from the communities are linked to the District's priorities.

The hypotheses

The participatory tool was designed to test 2 main hypotheses:

- Water resource related ES or other ecosystem services can have different values for communities depending on their specific location (place);
- Communities' use of places and then of ecosystem services is the result from a trade-off between the different values associated to it (eg. If a shrine is located in a highly fertile area, it will not be cultivated).

The Community tool components

A detailed description of the methodology used is presented in annex 3. A board is based on a satellite picture of the whole community. Two sizes were proposed to the communities for them to choose the most convenient board for them (3 or 6 km²).

First Phase (stages 1-4 in annex 3): After ensuring that the participants locate the main elements of their territory (school, road, forest, etc.), the participants are asked to show the place where they conduct their activities, first in the wet season then in the dry season. The proposed activities are based on the results of previous interviews and on workshops done for TAI and CPWF V4 project in the area. By the end of each season, each participant is asked

to rank the different places he has identified by order of importance and to explain the reason of his/her choices. Discussions are initiated between the different participants.

Second phase (stages 5 and 6 in annex 3): The observers and facilitators try to identify the different values the stakeholders associated to places and that are elicited through their explanations and choices. The exercise is not limited to the current situation. Participants are asked to rank –within a graphic wheel- *the most beneficiary actions they would like to be conducted in their community*. Actions that were mentionned by the stakeholders were for example: means to cope with conflicts; improvement of water provision, water saving, respect of customary rules, etc.). Then the facilitators test different locations in the territory to make participants express the different trade-off and the level of acceptability of the chosen action.

The district tool components

The workshop with district representatives was organized following 2 steps, in order to test the link between their priorities and the results of communities' ranking and choices

During the first step, the participants are asked to elicit **the different activities** they conduct in the communities. A list is proposed based on the results obtained from the previous workshop (TAI and CPWF V4 projects) (cf. table 1 and fig 2). Then, they are asked to locate their activity on the map of each community (where the exercise has been already done) and explain why they do a specific activity in a specific place.

In the second step, the facilitator asks them **the conditions** that are required for each specific activity located in a specific place to be successful. Then, the results from the community workshop are revealed to the district representatives and a discussion is conducted, with a focus on:

- the articulation between the different status given to ecosystems,
- the articulation between the different values expressed in a same place,
- the impact of differences on the implementation of district actions, notably in terms of access to water body.

Actions for the district		
Fine in kind	Monetary fines	Court case
Radio announcement	Public sensitization	Good farmer award
Monitoring field visit	Volunteers recruitment	Training volunteers
Financing trees plantation	Providing alternative lands	Sustaining volunteers activities
Drilling wells	Providing inputs	Buffer zone enforcement
Building small reservoirs	Maintaining reservoirs/dug outs	Providing water lifting devices

Table 1: List of proposed district activities (stage1)



Fig3 : Location of Zebilla district activities in Zongoyiri community (stage 2)) (F. Kizito, CIAT)



Fig3 : Comparison of values elicited by community members and district representatives (W. Daré, CIRAD)

2.2 Validation and dynamics of ES.

In December 2016, we presented and shared the results of our analysis of the previous workshop that had been held in April 2016 in front of all participants of the 3 communities and the same district representatives. Few participants of Binaba were also invited, as the TAI project had developed participatory mapping with them. The presentation initiated rich discussions among the audience who gave a rich feedback.

A Netlogo model

Then, a model developed on Netlogo platform was introduced to explore the connectivity, in time and space, of some actions mainly focused on regulation services (erosion control) and provision services (food production) (Fig 4). The aim was also to show how simulation could inform district decision maker about the impact of their activities to the targeted ES presented here.

- In the model, the spatial connectivity of ecosystem services and their flows is illustrated and some components are included Land use changes within target communities
- Biophysical estimation of sediment output with SWAT
- Participatory mapping and biophysical quantification of ES ‘feeds’ into the bio-economic models: Net logo

The expected results were to discuss the various incentives for ecosystem-oriented land use change by examining the dynamics associated with community natural resources management/and the social value of ES.

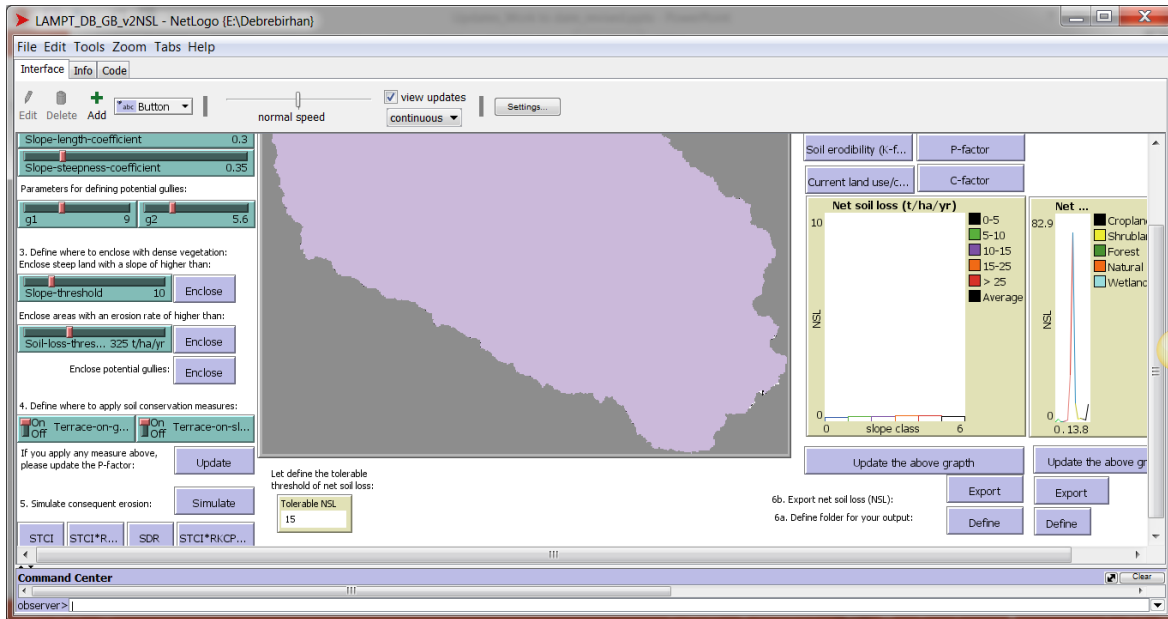


Figure 4: the netlogo model interface: example on Zongoyiri

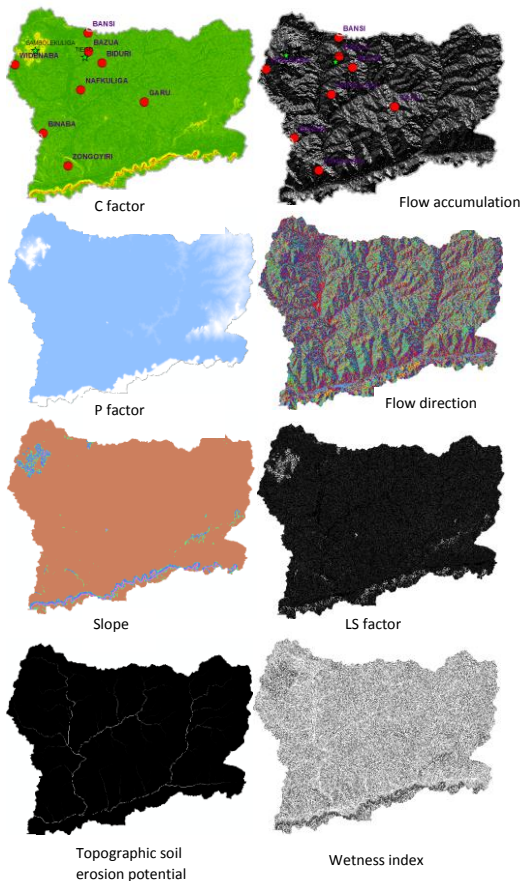


Figure 5: Maps of the different factors considered into the model

Debating on Stakeholders' proposals

Finally, a virtual community landscape map was elaborated as a synthesis of the different situations elicited in the 3 communities. This map was presented (Fig 6) to explicit what could be the decision process the various stakeholders should put in place if a NGO/ an operator/a donor comes into their virtual community to rehabilitate or build a new dam. To elaborate on this, participants were divided into 2 subgroups mixing representatives of the 4 communities, and members of the district. They were asked to answer the three following questions and to present their results to the whole group:

- Where to build the dam?
- How to choose the option and which one(s)?
- How and with whom will you discuss the options chosen?

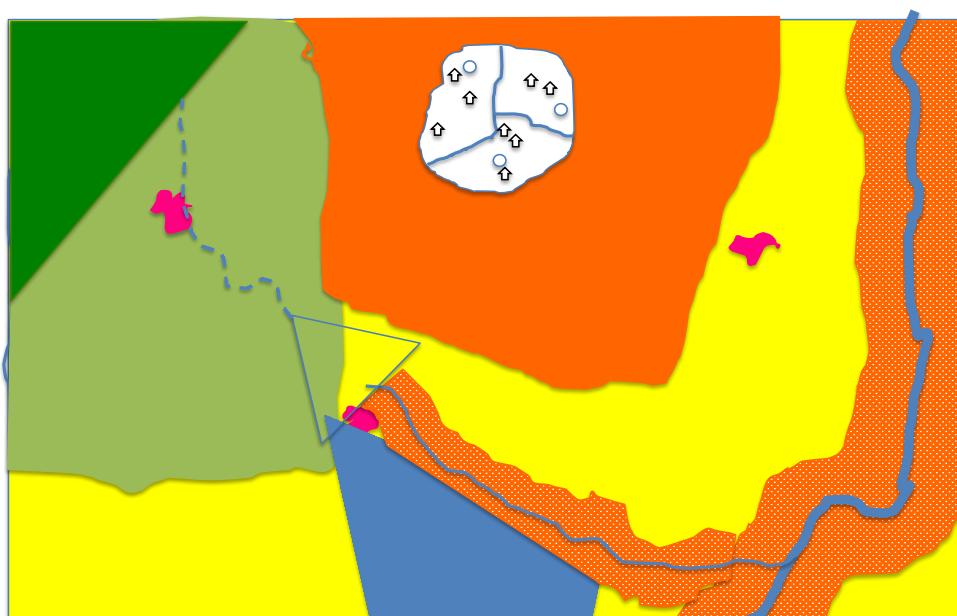
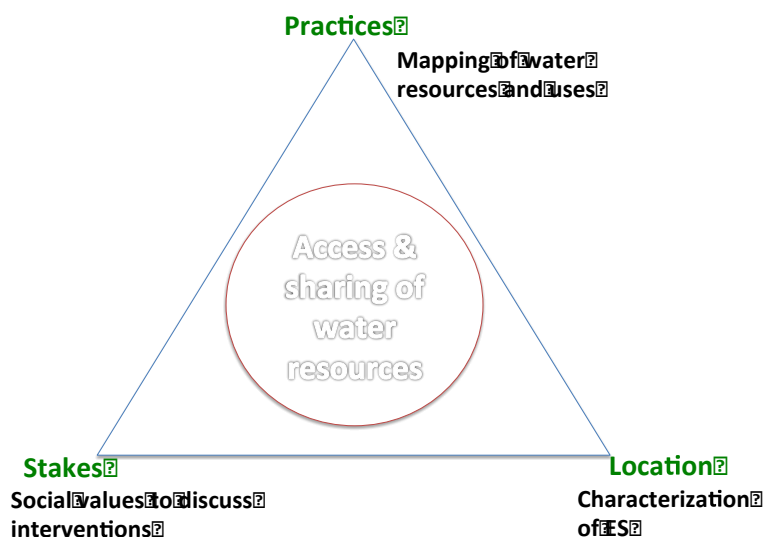


Figure 6: the "virtual" community landscape

Legend: orange: cropping area (even river banks); yellow: shrub land; dark green: protected forest, green : community forest; green checked: the non-functional irrigated scheme; blue : the reservoir; pink: sacred sites; white: residential area divided in 3 subsections.

3. Results

The following results, are presented in line with the methodology developed to test our definition of ecosystem services, which combines Location, practices and stakes (following figure). The three communities visited (cf. tables 2 and 3) present features concerning the places and the practices that can be associated to the various ecosystem services linked to water use and access.



	Distance to the river (Km)	Number and distance to the Small Reservoir (SR) (Km)	Number of Dugout	Access to potable water	Farming
Zongoyri	Limited access to river Red Volta 13,5 White Volta South 6 White Volta East 9	1 SR silted non functional West 6 km East: 0,7	1 North W	1 borehole for each section (5 including central one)	No farming on riverbanks Large pluvial cropping area Slash and burn area Fertilizer ban in 2015 (chief); few livestock
Widnaba	No access to river Red Volta West 11 White Volta East 20 Tributary 2	1 SR degraded (dry in the dry season) West : 1 km SE: 7		11 boreholes 12 wells	No farming on riverbanks
Nakfulinga	Access to river White Volta NW 2	1 SR degraded (Non filled by the Volta)	Dugouts networks North W 3km	9 boreholes 4 wells	Highly cultivated riverbank No irrigated land possible with reservoirs

Table 2: Water availability for the 3 communities

	Distance to the road (Km)	Distance to markets places (km)	Population	Forest	Availability of land
Zongoyri	Bolga road 29 On the road from Zougouiri to Widnaba	17 km from Binaba	Grouped habitat Low population 5 sections	Yes close to the village	High land availability Land rental by Zebilla and Binaba residents for cattle grazing
Widnaba	Bolga Road 8 Zongoyri to Bitnaba dirt road with the short dirt road; Bolga 8 km	8 km from Zebilla	Spase Households Higher population 4 sections	Only riparian forests	Land Availability
Nakfulinga	1,2 km form Bolga road	16km Zebilla 15 km Binaba	Sparse household	Few forest In the south	High population density comparing to the others

Table 3 : Characteristics of the three communities

3.1. Mapping of water resources uses and their location

Landscape unit were identified in the three communities in order to have a better qualification of the ES linked to specific places and practices (Fig. 7):

- Residential area
- Bush/forest
- Water-logged areas and valleys
- Riverbanks
- Temporary streams
- Water bodies: Volta river/ Reservoirs/ Wells /boreholes

Places relevant for their dry or rainy season activities or places relevant for both seasons were located on the map.

Dry season (Zongoyiri)



Rainy season (Zongoyiri)

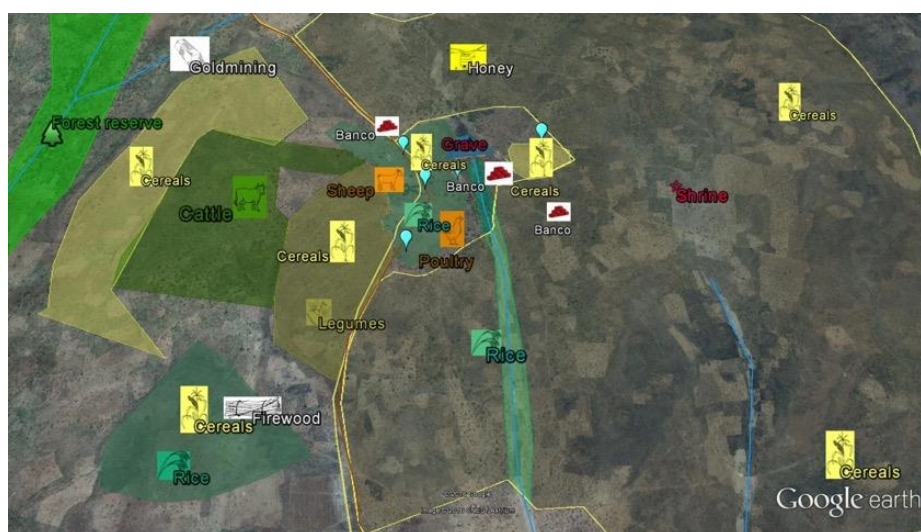


Fig 7. Zongoyiri map of places' uses during the dry season (top) and rainy season (bottom) - Note: Livestock is figured in green; small ruminants and poultry in orange, Pictograms represents households' residences; cf. maps built in the other communities in annex 4.

Places identified during the mapping exercises and associated practices

In Zongoyiri

Although the reservoir is nonfunctional, riverbanks are not cultivated by this community. The reasons they cited were that it is prohibited to cultivate there, they don't want to destroy fish habitats, and there is no problem of land pressure in the community. People from Binaba even rent land in Zongoyiri (Agreement is given by the Tindana – landlords). Local people mostly rent lands to the Tindana.

In Widnaba

A dam was built in 2004, and was used for irrigation in the past but the wall broke down few years ago (2008). It is now used for animals and for fishing (done by local people but also by foreigners leading to conflicts). The dams walls are too narrow and the canal allied to the dam is leaking.

There is no access to the river but temporary rivers can be used for animals watering during the rainy season. Some waterlogged valleys are used for rice production in dry and wet seasons and hedgerows of elephant grasses are individually planted by some farmers to block water; more people have farms in the large fertile eastern valley, and less in the narrow western one. In the sloppy area in the foothill on the west, stones bunds are used by some farmers to limit erosion. In the southern valley, Gold mining is done by local people (who owns a mine section) and by people from other communities.

All participants have some land ownership, some people from other community also rent lands to farm. There is enough land in Widnaba.

In Nafkuliga

This community differs from the others by its access to the Volta river banks. The riverbanks are highly used in wet and rainy season. The small reservoir allows also farming but the irrigated areas are lacking of appropriate canals. In this community, riverbanks are the place at stakes with issues related to their appropriation regimes and their dependence upon the management of the Bagre dam in Burkina Faso.

Ecosystem Services linked to scale and proximity to specific places

While some services were associated to large areas or landscape units, others were associated to particular places, precisely localized. Hence, within the main types of landscape units identified, some places were associated to particular service.

- Riverbanks were not associated with farming in all the communities: They are intensively cropped all year in Nafkuliga, but not in Zongoyiri where the bush and forests are largely used for rainfed agriculture.

- Reservoirs are linked mainly to other activities than farming because they are mainly not functional in the studied communities. The main activities mentioned are livestock, or fishing. In the rainy season, farmlands in the downstream of the reservoir are not used in Widnaba, but in Nafkuliga.
- Stream valleys and water-log: rice cropping areas are very concentrated on these valleys in rainy season (Widnaba);
- Dug outs were poorly mentioned by the communities
- In forest and bush areas, particular locations that are closer from households are determinant for firewood collection or grazing of small ruminants (while cattle graze further). In Nafkuliga, forest area in the south is mainly used in the dry season for firewood, honey...). In Widnaba it is used for also NTFP and gold mining activities. Small ruminants are reared in the bush/forest in Widnaba, while not in other communities. Little livestock breeding was mentioned in the bush in Zongoyiri and none closed to the villages.

The results for the communities studied are summarized in **the table 4**. The ecosystem services associated to landscape units can be classified in three major categories: Provisioning services, regulation and cultural services. We specify whether each unit is associated to the same service all year long, or only during the dry or rainy season. Stakeholders from the communities mostly mentioned provisioning services, but regulation and cultural services were also cited. Furthermore, participants underlined the major importance of cultural services associated to particular places.

Table 4 . Ecosystem services associated by stakeholders to the major types of landscape units (according to season)

Services: Places/Season	Provisioning services		Regulation services		Cultural services	
	Dry	Rainy	Dry	Rainy	Dry	Rainy
Households area (residence and cropping areas)	Poultry, small ruminants grazing Shea fruit (?) Mangoes	Crop (rainfed)		Stone bounds (erosion control) Sediments for fertilization Grass bands /hedgerows	Shrines	
Bush & forest	Honey, bush fire Fire wood, medicinal plants, honey cattle & small ruminants grazing	Crop (rainfed)		Fertilization	Shrines Cultural knowledge on medicinal plants	
Waterlogged areas		Crop (rice)		Grass bands water regulation		
Temporary streams / valleys		Gold mining Cattle drinking				
River banks	Legume crops, tobacco, vegetables			Less regulation of flood with		

			crops than with trees (synergy)
Volta River	Fishing		Sediments for fertilization of flooded floodplains and riverbanks
Water Bodies	Livestock + poultry drinking Irrigated land		Disservices (mosquitos infestations etc;)
-Reservoirs	Fishing	Fishing	
-Reservoirs	Human domestic use (+ drinking)		
- Boreholes	Livestock + poultry drinking		
- Boreholes	Human domestic use (+ washing)		
- Wells	Fishing		

For community members, places that were identified as valuable were not only associated to the type of ecosystem they shelter. It depends also on its particular spatial location, relative to other landscape elements (e.g: proximity to households, scale of this location...), and on its history (temporal dimension, e.g: shrines...).

3.2 Characterization of ES: conflict and synergies between ecosystem services from the actors’ point of view

The identification of place locations and practices made with the communities was used to go further in the analysis of the various ES services linkages, according to the figure above (cf. fig 8).

A stakeholder-oriented framework for ecosystem services

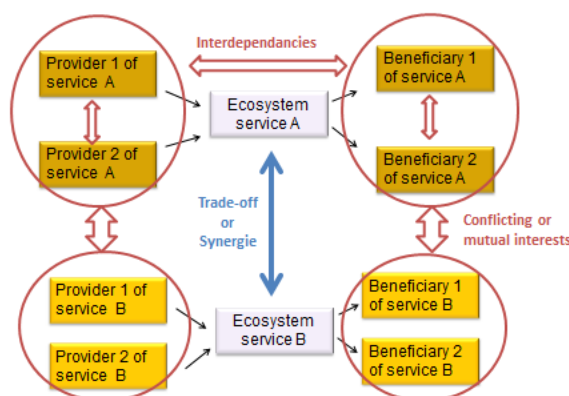


Fig 8. The framework to analyze trade offs and synergies (own elaboration)

Tradeoffs and synergies between Ecosystem services from actors’ point of view: the role of connectivity and time

This analysis through places show that some synergies and trade-offs between different ecosystems services were mentioned by communities as *associated to specific places*.

However, the terms ecosystems services, trade off and synergies were not used during the interviews and group work.

Synergies

- Riverbanks: planting economic trees on the riverbank allow synergies between provisioning services (collect of fruits) and regulation/support services (protect river banks against floods (Nafkuliga); while crops on the riverbanks do not allow this synergy.
- Reservoirs: planting economic trees on the small reservoirs banks allow synergies between provision services (collect of fruits), and regulation/support services (less sedimentation in the reservoirs and better water quality);

Trade-offs

- Reservoirs: farming crops on the small reservoirs banks is source of tradeoffs between provision services (irrigated crops) and other production services (access to water by livestock; or fishing)
- Reservoirs: farming crops on the small reservoirs banks is source of tradeoffs between provision services (irrigated crops) and regulation/support services (sedimentation and siltation of the reservoirs, loss of water quality if pesticides are use for farming),
- Balancing the cultural values (e.g social knowledge and norms / shrines) vs the provision values (crops on irrigated lands in Zongoiri or forest NTFP or products in the 3 communities). **But these cultural values seem to be viewed as a general condition for the existence of other services more than a specific category of service.**
- Forest slash and burn are seen as loss of provision services I (NTFP, Livestock grazing) but not as loss of regulating services (erosion control, forest habitat) versus enhancing other provision services (rainfed agriculture)
- river banks cultivation : provision service (dry season agriculture) versus regulation ES against floods that would be better with other type of riverbank use like buffer zone (Nafkuliga)

The analysis through places allow us to discuss the issue of "spatial" trade-off or synergies linked to the connectivity of the different locations or places under study: In Nakfuliga, the provision services on the riverbanks (whether crops or fruit trees) depend on the fertility transfers from upper Volta to downstream, therefore to the management of the Bagre Dam in Burkina. This connectivity may have a social dimension with the transfer of uses from a place to another, for example the ban of some activities – like the ban of farming on the reservoirs banks or the ban of slash and burn in the bush forest - may produce tradeoffs in other places: e.g., more fertilizers used for an intensification of farming in the existing or new croplands.

The participants also discussed how **the synergies and tradeoffs should be considered in the short and long term**, e.g. Bush fire allows provision services immediately through crop production, charcoal, but also regulating service through the improvement of soil fertility in the short term. But it decreases these fertility regulation services over the time.

Conflicts or mutual interests from actors' point of view

These interactions between different social groups can affect the provision or the use of the various ecosystem services linked to places. The discussions mentioned the “foreigners” especially for the use of reservoirs and stream valleys: the migrant Fulani cattle raisers (except in the communities where the activity of cattle ranching is sedentary), the fishermen, or the goldminers (illegal activity).

The conflicts/mutual interests are also dependent on spatial connectivity of the ecosystems services linked to places and can occur on different time scale.

Considering these two dimensions while designing interventions would allow to take into account:

- ⇒ the transfer of vulnerability that can occur between ecosystems services, places or populations;
- ⇒ The issue of the scale of interventions.

3.3. The identification of social values: a way to discuss management of stakes?

This activity took place in 2 of the 3 communities and with members of the district assembly. The mapping phase has showed the places and linked ecosystem services used by the stakeholders, and characterize the issues they mentioned. In a second moment, starting from these issues we try to elicit the values they carry to manage these places and ES linkages.

From the Communities' point of view

In each community, we started with the principal issues related to water access and use (silted reservoir, access to river, quality and availability of water, etc.) identified during the mapping of resources and locations. We focused on 3 questions

- How can the problem be explained?
- If action are to be designed to address it, what kind of action should be done and in what specific place?
- What are the necessary conditions for this (or these) action(s) and which actors are the more suitable to carry on the actions?

Each of the proposed conditions were displayed on a wheel as a radius in order to value each with tokens, to allow a discussion on the choice between these actions and to elicit the stakeholders' arguments.

In Zongoyiri

The issue raised was the dam built in 1962 that has been nonfunctional since the beginning because of the choice of the location. Three reasons were mentioned to explain why the reservoir dried: two technical (reservoir built on a stone with seepages; nature of the soils), and one cultural symbol (a Tindana's grave). The small reservoir has little water in rainy season and dries in November.

Participants were asked to locate where a new dam should be built and they identified a place on the north-east of the current dam, higher in the watershed.

They were asked to write on cards the conditions necessary to improve the access and use of water in the dam. The following conditions were cited:

- Protection: Ban cropping around the dam, farming only on one side
- Protection: Plant tree and grass around the reservoir
- Access control : Use restricted for animals to drink but everybody will have access to water- even Fulani cattle raisers)
- Management organization for the new dam: form a dam comity with landowners, chief, and assembly man. And engage the assembly man to represent the comity at the WRC, with a focus on the improvement of the communication between the assembly man, the district and the water board.

In Widnaba

This community shares some characteristics with Zongoyiri in terms of availability of water and land resources: non-functional dam, low access to Volta River, high availability of land.

The focus was on what actions are necessary to improve access and use of the reservoir's water. As the dam was badly designed, with water going over the wall and destroying it, while reinforcing the siltation of the dam, actions needed to repair the existing dam were discussed in two groups.

For the group 1:

- The district should do this rehabilitation
- The community is ready to plant grasses around the reservoir to protect it
- They can contribute and provide building material
- They will prevent people from farming near the dam (which causes its siltation)

For the group 2:

- Farmers who are located in the waterways should be displaced (possibility to re-allocate land)

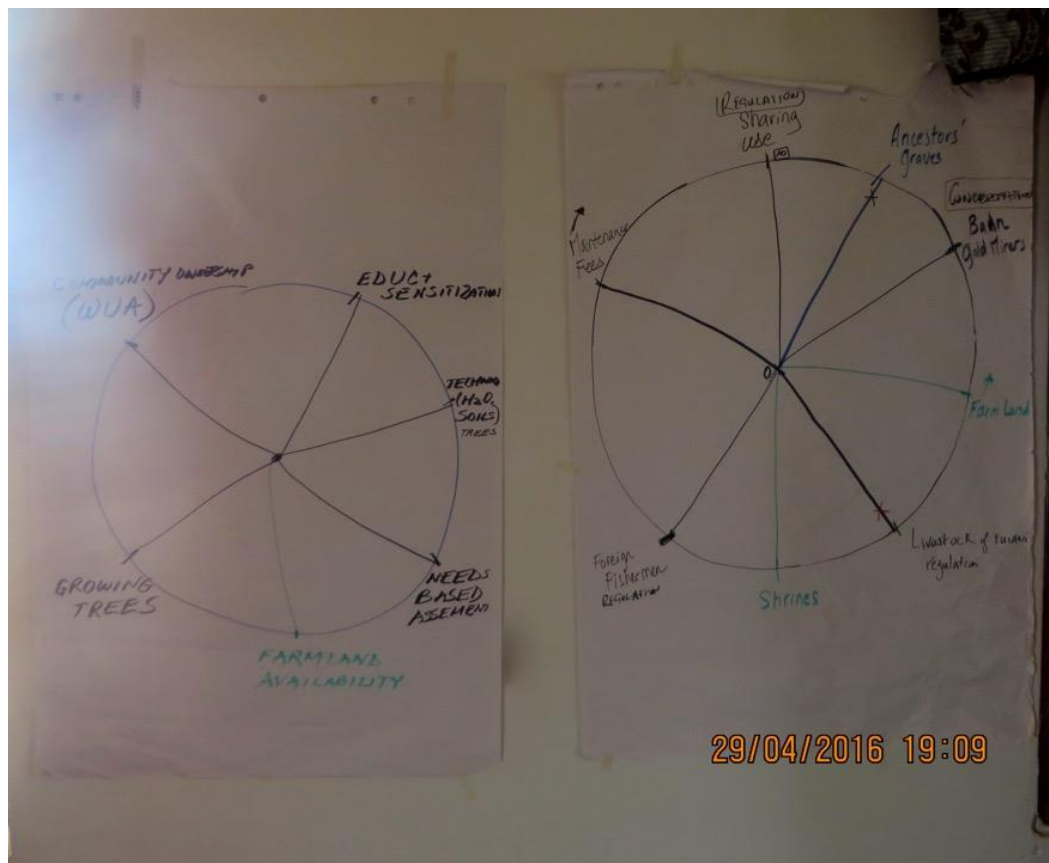
- There is a need to organize community meetings and transmit conclusion to the assembly man

In case of the dam repair, the conditions for a good use of the water were also mentioned

- Regulation of access: ban gold miners from the dam, as well as Fulani people as they don't pay fees for water, and control fishing from people outside from the community
- Regulation of access : organize a 3-days water rotation for a better sharing of water
- Management : increase community contribution and maintenance fees (WUA)
- Management: If the dam was rehabilitated, they could do dry season gardening. The reallocation of land to expropriated farmers should be possible on the southern area.

The conditions for water access and use cited by communities were synthetized in order to compare with the district point of view (cf. figure 9).

Figure 9: The district (left) and a compilation of the 2 communities (right) wheels



From the district officials' point of view

The representatives of the district were mainly focused on activities they conducted in the communities in general, only health, education and NADMO have specific activities in Zongoyiri. Most of Fire and Forest departments and NADMO activities (planting or growing trees) are conducted in the forest along the tributaries or the rivers banks (Red and White Volta) to limit bush burning, avoid river bank cultivation and prevent from floods. Health,

Education and MoFA concentrate their effort in awareness raising of population to prevent water diseases by a better protection and conservation of water bodies.

Working on the conditions to improve access and use of water in the dam, the representatives of the District expressed the following elements:

- Community involvement (through the Water user association WUA)
- Education & awareness raising to health issues
- Technical inputs: water devices, soil works, species of tree
- Communities' needs based assessment of the dams
- Farmland availability if need to relocate farmers
- Growing trees around the dams

Thus, the elicitation of values with the wheel device mainly revealed stakes of importance rather than real values assigned to places. Nevertheless, values emerged in the comparison between their results with those of the communities:

- **enhance the community ownership** of the infrastructures, e.g. by paying part of their maintenance (through water taxes) or reinforcing water user committees and notably the power of traditional chiefs who protect natural resources (like in Zongoyiri)
- **Priority to proximity users:** a limited access to foreigners (like Fulani or illegal fishermen or mining) which revealed that ownership should be linked to proximity;
- **Institutional control of agricultural innovations:** new technics should be controlled by MoFA;
- **regulatory values to support sustainable decision:** Traditional values were not specifically expressed even if some consider that the enforcement of community bylaws is more efficient than court case option to prevent or solve conflicts on water resources. Traditional chiefs were also mentioned as crucial to negotiate new lands to resettle people if small reservoirs are rehabilitated or rebuilt elsewhere.

3.4. Insights for management and interventions

For the WRC maintenance building and rehabilitation of dams (produce research plan/ redefine community plans)

We observed through the participatory mapping and identification of the value of places the problems with reservoirs in the three communities visited. Only one (in Nafkuliga) of the small reservoirs enabled people to make irrigated agriculture in the dry season (Onions, etc..) but does not operate well. The dam wall in Widnaba or the location of the small reservoir in Zongoyiri does not allow using water for irrigation in the dry season.

For the district mapping discussion

- Reinforcement of water user associations to define places to build or rehabilitate new dams, the conditions of their sustainability, the conditions of access to new irrigated lands (for youth, people who are not members of the community).
- Enhance the coordination between the different sectorial ministries of the District Assembly, the communities, the NGO before implementing new interventions in the communities in order to better fit with the community conditions, their values of the specific places where the interventions should be designed.
- In the communities, some ecosystems services and places were not mentioned such as the dug-outs. This should need more investigations.

5. Perspectives

- Importance to consider places x practices x values to refine ES approaches for water related ES management interventions-- > towards a model that related biophysical patterns to ES provision and use
- trade-offs to be assessed in time and space → implication for infrastructure management
- Research perspectives:
 - Adaptation of people to the degradation of the dam: the various ways to cope with and the impacts of this adaptation on various ecosystem services;
 - Migration dynamics, values that migrants associate to places, versus the places that are valued by the local people;
 - Companion modelling to complete for landscape management and erosion limitation; and understand why some tradeoffs are not considered by the actors, community members or district officials.

Annex

Annex 1: Program of the mission on values, practices and stakes

Date	Activities conducted
23-26/04/16	Preparation of the workshop
26/04/16	Trip Ouagadougou- Bolgatanga Discussion with WRC
27-30 /04/16	Participatory mapping in Zongoyiri(27), Widnaba (28), at Zebilla District (29) and Nafkuliga (30)
01/05/16	Trip back to Ouagadougou
01-03/05/16	Debriefing and first writing version of the report

Mission 1 : elicitation of values and places

Date	Activities conducted
9-14/12/16	Preparation of the workshop
14/12/16	Discussion with WRC
15/12/16	Participatory workshop at Zebilla District Wrap up of the TAI project
16/12/16	Finalization of the WP4 report

Mission 2: restitution and modeling of dynamics and connectivity

Annex 2: List of participants

Mission 1- April 2016

The communities

Zongoyiri. Date: 27/04/16			
No.	Name	Organisation	Contact
1.	Asamande Eric	Farmer	0248232114
2.	Alhaji Kumasi	Farmer	0206408841
3.	Saratu Issaka	Youth (Female)	0540300388
4.	Moro Sumani	Youth (Male)	0207383562
5.	Abena Anafo	Fisher	
6.	Wilson Azaaba	Farmer (Livestock)	0247996172
7.	Mohammed Abdul Raman	Farmer (Crop)	
8.	Akolbila Asitanga	Landowner	
9.	Teni Mbaha	Tenant	
10.	Baba Kumasi	Assembly Man	
Widnaba. Date: 28/04/16			
1.	Azure Daniel	Farmer	0242346097
2.	Abugre Naomi	Farmer	0205191356
3.	Abarago Rakia	Youth (Female)	0502423328
4.	Akuntam Karim	Youth (Male)	0205588956
5.	Azure Elijah	Fisher	
6.	Ayadago Martin	Farmer (Livestock)	0541528202
7.	Apam Gifty	Farmer (Crop)	0542437268
8.	Apbila Aladago	Landlord	

9.	Asutbisra Patrick	Small Scale Miner	0207844244
10.	Elisha Assoswini	Assembly Man	0242641514/02038 35260
Nafkuliga. Date:30/04/16			
1.	Akanuga Ayariga	Unit Committee	0241811772
2.	Asunka Amolif Moses	Chief Rep.	0246632902
3.	Faustina Ibrahim	Youth (Female)	
4.	Enoch Tanko	Youth (Male)	0201831860
5.	Emmanuel Atampore	Fisher	0247580932
6.	Awini Akurugu	Farmer (Livestock)	0543716056
7.	Ayimbila Alfred	Farmer (Crops)	0200623208
8.	Amort Adaza	Assembly Man	0203640830
9.	Rukaya Asumka	Water User (Brewer)	0543117664
10.	Comfort Abubila	Farmer (River Bank)	0205791695

The district

1	Hon. Simon AYOGBA*	District Coordinating Executive
2	David NAHIRA*	Coordinating Director
3	Yussuf SULEMANA	MoFA
4	Eva EFOB	Health
5	Abdallah ALI	Forestry
6	Hon. Moses ADUKPAM	NADMO
7	Theresa AZURE	Community Development

- Were not able to join the meeting on the 20/04/2016

Mission 2- Dec 2016

30 Same participants of Mission 1	Farmers	Widnaba, Zongoyiri, Nafkuliga
Ramson Awingut		Binaba
Naba Moses A. Appiah	Chief	Binaba
Hon. Julius Agolesi	Assembly men	Timonde
Joseph B. Abongo		WRC
Laiza Sulley		WRC
Aaron B. Aduna	Basin officer of the WVBB	WRC

Annex 3: The Community participatory mapping process

This annex aims at presenting the participatory exercise conducted in the communities between the 27th to the 30th of April 2016.

Board: a satellite picture (Google earth) of the communities' territory was used as a support: window of about 6 km with two scales (3 or 6 km).



Fig1: Zongoyiri people identifying their places on a google map (credit: F. Kizito, CIAT)

Activities: Tokens were used to figure the major types of activities that local people have along the year (rainy and dry season)



Fig 2: The proposed activities and the tokens to place them on the google map (credit: F. Kizito, CIAT).

Actions: Participants simulate their own activities.

- **Progress of the participatory exercise: two seasons/**

The dry and the wet season are played. Participants were asked to locate their important activities on the map at each season using the tokens.

The objective of the game - locate the places important for participants' livelihood – is presented as an introduction to the game. The game is divided into 6 steps:

Step 1: Recognition of sites / cites d'abord appropriation of the map. We use all the elements of the environment around the place where the session is organized, in order to help people understand where they are located in the map. The appropriation is very fast, the participants helping themselves to recognize **real specific places** on the google map. Facilitator gave them as much time as possible in order to ensure that everybody can understand the map. To be sure of the results, people are asked to situate their own house, and pins them on the map. They also indicate the different sections of their community.

Step2: Presentation of the tokens. The facilitator introduces the different options. Participants are encouraged to add activities, which are not represented by tokens on blank labels (pink post-it).

Step 3: Places location and associated places in the dry season.

- Participants are asked to locate water points (boreholes, dugouts, reservoirs, streams) in the dry season. They elicit the reasons of the location and the values they associate with.
- Each participant has a unique type of sticker to be distinguished from the others. Participants are asked to rank the different activities they have located on the board and to explain why (access, rights, and priorities).



Fig 3: Location of activities in the dry season in Zongoyiri (credit: F. Kizito, CIAT).

- Local facilitators help them to write down on a personal card why they choose this specific place for what specific activity for each season

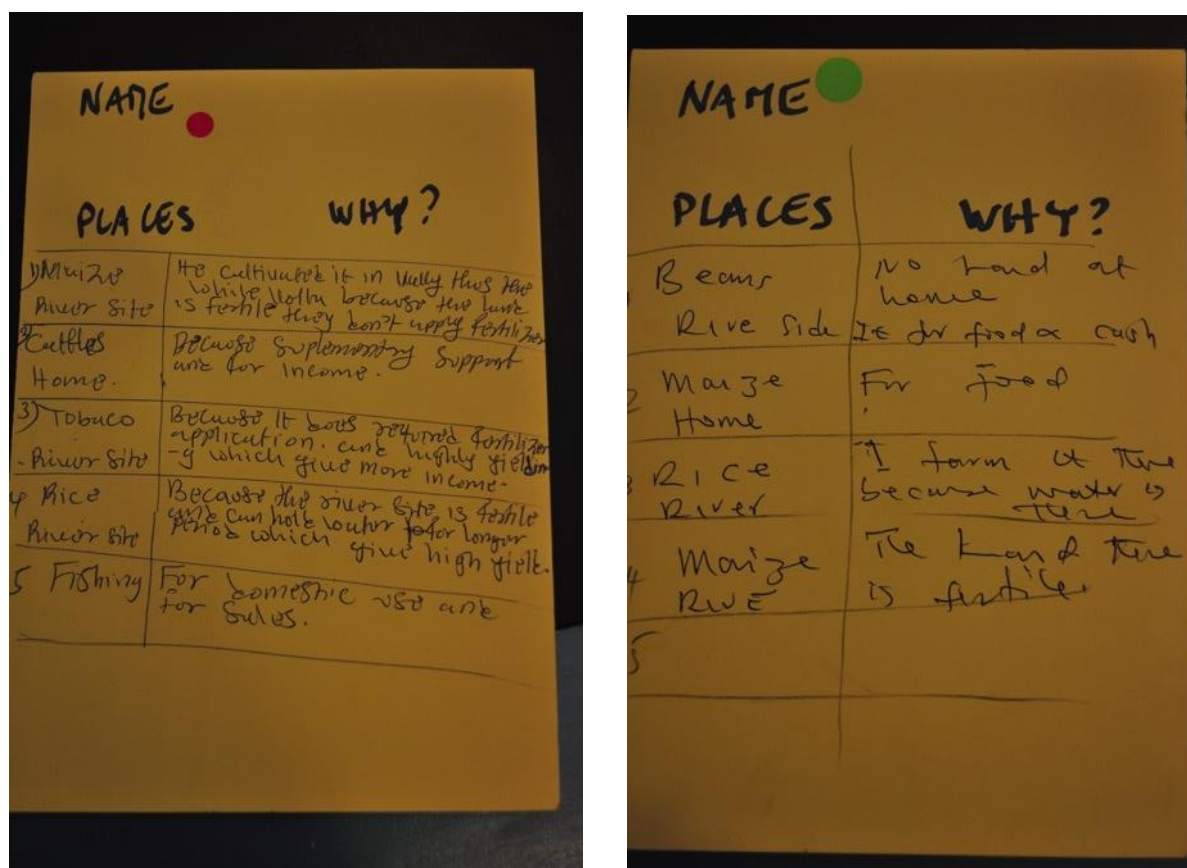


Fig 4: Two individual ranking of places (credit W. Daré, Cirad)

Step 4: Places location and associated places in the rainy season. Same exercise as step 3 but in the rainy season

Step 5: Future outlook: What if... ? is divided in two moments :

- First, based on the discussions facilitated in steps 3 and 4, we proposed to focus on a **common issue** related to water resources. Two subgroups are asked to self organize in order to define collectively a limited number of issues.
- After presenting the results to the whole group by a representative of each, the facilitator chooses one common issue. He proposed to locate this issue in a place to make people expressed what could be the constraints, conditions and consequences of this action specifically done in this location.
- Second, the facilitator ask them to define what could the change they would like to achieve in the future if there was not financial constraint.

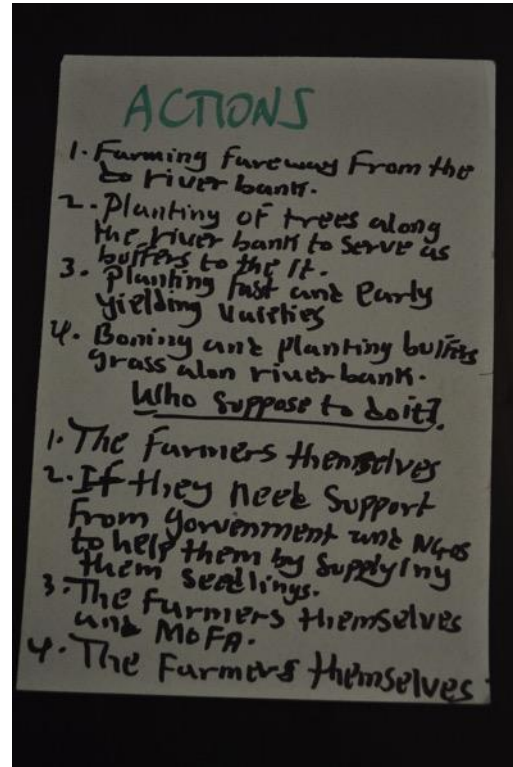


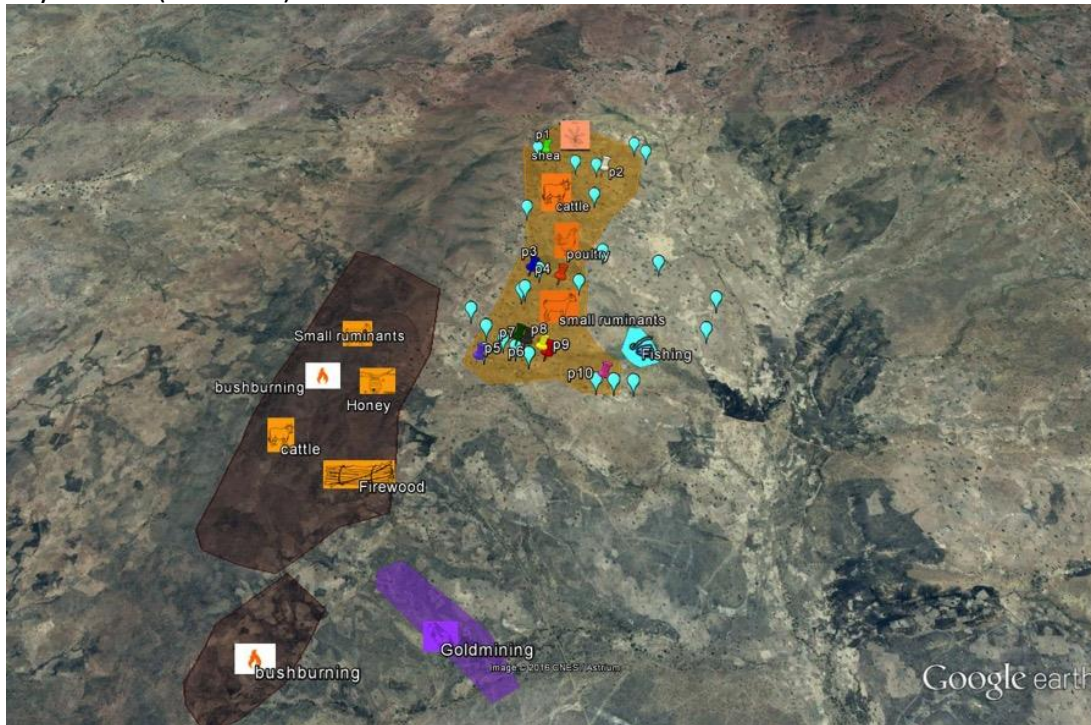
Fig 5: Participant presenting the results of its group at Nafkuliga (credit W. Daré, Cirad)

Step 6: Wrap up of the session. Participants express their feelings about the exercise, ask question of clarification. The workshop ends with the representative of WRC who place the exercise into its own policy to identify the issue at stake in the communities and to narrow its interventions on the field.

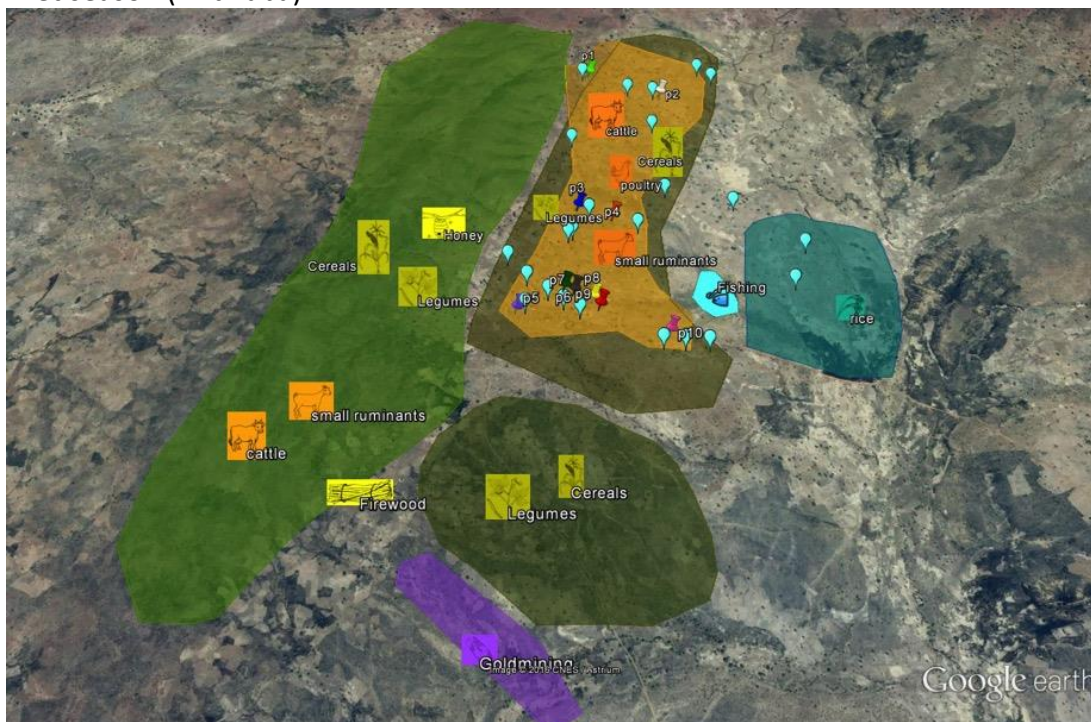
Annex 4. Mapping of places

Widenaba map of places' uses during the dry season (top) and rainy season (bottom)
Same legend as Zongoyiri, with the location of each participant' house (coloured pin)

Dry season (Widnaba)

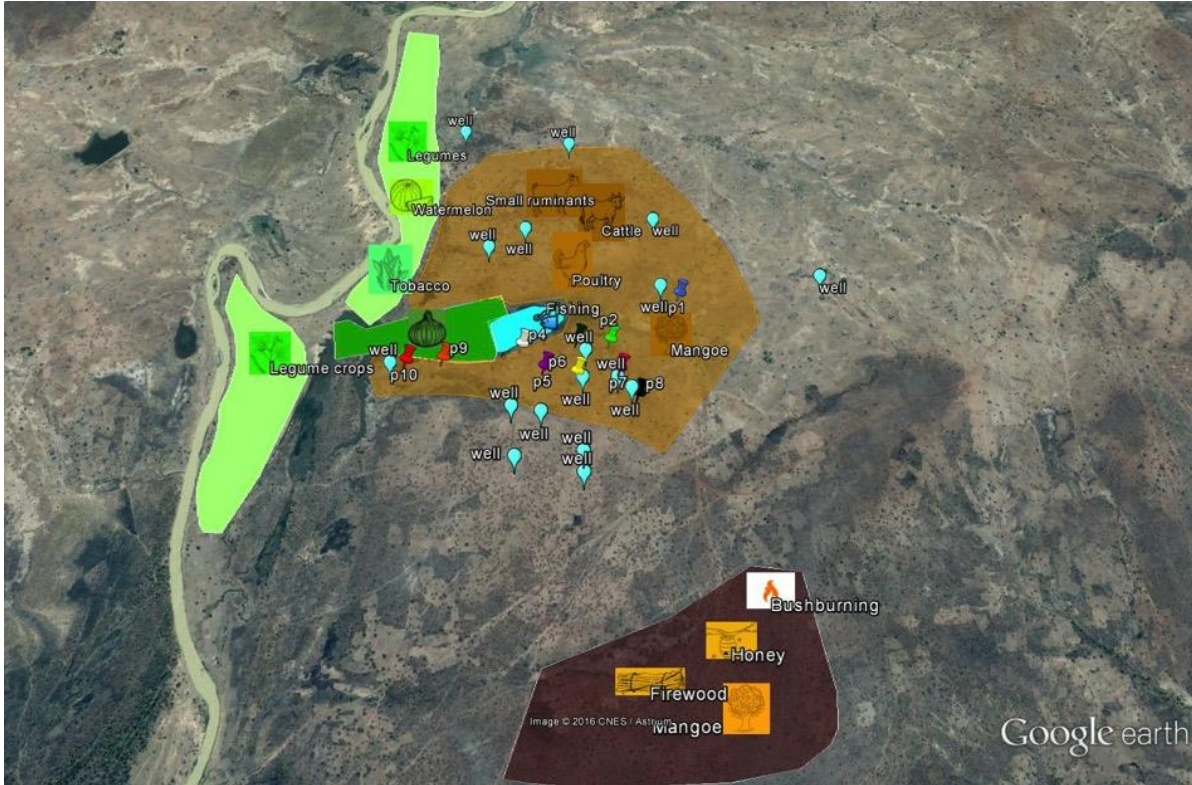


Wet season (Widnaba)

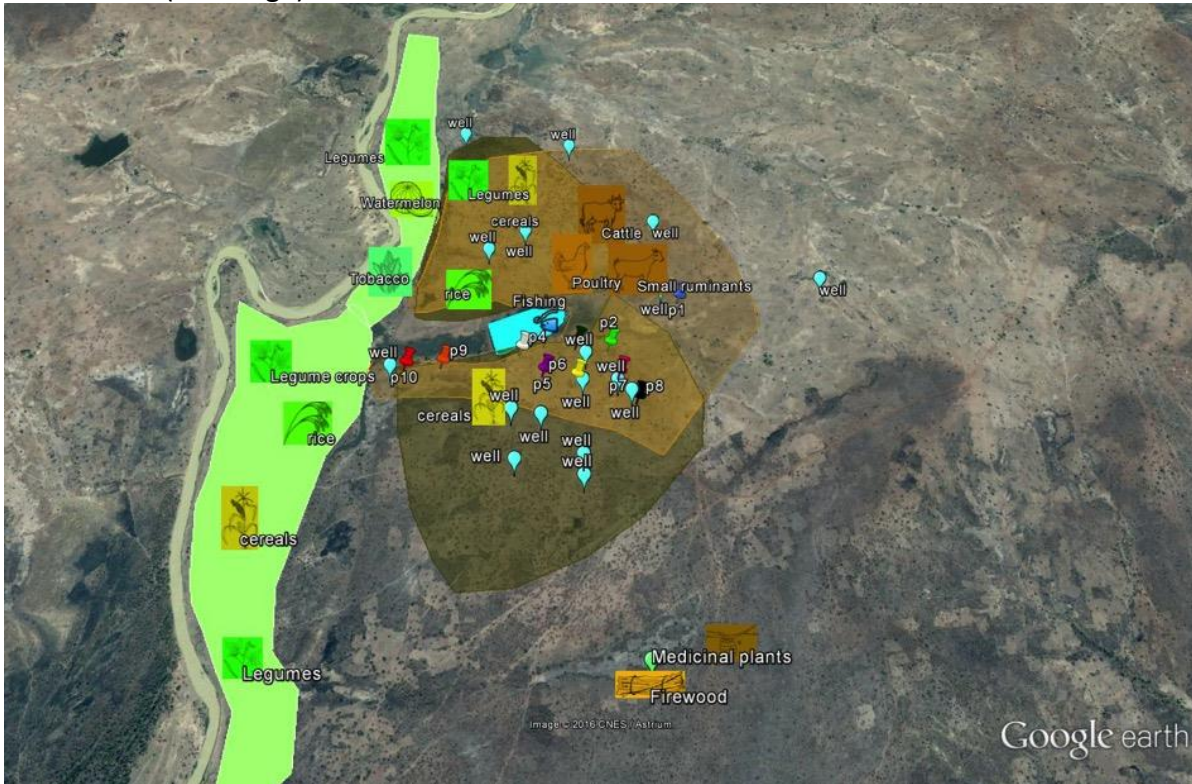


Nafkuliga map of places' uses during the dry season (top) and rainy season (bottom)

Dry season (Nafkuliga)



Wet season (Nafkuliga)



We would like to thank all donors who supported this research through their contributions to the [CGIAR Fund](#).