

Original Paper

Contribution of Communication for a Good Management of Water Bodies in Buurkina: Case of Lac Dem in the Commune of Kaya, Province of Sanematinga, North Center Region

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Abstract

Lake DEM, like other wetlands in Burkina Faso, is facing pronounced degradation due to numerous pressures, mainly anthropogenic, associated with management problems, a lack of communication and awareness of the basics of management of water bodies and thereby resulting in a weak local governance framework. It is with a view to reversing this trend towards the continuous degradation of our plant cover that our research work proposes the contribution of communication for better management of the Lac Dem water body by relying on the previous work of the Local Environmental Governance Consolidation Project (COGEL Project) in collaboration with the Ramsar Convention. This study is intended to be a scientific contribution. Also, the shared resource of the lake management plan offers us this opportunity to analyze the different uses of the water resource in a communication strategy at the level of the lake and within its sub-watershed. The estimate of water withdrawals from the lake by the various actors showed significant annual water quantities of m3 of water by the various actors involved in the sector. Our initial hypothesis, which is confirmed, testifies that the mode of withdrawal of the water resource from Lake Dem does not allow its sustainable use. However, given the status of the lake with multiple uses and the poor coordination of the actors, it seems imperative to operationalize the management framework of Lake Dem. Thus, the effective implementation of the lake management plan, and a good organization of all actors through communication strategies, will allow better coordination and sustainable use of the waters of Lake Dem.

Keywords

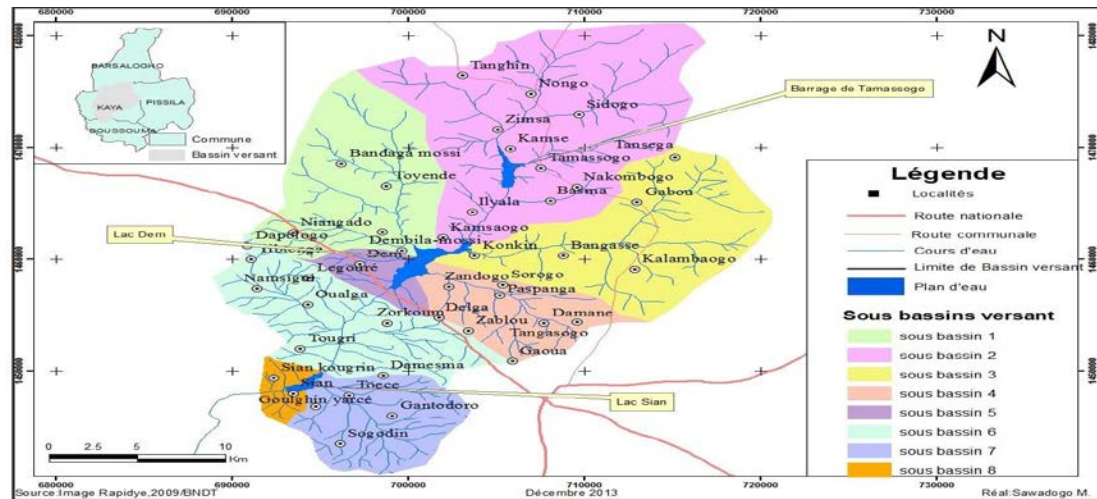
lac dem, communication, integrated water resources management, wetlands, onea, ramsar convention, burkina faso

Introduction

Burkina Faso has 1794 water reservoirs (DGRE, 2011). These are the natural and artificial wetlands that are located in all the watersheds and in the forest and wildlife reserves of our country. They are habitats for many terrestrial and aquatic animal species, as well as avifauna and many other living organisms. These ecosystems make a fundamental contribution to the ecological balance of the environment and to the lives of populations. Their resources, especially water, constitute natural capital that generates flows of goods and services. The Ramsar Convention defines a wetland as a geographical area where water is the main component of the natural environment; associated human, animal and plant life. These ecosystems can be natural (watersheds, lakes, rivers, ponds, plains, lowlands, forest and wildlife reserves etc.) or artificial (dams, water reservoirs, boulders or artificial ponds, irrigated agricultural land). However, poor management of these wetlands and their resources can involve a number of significant risks and obstacles for the stability of local residents and their habitats due to the difficulty of coping with the adverse effects of climate, development production activities due, among other things, to the proliferation of invasive plants, the siltation and silting up of rivers and bodies of water, the absence of communication strategies, the preservation of the health of populations and the biological diversity which becomes even more difficult with the pollution phenomenon of the Permanent Secretariat of the National Council for the Environment and Sustainable Development (SP/CONEDD, 2013).

1. A Methodology in the Geographical Universe of Lac Dem

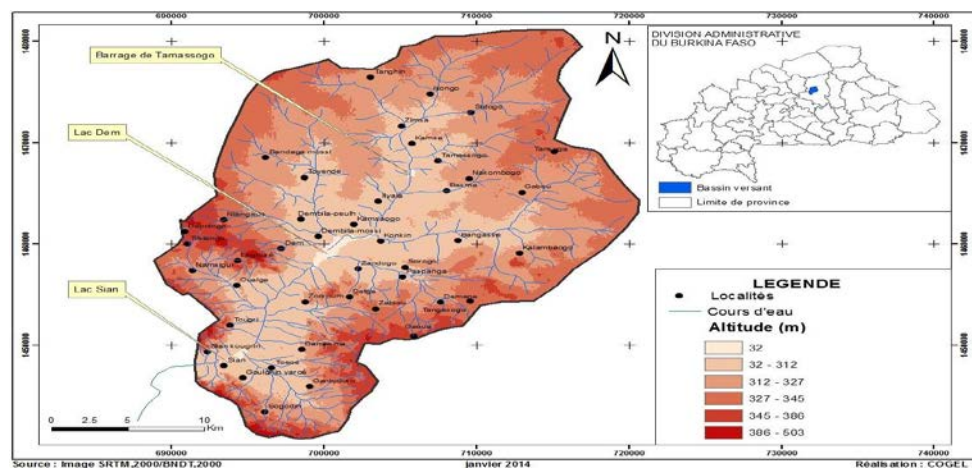
Lac Dem is an agribusiness center located in the administrative region of Centre-Nord (capital: Kaya). It falls under the province of Sanmatenga (capital: Kaya) and is entirely located in the Commune of Kaya precisely 13 km northwest of the city. Its depth is estimated at 2.3 m. During high water periods, the body of water stretches over 6.5 km long and 1.1 km wide and has an area of approximately 7,520,000 m² (Ouédraogo, 2006). It should be noted that Lac Dem remains a resource well protected by the inhabitants of the surrounding villages. The total area of the lake area is 1,354 ha. It is covered upstream by the classified forest of Dem (350 ha). The geographical surveys of Ouattara and Ouédraogo (2009), center the lake at the coordinate points 13°12'N and 01°10'W, gives map 1 below.

Map 1. Occupation of Lake Dem in the Geographical Space of Bukina Faso

Sources: Field surveys October 2023

1.1 A Watershed Marked by Curasse Peaks

Dem Lake is located on shale and migmatite granites (metamorphic and crystalline rocks). These rocks belong to the structure of the Kaya region and have favored the development of clay soils. BOULET et al. (1970) and falls under four units, namely crude mineral soils, poorly evolved soils widespread in the area, fairly deep tropical ferruginous soils and pseudogley hydromorphic soils. The watershed of the lake is marked by summits of breastplates with steep slopes on the glacis (GRAD, 2007). The site of the lake is located in the vast Mossi peneplain with an average altitude at Lake Dem of 291m, confers map 2 below.

Map 2. The Morphology of the Lake Dem Watershed

Sources: Field surveys October 2023

1.1.1 Sampling of the study site

The site chosen for our study is Lake Dem and focused on the villages of the sub-watershed of the lake, 14 in number, 8 of which constitute our sample. The 8 villages chosen are those peripheral to the lake and were therefore the subject of our surveys and field observations. They are: Dem, Dembila Mossi, Dembila Peulh, Ilyala, Kamsongo, Konkin, Zorkoum and Zandogo. The target population concerned heads of households, market gardeners, breeders, heads of technical and administrative services. A total of 80 heads of households (i.e., 10 per village), 80 market gardeners (i.e., 10 per village) were surveyed individually. The choice of people surveyed was made randomly (probabilistically) according to their availability. Eight (8) focus groups including 1 per village were also carried out. At the level of the technical and administrative services, interviews were carried out with the heads of the services concerned, in Kaya and Ziniaré, namely, the Director and technicians of the Nakambé Water Agency; the Director of ONEA in Kaya and the head of the drinking water treatment and production station of the Regional Director of the Environment and Sustainable Development of the center north; the Regional Director of Water and Hydraulic Developments of the Center North; the Regional Director of Agriculture and Food Security for the Center North; the Provincial Director of Agriculture and Food Security of Sanmatenga; the Provincial Livestock Director Kaya and a Technical Advisor from the Town Hall of Kaya.

1.1.2 An Inclusive Data Collection Method

We used data collection tools specific to qualitative and quantitative research, including interviews and questionnaires. This allowed us to collect precise data on the use of the lake's water resources. The interviews we conducted were semi-directive, the questions were formulated upstream before each meeting on the basis of our interview guides. Quantitative research is based on a systematic approach to collecting and analyzing information obtained from the sample of the population, with the aim of providing statistically valid results, generally used as percentages. As such, we used the traditional tool of the questionnaire. The literature review consisted of collecting secondary data to better understand our subject. Thus, the choice of the market price method made it possible to estimate the monetary values of each good and service provided by Dem Lake.

1.1.3 Data processing and analysis

After collecting field data, we entered the recorded interviews and analyzed the quantitative data using Excel software. The information was compiled manually (survey forms and interview guides), noted and recorded so that the presentation of the results faithfully respects the comments of the respondents. The exploitation of the qualitative data was done by means of the content analysis of the discourse of the interviewees. Each interview was analyzed in order to cross-check information with the other interviews and to identify the most sought-after information. The average of the results obtained from the data of our sample was assigned to the 7 other villages in order to be able to estimate an overall

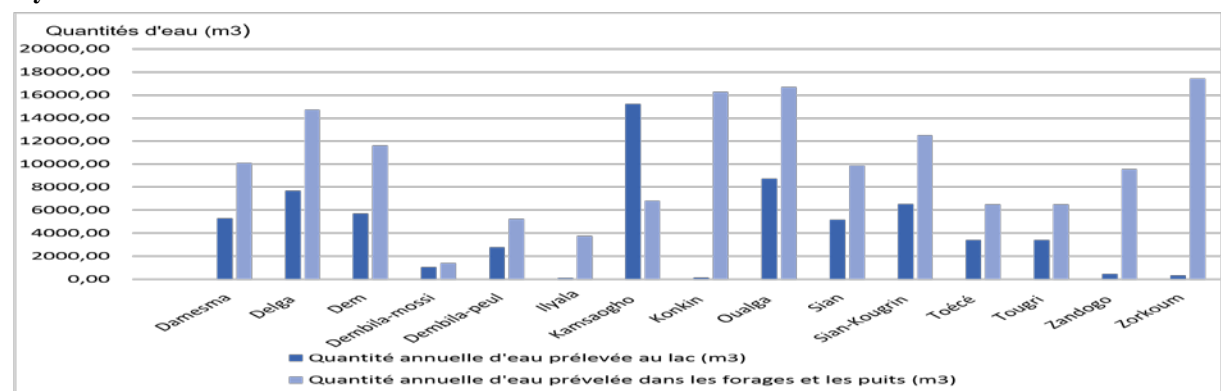
result at the scale of the sub-watershed of the lake.

2. Results and Discussions

2.1 A water-consuming Household Activity

The observation of graph 1 below tells us that households take more water from wells, boreholes and standpipes than from the lake. Indeed, the water withdrawals made by households in the lake are not very important because this resource is mainly used for the manufacture of bricks which is not a full-time activity.

Graph 1. Estimated Annual Colume of Water Withdrawn by Households from the Lake and Hydraulic Structures



Source: Survey data, 2023

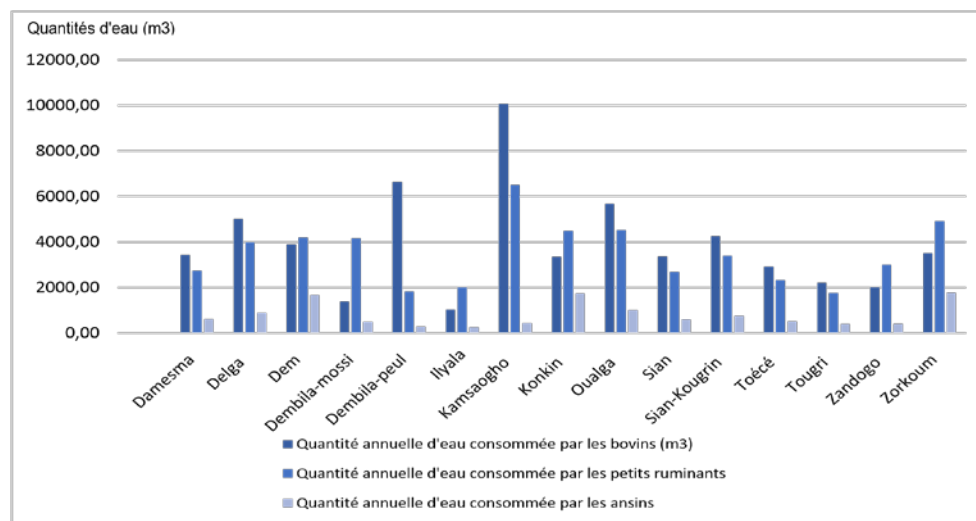
The same observation indicates that hydraulic works, especially that of boreholes, is the most used for household activities by the populations. For the villages in the sub-watershed of the lake, we were able to estimate the number of hydraulic structures at 54 boreholes, 19 wells and 2 standpipes. The village of Kamsaogo is an exception because we noted a lack of hydraulic infrastructure there. This locality has only one pump for its entire population estimated at more than 900 inhabitants, resulting in a certain inequality in access to drinking water in the area. We can then draw the conclusion that the more the populations have hydraulic structures, the less they consume the water resources of the lake. This fact allows us to show that the hydraulic works have a positive impact on the water resources of the lake as long as the communication strategies are implemented and to answer both our second specific question. The cases of the villages of Zorkoum and Konkin corroborate this, because the number of infrastructures in these localities favors the reduction of the use of water from the lake, hence less pressure exerted on this resource.

2.1.1 A high water consumer livestock

Livestock is the second activity of our populations and uses a lot of lake water after agriculture. The

purpose of this part is to estimate the quantity of water consumed by animals, in particular cattle, donkeys and small ruminants. The calculation method used in this part is based on individual surveys carried out with heads of household because they also practice livestock farming as a second activity. These surveys enabled us to establish the average number of animals (cattle, small ruminants, donkeys) per household (by household size), and therefore to be able to calculate an average coefficient for each category of animals, which corresponds to the number of animals per capita for each village surveyed. These coefficients multiplied by the number of the population allowed us to obtain the number of animals for each village. The average of the coefficients obtained from our sample (8 villages) was assigned to the 7 other villages in order to be able to estimate a result at the scale of the sub-watershed of the lake with an annual consumption of 123,207.20 m³. The villages that consume more water for livestock are Kamsaogho with an estimated volume of 17004.41 m³ and 8756.07 m³ for Dembila-Peulh and is explained by a strong habitation of Fulani communities whose main activity is livestock, confers graph 2 below.

Graph 2. Estimated Annual Volume of Lake Water used for Farming



Source: Survey data, 2023

The major consumers of water remain cattle compared to other animals, with a volume of water of 58788 m³ for 4027 cattle against 52560.5 m³ for 20575 small ruminants, and 11850.95 m³ for 1353 donkeys per year. The potential scenario of an increase in this cattle population would therefore lead to a sharp increase in the demand for water from the lake. However, it is important to point out that there is a fairly high number of small ruminants (more than four times that of cattle) in this area. Despite this strong numerical superiority, the water consumption of the latter does not exceed that of cattle. As a result, we note that with regard to the pressure exerted by pastoral activity on Lake Dem through the

use of its water resources, cattle breeding has a preponderant place. On the donkey side, there is a low number with less water consumption. This is explained by the fact that these animals are used more for field work than other tasks.

2.1.2. A state company ensures the availability of the resource: National Office for Water and Sanitation (ONEA)

ONEA is the State company in charge of Urban Drinking Water Supply and Sanitation (AEPA) in Burkina Faso. As part of the DWS, it uses groundwater and surface water resources (lakes, dams etc.). The city of Kaya is supplied by the water resources of Lake Dem which ONEA has been taking since March 2009. The objective is to know the volume of water taken by this structure and see the evolution of these takings for the population supply. During our field surveys in Kaya, we were able to obtain from the management and technical services of ONEA, the data relating to the monthly and annual quantities of water withdrawn from Lake Dem from 2010 to 2013. Indeed, the volumes of raw water from the lake withdrawn by ONEA in these years as well as the quantities of water withdrawn by ONEA amount to 683,327 m³ in 2010, 837,220 m³ in 2011; 918,100 m³ in 2012 and 1,093,239 m³ in 2013. This means that there is an increase in water withdrawals by ONEA from the lake each year. Between 2010 and 2011 there was a growth rate of 22.5%. In 2012, this rate increased to 34.4% to reach 60% in 2013. The reason for this increase is explained by the increase in the population, the growing number of subscribers and their demand (Idrissa Diallo, interviewee number 1, qualitative research data). Our observations in the field have allowed us to note that there is a permanent presence of water in the lake, but this water decreases considerably at a certain time of the year (March, April and May). This period coincides with the peak samples taken by ONEA.

2.1.3 A human resource lacking skills

Market gardeners do not have the necessary skills and adequate training on crop irrigation techniques and needs. It is important for farmers not to confuse crop water needs with their irrigation needs. Irrigation water needs must take into account several parameters including the type of soil and the water needs of the plant. This requires technical training on these different communication aspects. Indeed, during our surveys, we were able to realize that market gardeners have gaps in the sense of information and communication around their activities. It is very fitting that Mr Thomas Ouédraogo underlined and I quote: “water is poorly managed by market gardeners. The reasons for this poor management can be explained by several factors, in particular the lack of control of the water needs of crops, the state of the means of drainage, the non-compliance with development standards, the poor organization of irrigators, the poor management of hydraulic structures etc. (respondent number 2, qualitative research data). Mr Adama Millogo enriches these remarks by saying that and I site it: “market gardeners do not calculate the irrigation needs of crops, their irrigation is mainly based on observation” (respondent number 3, data from qualitative research). These comments are consistent

with our field observations which showed us that market gardeners are not trained in irrigation techniques. Our discussions with the latter have enabled us to understand that they have no scientific basis on the irrigation needs of crops; they rely more on their personal experiences to irrigate. This means that the training and strengthening of the skills of these actors will promote better control of the water in the lake. The logistical difficulties are especially observed at the level of market gardening activities. It is defined by the technical means of supply and support for the market gardeners' operational systems. Among these technical means, we can cite motor pumps, pipes, etc. The logistical problems are due to the lack of financial means. They are materialized by the obsolescence of the pumping equipment (pipes regularly pierced, torn, etc.), see photo 1 below.

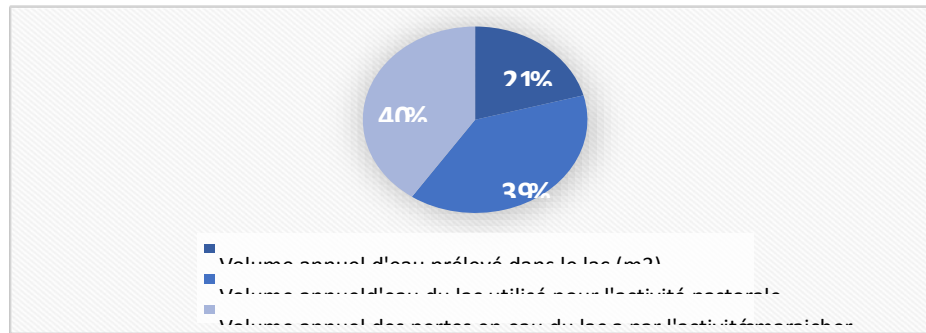
Photo 1. Bad Condition of Garden Hoses Leading to Water Loss



Photo: Field survey, 2023

As we can see in photo 1, the condition of this watering equipment favors water loss due to leaks. Thus, our results show that these losses are very high. They represent an estimated annual volume of 128,767.02 m³, or 3.11% of the total quantity of water withdrawn annually for market gardening. Compared to the total quantity of water withdrawn annually for market gardening, these losses certainly do not seem significant, but they exceed the average annual quantity of water withdrawn by pastoral activity as shown in Figure 1 below.

Figure 1. Comparison of the Annual Volume of Water Lost from the Lake by Market Gardening, with the Annual Volumes of Water from the Lake Withdrawn by Households and Breeders

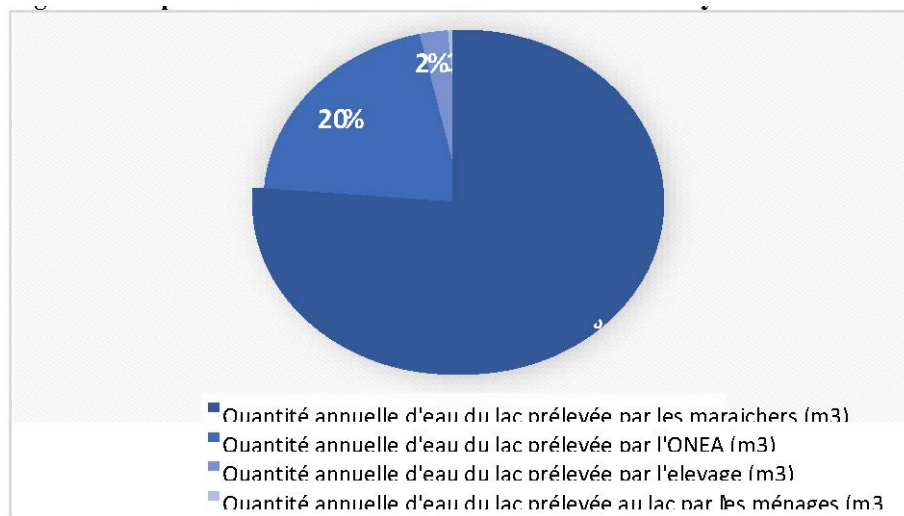


Source: Survey data (2023)

he annual volume of water lost by market gardening activity exceeds the annual volumes of lake water withdrawn by households and livestock breeders. We can then conclude that the improvement of market gardening equipment and materials would allow a reduction in losses and therefore less pressure on the lake's water resources. Equipment problems are not the only sources of water loss, there is also the lack of capacity building for actors.

2.1.4 A Proportion of trends in volumes of water withdrawn by actors

The water resource of Lake Dem allows different actors to carry out activities. The volumes of water withdrawals from the lake vary according to the nature of the activities. Thus, the objective in this part is to show the importance of water withdrawals from the lake according to the activities carried out in the sub-watershed of Lake Dem.

Figure 2. Proportions of the Volumes of Water Withdrawn by the Actors

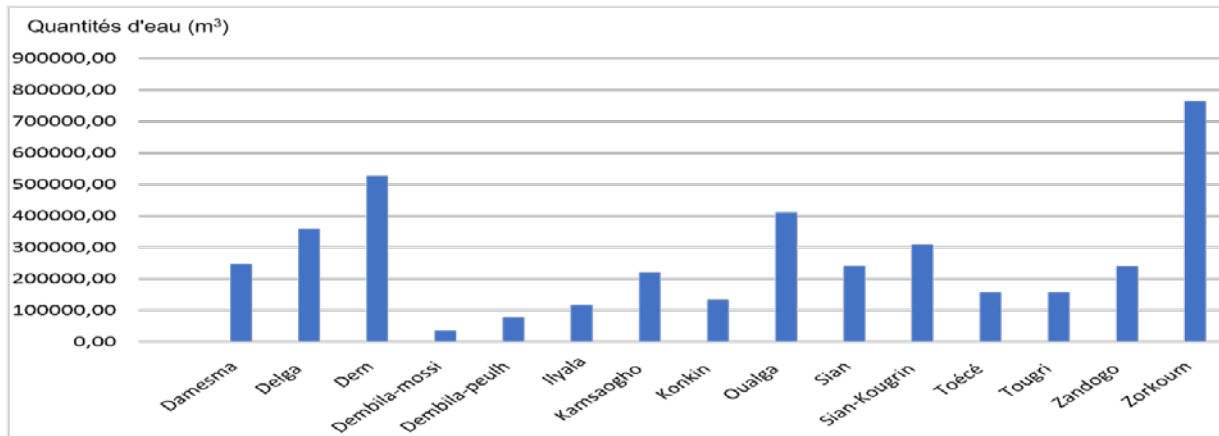
Source: Survey data, 2023

Figure 2 above shows the proportions of the volumes of water withdrawn and provides an answer to the first specific question. This figure indicates that the activities that consume the most water from the lake are market gardening and the production of drinking water by ONEA. Indeed, with very high proportions (77% for market gardening and 20% for ONEA) these two activities stand out from the others (2% for livestock farming and 1% for households). These percentages support the fact that agriculture, especially market gardening, is the primary production activity in the sub-watershed of the lake. This shows that better water control by market gardeners will allow better use of the lake's water resources and also reduce the pressures exerted on it. By comparing the quantity of water withdrawn by these actors with the volume of water available from the lake, and given the increase in population and needs, Lake Dem risks no longer being able to ensure its environmental flow. Hence the need for better governance of this water resource by integrating aspects of communication and awareness

2.1.5 The different actors involved in the water consumption process

Market gardening in the Lake Dem sub-watershed is practiced on the shores of the lake and uses its water resources. The purpose of this part is to establish the estimated volume of lake water used annually by market gardeners for watering, by village of the sub-watershed of the lake. To do this, we conducted surveys with market gardeners in the 8 villages bordering the lake and focus groups in each village. Thus, by village, we were able to individually investigate 10 market gardeners on their methods of water withdrawal, their cultivated area, the duration of speculation, the volumes of water used and the quantities of water lost by irrigation. These individual surveys enabled us to calculate the average volumes of water irrigated, losses and the average areas of the perimeters per market gardener for each village surveyed. Using the focus groups by village, we were able to establish the number of market

gardeners with a perimeter: almost all the heads of households in each village, i.e. 90%. The average of the results obtained from our sample (8 villages) was assigned to the 7 other villages in order to be able to estimate an overall result at the scale of the sub-watershed of the lake. Overall, the average annual quantity of water used by market gardeners in the Lake Dem sub-watershed amounts to 4,005,138 m³.

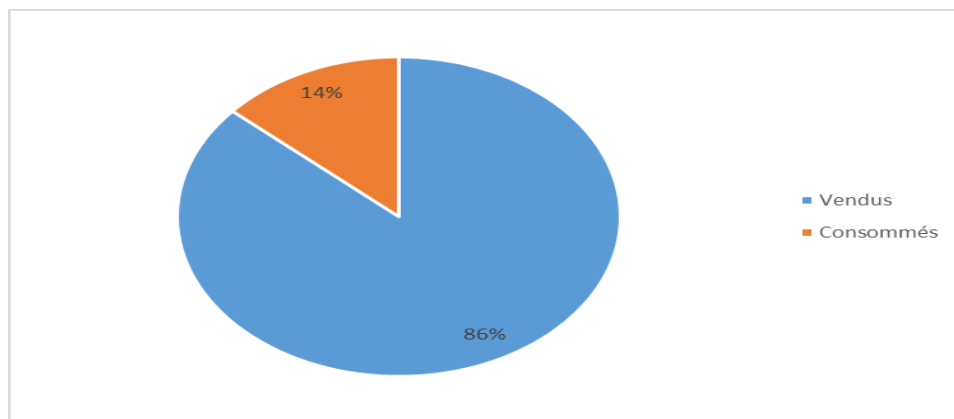


Graph 3. Estimation of the Annual Volume of Water by Market Gardeners through Irrigation

Source: Survey data, 2023

2.2 Estimation of the Economic Vof fishery Resources

Fishing is one of the activities carried out by the local populations of Lake Dem. From the surveys, it appears that the favorable time for fishing lasts between 4 to 5 months and the rest of the month is considered as the period when the activity is slowed down. The main species of fish sold are catfish, sea snails, sardines, carp and prawns. We found that fishing is not the main activity of fishermen. Fishing only comes in third place after agriculture and animal husbandry. Inspired by the categorization of fishermen carried out by the FAO (Bado et al., 2007), we can say that the fishermen of Lake Dem belong to the category of semi-professional fishermen. Alongside the latter evolve occasional fishermen whose practice of the activity remains a hobby. In Lake Dem, a fisherman sells an average of 857 kg of fish per year and obtains an average amount of 417,160 FCFA per year and the quantity of fish devoted to family consumption is estimated at 134 kg per year, i.e. 67,000 FCFA. Figure 3 below shows the percentage of fish sold and that reserved for family consumption.

Figure 3. Distribution of the Use Made of Fish from Lake Dem

Source: Survey data, 2023

Based on the estimates made, the quantity of fish taken from Dem Lake is 46,595 kg/year. The quantity of fish intended for family consumption is 6,293 kg/year, or 14% of the total fish harvest. This is equivalent to 3,146,500 FCFA. The quantity of fish sold is 43,302 kg/year, or 86% of the total. The amount obtained for this sale is 19,606,500 FCFA. In short, the total monetary value of the halieutic resource is 22,753,000 CFA francs. The quantity of fish taken from Dem Lake is low due to the siltation of the body of water and the development of prohibited fishing practices such as poisoning the water with pesticides used for agriculture. According to the fishermen, the lack of equipment such as canoes and nets does not allow them to take large quantities of fish from the lake.

2.2.1 An estimate of the economic value of assured drinking water

The local population of Lake Dem uses the water mainly for irrigating market gardening plots and watering livestock. The city of Kaya located 15 km from the lake, to overcome the problem of drinking water supply has since 2006 used Lake Dem to supply drinking water. Indeed, before the exploitation of Lake Dem, two (2) wells and fourteen (14) boreholes served as supply systems for the city of Kaya (COULIBALY, 2011). The water from Lake Dem is also used to supply drinking water to the town of Kaya. The number of people who get drinking water from Lake Dem is estimated at around 43,520 individuals (COULIBALY, 2011). The demand for water is increasing. The National Office for Water and Sanitation (ONEA/Kaya Center Agency) is responsible for supplying the city with drinking water. Kaya ONEA sold 1,086,880 m³ of water and received 303,695,274 FCFA in the second year of 2013. It should be noted that ONEA collects water free of charge like any other user. Indeed considered as a common good, there is a rivalry that takes place on the resource. Would it not be necessary to apply the user-pays principle on this resource since the fourth principle of IWRM considers it as an economic good? It is with this in mind that the inter-village land charter for the management of Dem and Sian lakes was drawn up to provide for the conditions of access to resources. Based on article 7 of the

charter, we estimated at 54,344,000 FCFA the tax that ONEA could pay to the community per year. This sum is a considerable loss for local authorities who could use it to self-finance activities to protect water resources and promote the goods and services provided by Lake Dem.

2.2.2 Estimating the economic value of non-timber forest products

Woody and non-woody species play an important socio-economic role: the fruits are sold and consumed by people and animals, the leaves, barks or roots are used in the local pharmacopoeia, consumption, and used as a source of food. Throughout the catchment area of the lake, protected plant species mainly concern those said to be useful for their fruits, flowers, bark, leaves and roots. According to Ouattara and Ouédraogo (2009), these are: *Vitellaria paradoxa*, *Acacia albida*, *Tamarindus indica*, *Lannea microcarpa*, *Sclerocarya birre*). Also, are classified among the species with a strong dominance of individuals: the *Ziziphus mauritiana*, the *Khaya senegalensis*. For these authors, the particular aspect of this sector lies in the creation of numerous *Adansonia digitata* agroforestry parks in cultivated areas close to human habitats. Parks of *Acacia albida* are abundant there and are subject to intense pruning for fodder purposes. The fruits and leaves from these trees are used as food products by households in the study area. Non-timber forest products (NTFPs) are defined as any material of animal or plant biological origin other than wood, originating from forests or other wooded land or from trees outside forests (FAO, 2001, quoted by Ouédraogo et al.). The collection and processing of NTFPs are done particularly by women and are present at all levels of the sector. Also, this study made it possible to estimate the average value of NTFP consumption by households in the eight villages selected as well as the total value which is obtained by extrapolating the average values per household to all households in the wetland of Lake Dem. The study carried out was based more on the supply services of Lake Dem in order to highlight the benefit of Lake Dem. Table 1 below summarizes all the ecosystem goods and services of Lake Dem.

Table 1. Total Economic Value of Dem Lake Provisioning Services

| Resources | Total value (direct use) | Go % |
|------------------------------------|--------------------------|------------|
| Agricultural land resources | 930 080 000 | 42 |
| Vegetable crops | 871 714 000 | 39 |
| Halieutics resources | 22 753 000 | 1 |
| Water resources | 303 695 274 | 14 |
| Pastoral resources | 33 490 850 | 2 |
| Non-timber forest products | 52 975 873 | 2 |
| Total (Fcfa) | 2 214 708 997 | 100 |

Source: survey data, 2023

The estimate of the value of market goods and services from the lake gives a monetary value of more than two billion two hundred million CFA francs. This value is minimal because the study focused on the evaluation of the direct use value of some goods and services associated with Lake Dem. The value of agricultural production (cereal crop plus market gardening) which is 1,801,794,000 CFA francs is greater than that taken from the ecosystem around Lake Dem. The value of the goods taken (fish, NWFPs, pasture, water) in the lake is 412,914,997 CFA francs.

Conclusion

Water is an essential resource for the survival of populations, especially rural populations. Wetlands are used by these populations for various activities including agriculture, livestock, fishing, etc. With regard to Lake Dem, its water resource, like that of many other wetlands in Burkina Faso, faces many pressures. These pressures generally linked to anthropogenic activities, coupled with strong climatic variability and a weak governance framework characterized by the absence of information and communication strategies constitute a serious threat to the survival of ecosystems. The objective of this study was to analyze from a communication angle the different uses of the water resource at Lake Dem and within its sub-watershed. It is intended as a contribution to the operationalization of the management frameworks for Lake Dem, in particular the lake management plan for the preservation of this shared resource. Thus, the analysis of the results of the field survey carried out with the various actors indicates the virtual absence of communication strategies for a better appropriation by all the actors of good practices and new principles. In addition, several other difficulties in terms of communication and information hinder the smooth running of the management of the lake and therefore the proper extraction of its water resources, among which, the lack of necessary skills and adequate training of market gardeners. on crop irrigation techniques, the poor state of the logistical means of dewatering, the poor coordination of actors and a weak governance framework and the absence of training.

Au regard de ce qui précède et compte tenu de l'importance et le caractère du lac à usa_ Water is an essential resource for the survival of populations, especially rural populations. Wetlands are used by these populations for various activities including agriculture, livestock, fishing, etc. With regard to Lake Dem, its water resource, like that of many other wetlands in Burkina Faso, faces many pressures. These pressures generally linked to anthropogenic activities, coupled with strong climatic variability and a weak governance framework characterized by the absence of information and communication strategies constitute a serious threat to the survival of ecosystems. The objective of this study was to analyze from a communication angle the different uses of the water resource at Lake Dem and within its sub-watershed. It is intended as a contribution to the operationalization of the management frameworks for Lake Dem, in particular the lake management plan for the preservation of this shared

resource. Thus, the analysis of the results of the field survey carried out with the various actors indicates the virtual absence of communication strategies for a better appropriation by all the actors of good practices and new principles. In addition, several other difficulties in terms of communication and information hinder the smooth running of the management of the lake and therefore the proper extraction of its water resources, among which, the lack of necessary skills and adequate training of market gardeners. on crop irrigation techniques, the poor state of the logistical means of dewatering, the poor coordination of actors and a weak governance framework and the absence of training.ges multiples, our hypothesis “the mode of abstraction of the water resource does not allow a rational and sustainable use of it” has been confirmed. There is then the imperative need to operationalize the tools of communication and capacity building within the framework of a management adapted to the context of Lake Dem. To do this, efforts must be made by all the actors concerned by the Project, including the Ramsar Convention for a more effective and sustainable management of Lake Dem.

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