Organisational Dynamics of Rural Populations around Water Sharing and Management in the Baobolong Valley

Mamadou FALL*
Coura KANE**
Awa NIANG***
Marième NGOM****
Violeta PUȘCAȘU*****
Alioune KANE******

Abstract

The presence of water in a space implies interrelationships between it, its immediate environment and the people who live there. Water resources play an important role in the social, economic and cultural life of populations, particularly in rural areas. The necessity of water services justifies the extent of its covetousness. In another vein, water resources, through phenomena such as flooding, intense runoff, and river overflow, cause enormous difficulties. This leads to profound changes, thus compelling populations to develop strategies for their adaptation, but also their subsistence in their "new" living environment or simply leaving it for a better place elsewhere. Through this interplay of service quality and natural inconvenience, water resources influence land use and spatial organization, shape governance mechanisms, and dictate the spatial distribution and movements of populations. This involves installing complex systems around water points and bodies of water, the study of whose

* Professor, PhD, Cheikh Anta Diop University of Dakar, Senegal, Corresponding author: mamadou3.fall@ucad.edu.sn
** Lecturer-researcher, PhD, Alioune Diop University of Bambey, Senegal, E-mail: coura.kane@uadb.edu.sn
*** Professor, PhD, Cheikh Anta Diop University of Dakar, Senegal, E-mail: awa10.fall@ucad.edu.sn
**** PhD, Iba Der Thiam University of Thiès, Senegal, E-mail: sodamariem38@gmail.com
***** Professor, PhD, "Dunarea de Jos" University of Galati, Romania, E-mail: violeta.puscasu@ugal.ro
****** Professor, PhD, Cheikh Anta Diop University of Dakar, Senegal, E-mail: alioune.kane@ucad.edu.sn

Copyright: © 2026 by the authors.
Open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license https://creativecommons.org/licenses/by/4.0/

organizational levels would allow us to understand their functioning and dynamics. The spatial entities that are defined constitute a network in which water remains the primary organizing factor, through its spatial distribution and management. Here, water is simultaneously a resource, an environment, a determining factor for the functioning of ecosystems, and also the basis for diverse activities and fundamental human values, both extraterritorial and territorialized. This article aims to analyze the relationship between water and human communities, focusing on the relevant spatial and temporal scales specific to rural areas in order to identify the impacts of the typology and spatial distribution of water resources on socio-cultural environments, the role of actors involved in their management, and the occupation of space.

Keywords: *water; space; population; management; rural environment*

Introduction

History has shown that the greatest civilizations arose around water sources. As early as 1964, Karl August WITTFOGEL[*] , defended the thesis that "*the birth of the first great states can often be explained by a hydraulic motivation*". Relationships between water and space exist and have always existed wherever the resource is located. In rural communities south of the Kaffrine region, water resources can be divided into four types: boreholes, wells, ponds and Baobolong. In this rural area, water is a factor in local development and social organization. It's considered to be a habitat, a food source, a cultural and religious medium, a means of production and a commodity. Its management is subject to technical innovations and sharing rules to meet collective needs. Thus, around water resources, structuring mechanisms are emerging that are deployed within modes of access, use and regulation, situations of inequality, spatial organization logics and management modes. As a result, they dictate or, at least, influence the organization of space through models of integration, communication, use, sharing and management.

Method and Materials

The spatial scale of this study is limited to rural municipalities located in the south of the Kaffrine region (Figure 1).

[*] Karl August WITTFOGEL is the author of the famous book *Oriental Despotism: A Comparative Study of Total Power,* published by Éditions de Minuit, Paris, 1964.

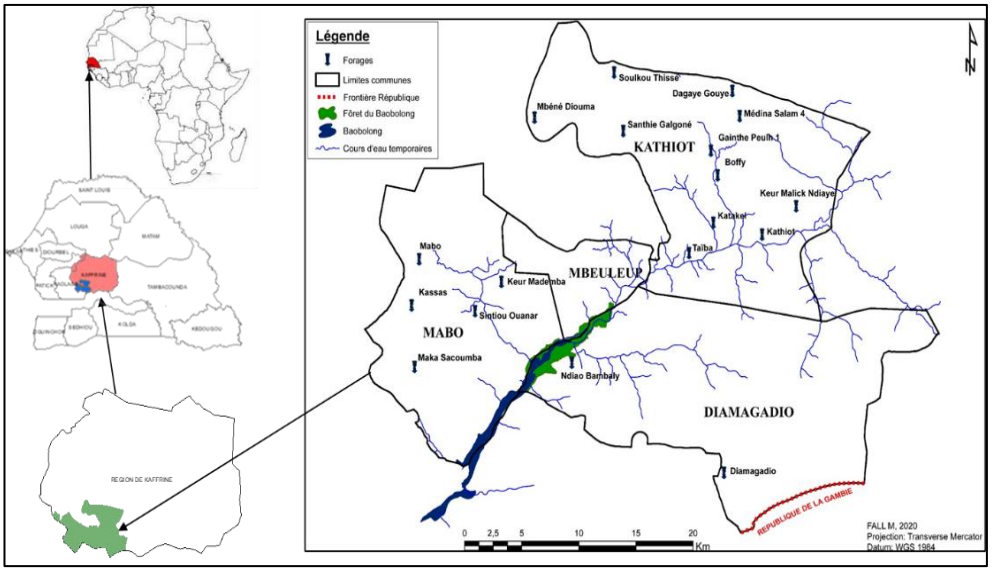

Figure 1. Location of the study area

The methodological framework used is based on the processing of quantitative and qualitative data collected in the field. It defines the key research steps for assessing the factors of spatial organisation, the dynamics and mechanisms of water governance through community management systems, the direction of population movements and their distribution in this rural area. To this end, the aim was to identify stakeholders, population centres, and categorise villages according to the presence or scarcity of water, etc.



Figure 2. Data collection from rural populations

The sampling method used was non-probabilistic, or reasoned choice, with a 1/5 quota survey. To ensure that the sample was representative, we considered the infrastructure levels (mainly water facilities) of the municipalities, the demographic size of the villages and the distances between households' places of residence and the water points they use. Out of a population of 6,367 households, 424 were surveyed using questionnaires to collect quantitative and qualitative data. Interview guides were also administered to public and private institutions (town halls, community associations, technical services, etc.). In addition, archival data were collected to help establish the theoretical and operational framework of the study. Finally, secondary data were collected from planning documents, study and project reports, etc.

Results

Intermittent distribution of artificial basins, structured around boreholes, and the natural basin of Baobolong

The typology of water resources in the area allows us to distinguish between two types of basin: artificial basins, structured around borehole service areas, and the natural Baobolong basin. A second categorization of villages was carried out on the basis of the typology and spatial distribution of water resources: *villages located on the banks* of the Baobolong and *villages not located on the banks* of the Baobolong; villages connected to a drinking water supply (known *as AEP villages)*, with at least one drinking water supply facility, and *villages without AEP.* This categorization revealed water territories structured around the management of borehole service areas and the Baobolong valley.

Hydraulic boreholes define artificial basins or service areas that are bringing about profound changes in the structure of rural areas. An artificial basin corresponds to all the localities that are supplied with water from the same borehole. It can be extended to include villages that are likely to become centers of attraction but are not yet connected to the AEP network. *The Multi-Village Water Supply Policy (AEMV) promoted by the Senegalese government consisted of constructing a modern well or borehole in a central village and supplying satellite villages located within a 5 km radius. The concept of artificial catchment areas took off with this AEMV system, which transcends the boundaries of administrative entities (rural

* The AEMV system aims to supply several localities. It differs from the AEV (Adduction d'Eau Villageoise) system, which serves a single village (JICA, 2011, *Study on rural water supply in the Tambacounda and Matam regions*).

commune boundaries). This led to the emergence of a way of structuring rural areas around the sharing and management of boreholes.

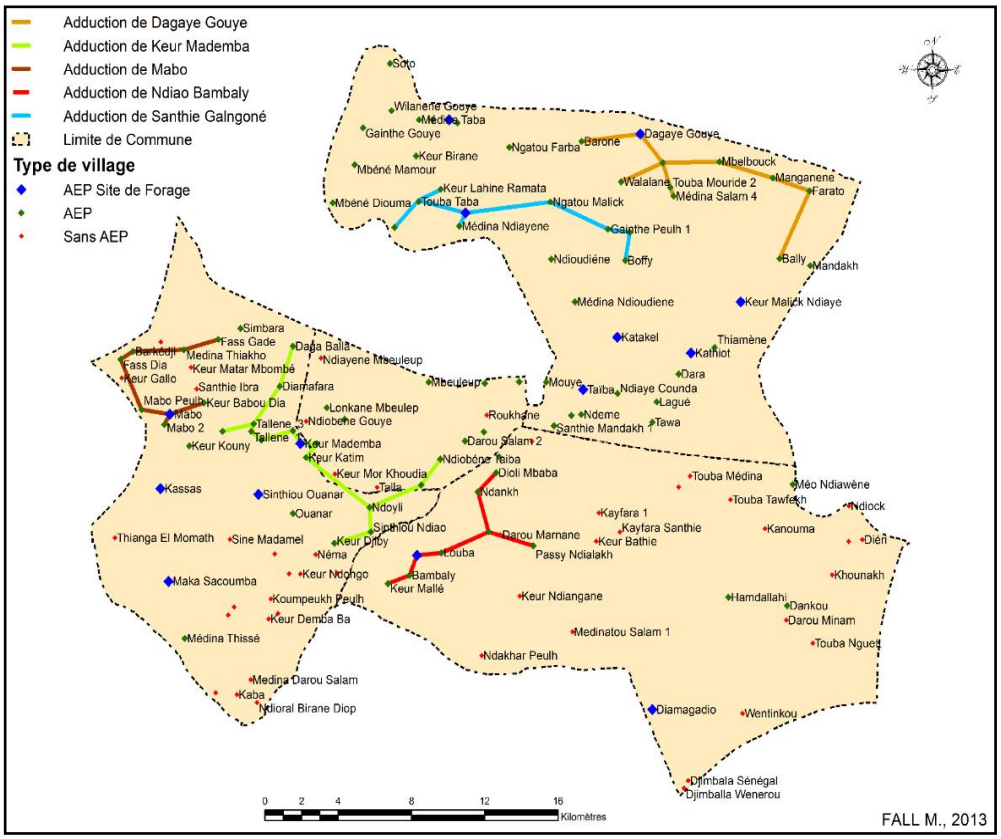

Figure3. Map of water supply networks or artificial basins in the area

The Baobolong is a temporary watercourse that originates from the Gambia River. It is located between 13° 37' 0'' and 13° 60' 0'' north latitude and between 15° 50' 0'' and 15° 20' 0'' west longitude, with an area of 1,650 km², most of which is in Senegalese territory (63.8%). The Baobolong Valley stretches for 150 km. In Senegalese territory, it runs from the south-west of the Department of Nioro to the Commune of Kathiot, in the Department of Kaffrine. The Baobolong River is the focal point for all the villages in the study area, but is only perennial in the Communes of Diamagadio, Mabo and Mbeuleup.

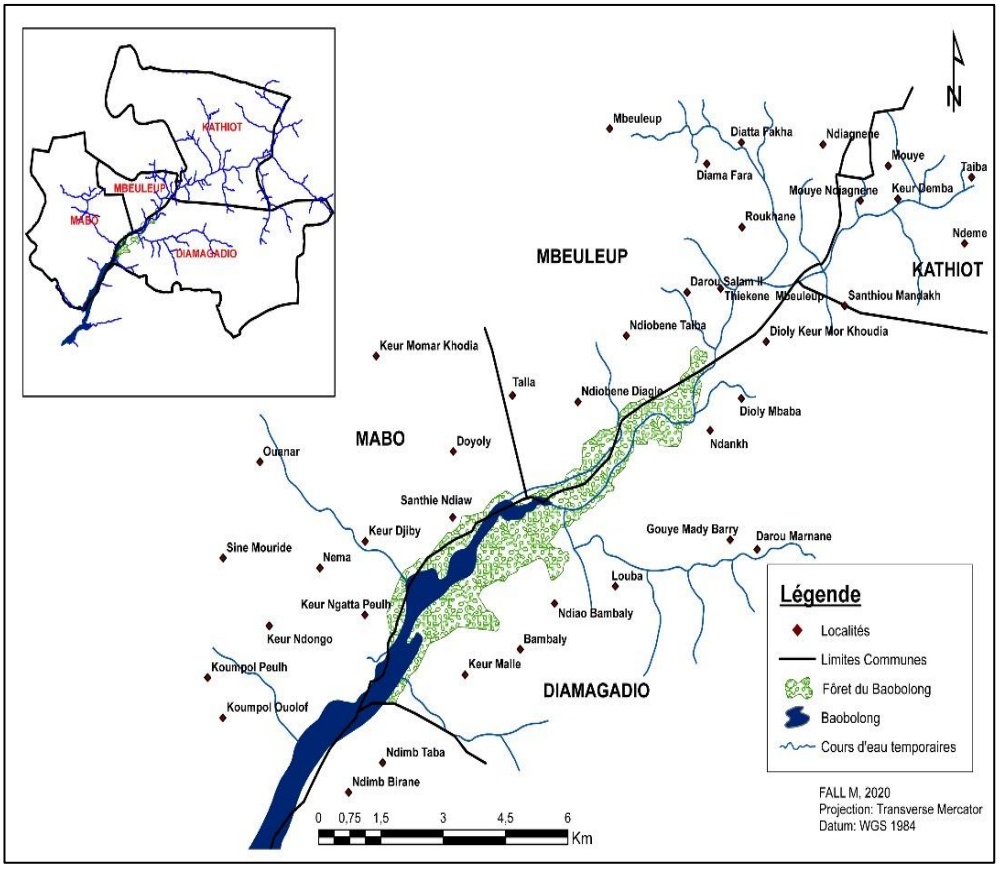

Figure 4. Baobolong Valley in the Kaffrine region

As part of this study, the impact of water on the spatial and organizational dynamics of populations is assessed according to several dichotomous parameters (riparian and non-riparian, with and without drinking water supply) derived from the spatial distribution of the resource, which gave rise to the categorization of villages.

The influence and attractiveness of villages with water points

The attractiveness of water resources depends on the quality of their service. Wherever a water source is located, populations, especially rural ones, are drawn to live there and develop their activities. Localities with drinking water supply and those bordering the Baobolong River are seeing an increasing number of people settling there. The former because of the quality of service provided by their waterworks (drinking water) and the latter because of the countless possibilities offered by the river (water for production). Through the influence they have on villages, boreholes play a significant role in spatial restructuring, marked by a high

concentration of populations in villages with water supply systems, first, and then around water supply facilities. This makes these localities highly sought-after areas for both locals and migrants.

Table 1. Population distribution by type of village

Municipality	Village	Type of village		Population
		Borehole	***Baobolong***	
Diamagadio	Bambaly	AEP	Riverine	***1022***
	Dankou	AEP	Non-riverine	***1367***
	Diamagadio	WSS (Drilling site)	Non-riparian	***395***
	Kanouma Mboyene	*No AEP*	*Non-riparian*	***464***
	Keur Ndiangane	*No access to drinking water*	*Non-riparian*	***1143***
	Ndiao Bambaly	Water supply (drilling site)	Riverside	***1694***
Kathiot	Mbéné Diouma	AEP	Non-resident	***1680***
	Mouye	AEP	Non-riparian	***1475***
	Ngatou Malick	AEP	Non-riverine	***1798***
	Ndioudiene	AEP	Non-riparian	***1937***
	Santhie Galngoné	AEP (Drilling site)	Non-riparian	***3550***
Mabo	Diamafara	AEP	Non-resident	***1782***
	Sinthiou Ndiao	AEP	Riverside	***48***
	Keur Ndongo	*No AEP*	*Non-riverine*	***192***
	Keur Ngatta Peulh	*No water supply*	*Non-riparian*	***100***
	Mabo I	Water supply (drilling site)	Non-riparian	***1891***

Source: ANSD, RGPH 2023

The development of water points and water bodies for domestic and production use can change the situation in terms of land use. History has shown that populations continue to covet locations with easily exploitable water points and their immediate surroundings. Water is central to population distribution. In rural areas, "*the lack of water points often leads to excessive concentrations around villages*" (DESCROIX, 2002). Indeed, field surveys have shown that populations from the Fatick Region, Casamance and the Republic of Gambia have settled in Ndiao Bambaly (Diamagadio Commune) for the purpose of fishing, market gardening and rice cultivation around the watercourse.

Furthermore, Baobolong plays a role in the formation and functioning of ecosystems in this rural area. With the help of NGOs such as COMI, rural populations have managed to reforest 60 hectares of the forest along the watercourse, around which a community management system has been organized. This environmental protection initiative has encouraged the return of animal and plant species that had previously

disappeared, as well as the development of tourism and other leisure activities such as hunting.

During the wet season (when the borehole watering holes are closed), the ponds also dictate the movement of livestock farmers. In addition, they play an essential role in determining and structuring transhumance routes, as well as resting places. "*A description of the main transhumance routes provides an insight into this* " (SY, 2009). The movement of people and livestock towards ponds leads to new routes. Villages with ponds then become meeting places during the winter. They are often the scene of conflicts between farmers and herders over the sharing of land between grazing areas (around ponds) for livestock and agricultural plots.

The repulsive nature of villages without water supply and the isolation of basins and lowlands

In this rural area, villages without water supply correspond to areas marked by severe degradation of vegetation cover because of long-term extensive monoculture, specifically peanut farming. These are small, scattered and sparsely populated villages. They have no significant infrastructure; they have neither standpipes nor modern wells. In these villages, the population rarely reaches 300 inhabitants (Table 1). They are losing their populations to villages with drinking water supplies. There are no local demographic data to estimate displacement rates, but 73% of households surveyed in villages without drinking water supply believe that "the *scarcity of drinking water remains the main cause of population displacement*".

In the basin and lowland areas, the topography is conducive to intense rainwater runoff. "*Runoff water flows through villages, agricultural plots, rural infrastructure, etc., causing a great deal of material damage and, in some cases, even human casualties*" (FALL, 2008). Several hectares of crops are destroyed by runoff, especially in the west and south of the area (village of Sinthiou Ndiao, Mabo Commune). Added to this are the cycles of flooding that force rural dwellers to flee, most often to the north, to the outskirts of the urban agglomeration of Kaffrine.

Water in the genesis of rural territories

To study water territories, Douguet, et al. (2006) raise two complementary dimensions to demonstrate the duality of the relationship between humans and this resource: the question of the territorial influence of water management and policies on the one hand, and the question of the water sector's sphere of influence in territorial policies on the other. As a result, the territorialization of water management and policies requires a precise definition of the actors involved and an

understanding of the extent of their powers and roles in the water management process.

In the field of water resource planning, spatial water management has placed the territorial issue at the center of the debate on the sustainability of water governance systems, because "*the methods of its management are one of the keys to the organization of the territory and its functioning, but also a tool for spatial planning*" (Ghiotti, 2007). For this study, ***water territories*** refer to the political (management of boreholes and the Baobolong) and economic (management of water-generated revenue) appropriation of water resource management by rural populations and many other actors through local management structures: the Association of Borehole Users (ASUFOR) and the Association of Villages along the Baobolong (AVRB). Territory thus appears "*as an operational concept in both water development and management. It has become a guarantee of the adaptation of policies to local contexts and issues, which are increasingly influenced by the logic of sustainable development*" (Gachet, 2007). With the water crisis and its repercussions, "*the need to address the water problem at the territorial level*" (Ichard-Schott and Honegger, 2011) has emerged and crystallized the debate on what has come to be known as the "water territory" (Diatta, 2015).

In order to better understand the nature of the complexity of territories, DIATTA (2015) proposes a categorization based on the operationalization of the concept of "water territory". This results in three categories of territory.

Natural water territories refer to the watershed and the river basin. In relation to our study, this territory corresponds to the Baobolong management system regarding its flooded part in the Kaffrine Region. "*The river basin is the ideal territory. But we don't necessarily have to plan at the basin level. We can choose a reach or a sub-basin. The important thing is to use the territory that corresponds to the issues to be managed and the willingness of the actors to act*" (Burton, 2010). According to the same author, "*we do not manage a basin, but the human activities that take place there*". For our study, the AVRB seems to constitute the organizational framework for participation at the level of the four municipalities bordering the Baobolong.

Emerging or artificial water territories consist of areas of water production, distribution and use. These include areas served by urban drinking water supply networks, the area of influence of boreholes and water points in rural areas, and the immediate area of influence of structural hydraulic works (the ASUFOR territory). "*The water territory is a spatialized response to a local need through the mobilization of knowledge, practices and techniques at a given time*" (Alexandre et al., 2004; cited by Diatta, 2015).

Declining (non-functional) water territories refer to networks, non-functional water points and fossil valleys. Water territories "are born, evolve and die". They only regain their function when they are renatured or redeveloped and are dependent on natural conditions on the one hand and the viability of their mode of governance on the other. In our study area, the "privatization" of rural borehole management has led to the decline of the ASUFOR territory.

The territorial dynamics of water management through ASUFORs and local agreements refocus decision-making on the user. Territorialization refers to the process of building a territorial social project. It involves the relocation of public policies that are developed at the territorial level. Today, the success of the concept of territory is linked to its design, which gives more space to actors (particularly local ones) and to the experimentation with new modes of multi-level territorial governance.

The territorialization of water refers to giving users responsibility for defining policies on supply, use and sharing of the resource. The water territories built around water use and sharing in the study area therefore refer to management areas that are shaped by institutional conventions and local agreements (in line with national legislation), in which rural populations remain the main actors. With the rural environment as a physical backdrop, the social and spatial relationships that develop around water and its management constitute the lived experience of the populations.

The natural Baobolong basin and the artificial basins created by boreholes (service areas) constitute territorial frameworks for water management, but in rural areas they coexist and interfere with other management territories (communes and departments). The basin has become "*a **geographical object** studied as such and placed within the context of issues related to the organization and administration of a territory*" (Ghiotti, 2007). From this perspective, the watershed is a territory that has no political legitimacy, but at the same time it gives rise to a new form of governance by becoming an object of power. "*It allows logic, issues and opposition to materialize and be spatially located, and new actors who were previously marginalized to position themselves*."

The emergence of ASUFORs and AVRBs (water territories) is the product of the organizational dynamics of rural populations around the sharing and management of resources. They are increasingly establishing themselves as rural economic hubs. This economic issue is attracting the interest of local political decision-makers (communes and departments), who are legitimate because they have a public

mission and are elected by direct universal suffrage, but also the private sector, since the reform establishing the "Office des Forages Ruraux" (Ofor*). Water management in rural areas is thus at the center of competition between various powers and has given rise to several territories: "*a territory of management and a territory of decision-making, reflecting the multiplicity of social dynamics*" (Ghiotti, 2007).

Moreover, with the territories of ASUFOR (drilling management) and AVRB (Baobolong management), the rural municipalities bordering Baobolong have become a political arena where the interests and projects of various water stakeholders (local authorities, users and the private sector) clash, where power rivalries (management structures and municipalities) oppose each other and where different administrative entities merge.

Discussion

The attractiveness of Baobolong and its boreholes, which, through the seasonal settlement of transhumant herders and the permanent settlement of populations from diverse backgrounds, is leading to profound spatial and social changes: the expansion of village boundaries, land conflicts, competition for access to and sharing of resources, etc. This situation raises land, economic and political issues that must be taken into account in the development of local plans and development schemes.

Issues surrounding population concentration around water sources and bodies of water

In terms of land use, villages with public water supply systems are undergoing profound changes with a redefinition of land use patterns. There is now a legal procedure to follow in order to occupy a residential plot. From now on, it is mandatory to register residential plots according to a cadastral division that highlights the layout of neighborhoods in village centers and drilling sites. The demographic boom resulting from the massive influx of people from elsewhere (generally to obtain water) and the high natural growth rate of these villages is not without its problems. The limited amount of habitable space in these rural areas is

* The "Office des Forages Ruraux" (OFOR) is a public industrial and commercial establishment (EPIC) established by Law No. 2014-13 of 30 January 2014. It is the technical arm of the State in the management of rural water resources and operating contracts with the private sector, replacing ASUFOR in the management of rural boreholes.

also a factor explaining why populations are concentrated around water points and bodies of water.

Cultivated plots are increasingly being converted into residential areas (Fall, 2008). Land conflicts, previously caused by agricultural plots, have become more recurrent over plots used for housing. Large villages that form a buffer zone between the urban sprawl of Kaffrine and rural areas are more affected by this phenomenon.

The economic issue is linked to the variation in the rental value of residential plots depending on their location in relation to borehole water points. A plot located near standpipes is worth much more than one that is further away. "*The position (location) of houses in relation to borehole service points is a new relevant indicator for determining the viability of rural housing*" (Fall, 2008). In addition, the spread of villages through the creation of new plots of land is a source of increased rural tax bills.

Finally, the prospect of development that follows the installation of boreholes in a locality encourages rural dwellers in villages with water supply systems to adopt new approaches or strategies that enable them to acquire plots of land around water points. Among these approaches, the development of a certain political activism features prominently. This phenomenon has quickly taken on significant proportions, making villages with AEPs highly coveted by political parties, especially candidates running for municipal councilor positions. The relationship between politicians and villagers is developing further and is reflected in mutual support. It boils down to massive participation by villagers during voting operations, on the one hand, and interventions by the political class (especially the ruling party) to find land for their activists to live on around water points, on the other. This issue is now well understood by rural dwellers, who are beginning to take a greater interest in politics through the proliferation of support committees and local sectors set up by political leaders in several localities. Thus, interest in these border areas is prompting candidates for the leadership of the various municipalities to focus their speeches on land distribution and water resource management.

Expansion, change and decline of water territories

The river basins in this rural area, whether artificial or natural, bring together "water communities" spread across several different municipalities under the same management system. To this end, the historical social and commercial ties that link certain localities are now complemented by the sharing and management of water. The village, or even the municipality, where the water source is located is *no longer* synonymous with monopolization, as usage and management are shared.

Through water management, spaces for negotiation are created. It forges links between different localities. Villages, which were once more or less distant from each other, are grouped together around a hydro system subject to the logic of community management, regardless of cultural, ideological or institutional differences.

To understand the dynamics of the water territories in the area, it is necessary to study the territory's capacity to expand and change. This capacity gives rise to the creation of territories connected to those of the AVRB and ASUFOR: ***usage territories***, which are circles resulting from water consumption outside the production center (Figure 5). In fact, a territory whose function is to produce and consume water to meet the needs of the population is part of a space defined as a first circle. When productive activities are added to the initial water consumption and exceed local needs, goods from irrigated agriculture or industrial activity are exported. "*These consumption centers may be far from the production center. A second circle appears: that of new consumers, who have become distinct from producers*" (Alexandre et al., 2004). The water territory therefore incorporates an inseparable link between the local area and the process of establishing a consumption circle, which is itself a water use territory. It is a product of water territory.

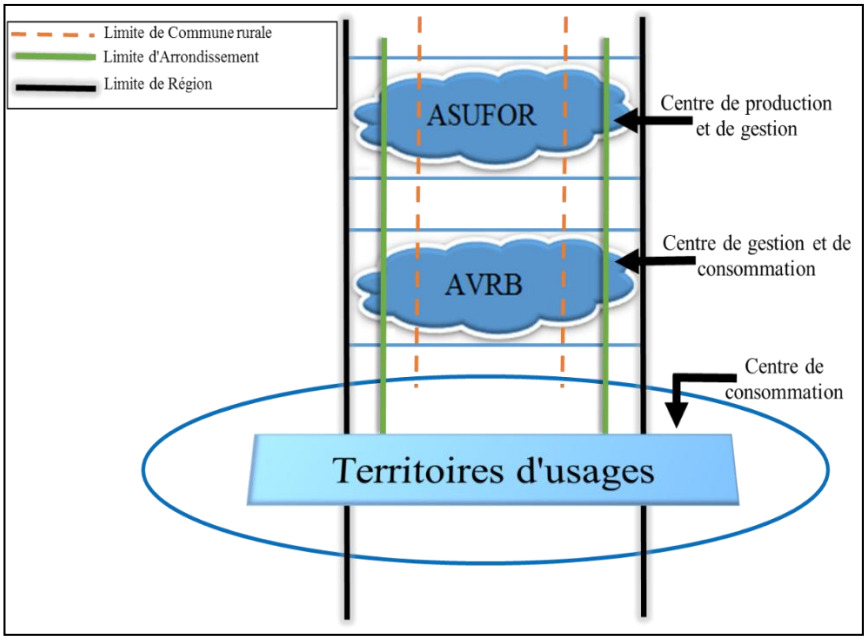

Figure 5. Expansion and diffusion of water territories in the study area

Thus, we consider that the territory is not closed, trapped by physical or topographical boundaries. It is *multi-scalar*. "*Far from being closed, like its political counterpart, the geographical territory remains resolutely open, ready to embrace all the spatial combinations that human communities weave within the limits of the terrestrial expanse, as well as those of individual experience*" (Di Meo, 1998).

Analyzing water territories from an economic perspective means identifying the arc that connects water production, its integration into the market and the multifaceted nature of financing. We know where water production begins, but the limits of its consumption are unclear. If the water produced is used for final consumption by households, we can define a first circle (continuous or discontinuous) encompassing the watershed that produces the resource and the area where this water is consumed. If this water also enters "*an agricultural or industrial production process, the dynamic only stops when this new production is finally consumed*" (Alexandre et al., 2004). This expands the first circle into a larger second circle. In this sense, *consumers in the urban center of Kaffrine* who use market garden produce from the villages of Ndiao Bambaly (Commune of Diamagadio), thanks to the exploitation of boreholes or Baobolong, can claim to belong to the same territory as the water producers in this rural area. This brings us back to the local/global dialectic.

To illustrate the decline of water territories, we can point to the ASUFORs. This territory is in decline because the users who made up the territorial unit of water management have been sidelined and replaced by the private sector. In our study area, the company FLEX-EAU* is now responsible for managing boreholes, thus reducing local populations to mere customers.

Conclusion

Water, through its presence, uses and management, shapes territories and is at the heart of the organization and structuring of space. "*Both an environment and a resource*" (MARGAT, 2008), it is an important pillar of local development. On the one hand, it is a resource around which territories emerge and, on the other hand, its strategic importance in promoting various production activities in rural areas is recognized. The diversity of sources (drilling, wells, ponds, Baobolong) offers a range of uses that can be grouped into two categories: **water for consumption** and

* On Tuesday 24 January 2017, OFOR and Flex-Eau SA signed the Public Service Delegation contract for water for the Kaolack and Kaffrine regions. The 10-year lease contract covers 279 multi-village water supply systems with an annual production of 12,380,000$m^3$of water. (OFOR, 2017).

water for production. Its impact on the shaping of spatial entities and the structuring of community dynamics in rural areas is therefore evident thanks to its essential functions in life and socio-economic development. Control of water also means assertive regulation of territorial development.

Bibliographical References

Alexandre et al. (2004). *Territoires et gouvernances de l'eau* in *Politiques publiques et gouvernance*, Grenoble, 20 pages.

Burton, J. (2010). *L'élaboration de plans de gestion: quelques concepts*. http://www.riob.org/IMG/pdf/Dakar-atelier-2-JB.pdf

Descroix, L. (2002). The role of humans in soil maintenance and degradation in sparsely populated regions: a comparative analysis of three case studies. *Cahiers de géographie du Québec*, *46* (128), 215-235.

Diatta, M. C. B. C. (2015). *Water in development: a geographical approach to the impact of water sector reform in rural Senegal*. University of Pau and Pays de l'Adour and Cheikh Anta Diop University of Dakar, Discipline: Geography and Planning.

Di Meo, G. (1998). *Social Geography and Territory*. Nathan University, Faculty of Geography.

Douguet, J. M., Longuepee J. & Petit O. (2006). *Water Territories*. Editorial from dossier 6, *Sustainable Development and Territories*, published online on 10 February 2006, URL: http//www.developpement durable.revues.org/3320.

Fall, M. (2008). *Rural Hydraulics and Territorialisation: Structuring Space around Water Points and Water Bodies in the Rural Community of Nganda*. D.E.A. Thesis, Faculty of Arts and Humanities, Cheikh Anta Diop University of Dakar.

Gachet, E. (2007*). Book review.* Stéphane Ghiotti, *Water territories, management and development in France*, CNRS EDITIONS, 2007, 247 P.

http://www.cliocr.clionautes.org/spip.php article1594. Monday 24 September 2007, Cervantes College, Vernon (27).

Ghiotti, S. (2007). *Les territoires de l'eau, Gestion et développement en France* (Water territories, management and development in France). Paris, CNRS Editions.

Honegger, A. & Bravard J-P. (2005). Water scarcity: natural phenomenon or social issue? *Géocarrefour*, vol. 80/4, 257-260.

Marga, J. (2008). *L'eau des méditerranéens : situation et perspectives (Mediterranean water: situation and prospects).* Edition de l'Harmattan

Richard-Schott, F. & Honegger, A. (2011). Sustainable water resource management in the Rhône basin, from theory to practice. *Géoconfluences*, 10 May 2011. http://geoconfluences.ens-lyon.fr/doc/transv/DevDur/DevdurScient11.htm,

Sy, O. (2009). Role of ponds in the management of Sahelian pastoral systems in Ferlo (Senegal). *Cybergeo: European Journal of Geography, Environment, Nature Landscape*, article 440, http:/www.cyber.revues.org/22057.

Wittfogel, K. A. (1964). *Oriental Despotism: A Comparative Study of Total Power*. Les Éditions de Minuit.