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RESEARCH ARTICLE

DIAGNOSTIC ANALYSIS AND PROPOSAL FOR AN OPERATIONAL INTEGRATED WATER RESOURCES MANAGEMENT (IWRM) FRAMEWORK IN CASIERS A AND B OF BONGOR (MAYO-KEBBI EAST PROVINCE, CHAD)

DILLAH Henry*¹ and KADJANGABA Edith²

¹Hydro-Geosciences and Reservoirs Laboratory (LHGR), Faculty of Exact and Applied Sciences, University of N'Djamena BP 1027; ²Geology, Geomorphology and Remote Sensing Laboratory, Department of Geology, Faculty of Exact and Applied Sciences, University of N'Djamena BP 1027

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ABSTRACT

The main objective of this article is to carry out a diagnostic analysis of water resources management and to propose an operational Integrated Water Resources Management (IWRM) framework adapted to Casiers A and B of Bongor, a strategic agro-irrigated area in southern Chad). The approach is designed to strengthen water sustainability and the agro-socio-economic resilience of local productive systems. This scientific article presents a methodological approach based on semi-structured interviews and group interviews (focus groups) using survey questionnaires and interview guides. Analysis of the sampled population shows a representation of 11% women compared to 89% men during the focus group. This is an indicator of the limited role that women occupy in agriculture and water management in Casiers A and B. The meeting with the local casier management council and water users recorded the participation of 59% farmers, 20% herders, 15% water and forestry agents, and 6% ANADER agents. These results reflect stakeholder involvement in the management and protection of irrigation water. Pesticide application frequencies were examined: 50% of farmers treat their crops only in the event of pest attacks or symptom appearance, while 30% apply treatments weekly. Application frequencies rarely account for climatic conditions (14%) or crops grown (6%). Another requirement of Good Agricultural Practices is the ecologically sound application of phytosanitary products. According to the farmers interviewed, quantities depend on the pesticide (70%), the crop (23%) and, to a lesser extent, manufacturer instructions (1.5%). However, some market gardeners reported applying fixed quantities regardless of the pesticide or crop; for example, 7% systematically apply half a litre per hectare. It should also be noted that the water table level has dropped considerably (1.7-2.23 m). Furthermore, 79% of farmers are unaware of the IWRM principle, compared to 21%; this shows that very few truly understand the concept of Integrated Water Resources Management. To successfully transpose IWRM to the local level, the Chadian State must apply the principle of decentralisation, enabling the transfer of administrative powers from the State to local authorities, adopted on 11 December 2006 under Law N°06-33/PR/2006, while also enforcing the Water Code under Law No. 016/PR/99 of 18 August 1999, and introducing a new Water Code incorporating a National IWRM Plan (NIWRMP). The proposed IWRM framework identifies four main orientations corresponding to four levels of management.

*Corresponding author:
Salwa M Alfituri

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INTRODUCTION

In Sahelian zones, particularly in Mayo-Kebbi Est Province, water resources represent an essential lever for socio-economic development, especially in irrigated agriculture, livestock farming and drinking water supply (Olivry, 1996; Leduc et al., 2001). Casiers A and B of Bongor, located in the Logone basin, are heavily dependent on the availability and management of water resources (surface and groundwater). However, these resources are subject to significant climatic variability and increasing anthropogenic pressure, characterised by growing water demands and competition between uses (FAO, 2012).

In this context, Integrated Water Resources Management (IWRM) presents itself as a comprehensive approach aimed at promoting coordinated management of water, land and related resources in order to maximise economic and social well-being without compromising ecosystem sustainability (GWP, 2000). Despite the strategic importance of the Bongor casiers, current water resources management remains largely sectoral and poorly coordinated. This situation leads to inefficient resource allocation and intensifies conflicts between different users (farmers, herders, local populations) (Rahaman & Varis, 2005). Moreover, the absence of an operational IWRM framework adapted to the local context limits informed decision-making and the sustainability of irrigation systems

(UNESCO, 2009). A thorough diagnostic analysis is therefore required to identify the constraints of the current system and propose an operational IWRM framework enabling more efficient, equitable and sustainable management of water resources (Biswas, 2004). In Casiers A and B of Bongor, the absence of an integrated operational water management framework prevents optimal, sustainable and equitable water use. The implementation of an operational IWRM framework adapted to the local context would significantly improve sustainable and equitable water resources management (GWP, 2000). A number of questions thus arise: how can an operational IWRM framework be established and adapted to Casiers A and B of Bongor? How can coordination between stakeholders be improved?.

Presentation of the Study Area: The town of Bongor is located in south-western Chad, in the Mayo-Boneye department, Mayo-Kebbi Est Province. Bongor lies at latitude 10.2691° N and longitude 15.3960° E (Figure 1). It is situated 235 km from the capital N’Djamena along the N’Djamena-Moundou axis. It borders Chari-Baguirmi to the north, Mayo-Kebbi Ouest to the south, Tandjilé to the east and Yagoua (Far North Cameroon) to the west. According to the General Population and Housing Census (RGPH2, 2009) the population of Mayo-Kebbi Est Province is estimated at 44,301 inhabitants, with an annual growth rate of 2.7%.

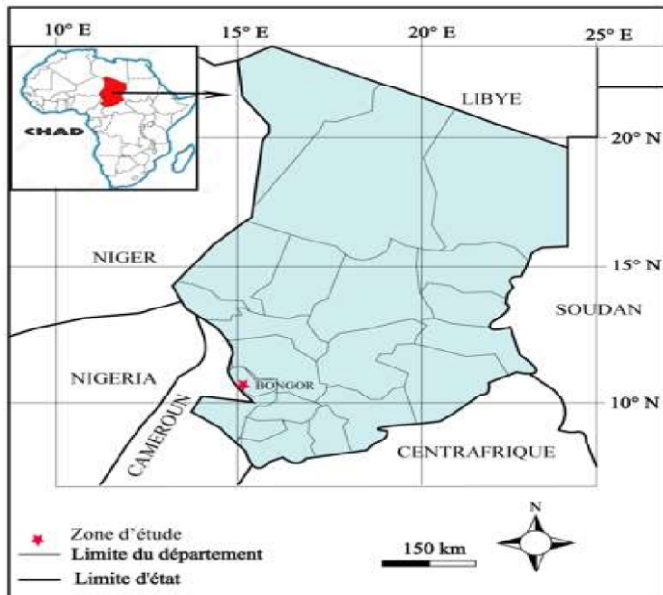


Figure 1. Location map of the study area

Casiers A and B of Bongor constitute one of the main agro-irrigated zones, fed by the waters of the Logone River. The intensification of rice cultivation and the expansion of irrigated areas have led to growing water demands, often met through increased use of boreholes and wells during the dry season or when surface water is insufficient. This situation places direct pressure on the groundwater tables of Mayo-Kebbi Est, a resource essential for agriculture and drinking water supply. The absence of regular data on extracted volumes, piezometric dynamics and groundwater quality limits the capacity of local authorities to plan sustainable exploitation. The location of Casiers A and B of Bongor, the main study sector, is shown in (Figure 2).

Geology of the Study Area: In Casiers A and B of Bongor, clay-sandy alluvium is encountered (Figure 3). This type of deposit indicates materials transported by the Logone River and deposited during floods and water retreat a mixture of clays, silts and fine sands, with no rocky structure and a variable thickness, often between 5 and 30 metres in the Chari-Logone floodplains. These deposits originate from ancient Logone River meanders, repeated floods, seasonal inundation episodes and slow sedimentation in humid depressions (PIAS 1968). This means the area is geologically young, without rocky outcrops, dominated by dynamic geology renewed by floods, and characterised by high lateral homogeneity.

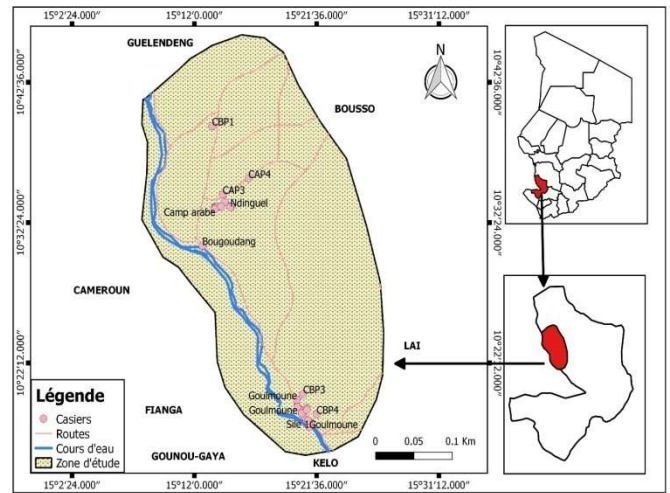


Figure 2. Location map of Casiers A and B of Bongor, main study sector

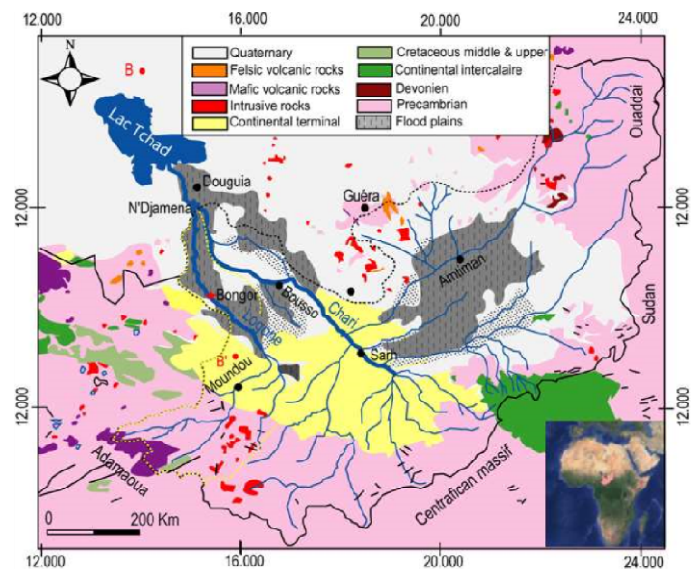


Figure 3: Geological map of the Chari-Logone basin (after Louis 1970, modified in Mahamat Nour, 2019). The star indicates the study area

MATERIAL AND METHODS

The methodology used in this study combines several approaches: documentary analysis of hydrogeological studies of the Mayo-Kebbi Est basin; study of irrigation practices in Casiers A and B of Bongor through field surveys and direct observations; design of an IWRM framework; and institutional analysis with a proposal for a local irrigation water governance framework.

Field Surveys: Surveys were conducted from 27 December 2024 to January 2025.

Preparation of Field Data Collection Tools: The development of the data collection instruments was carried out progressively through research and interviews with experts in the field. The data collection tools used in this study mainly consisted of interview guides and individual surveys (in form of questionnaires). Thus, interview guides were administered to institutional stakeholders, while questionnaires were distributed to farmers. This methodology was developed based on several methodology courses at the university of Quebec in Montreal (UQAM), namely SAC 1500-Territorial Issues I: Quantitative Tools, SAC 3500-Participatory Evaluation of Cultural Action, and SOC 2102 (Florence L., 2019).

Techniques Used

Two types of interviews were used:

- Semi-structured interviews.
- Group interviews (focus group).

Semi-Structured Interviews: Semi-structured interviews were favored for this stage, as they allow participants to express themselves freely on the subject. This also enables follow-up on specific statements where necessary to better understand the situation. This interview format allowed for flexible, conversational exchanges. As some topics may be sensitive, this approach was more appropriate: a general initial question allows the interviewee to feel at ease and in control. Open questions were posed and the discussion proceeded according to the responses given (Geoffrion, 2009).

Focus Group Interviews: A focus group was also conducted with farmers from Casiers A and B. This focus group facilitated understanding of farmers' behaviour by analysing participant interactions. Open questions enabled a more in-depth understanding of agricultural water management issues and each participant's perspective on the topics discussed.

These techniques were implemented using the following tools:

- Survey questionnaires ;
- Interview guides.

Survey questionnaire sheets were prepared for individual interviews. To ensure the proper conduct of interviews, the questionnaire was tested and validated in agreement with agents from the National Agency for Rural Development (ANADER) support in Bongor. This confirmed its relevance to the survey context and its comprehensibility to target respondents. The questionnaire used with farmers, herders and other water users aimed to supplement data not available in the literature and to produce a situational portrait of IWRM and the effects of irrigation on groundwater resources. It collected both quantitative and qualitative data, covering: actual agricultural water use, the concept of water management, accessibility of water by farmers, and the effects of agricultural practices on groundwater in Casiers A and B of Bongor. Interview guides were used during meetings with public authorities and organisations active in the area. The aim was to deepen understanding of key issues, particularly irrigation water management, and to gather stakeholder perceptions. These qualitative interviews enabled identification of the main challenges in the casiers.

Data Collection and Entry: In-person interviews were selected because qualitative data were sought and this method enabled more effective access to the target population. During most interviews, an agent from the Bongor Casier Management Committee accompanied the team. Some interviews were also facilitated by casier management committee chairs, engaged for their knowledge of the casiers, their understanding of different farming types, and their proximity to farmers. They also facilitated communication through translation. The population sample was constructed through pre-determined criteria, using random sampling informed by local agricultural experts, ANADER agents, and initial field reconnaissance results. The village of Biliam-Oursi (Casier A) and areas were selected based on geographical location, type of agriculture practised and type of irrigation used. Most farmers interviewed were members of market gardening groups or associations and were met in the village, in their fields, or in association offices. In total, 70 farmers were interviewed across five neighbourhoods in Casier A and two neighbourhoods (Silé 1 and Goulmoune) in Casier B of Bongor. In Biliam-Oursi, 25 farmers practising rainfed agriculture were selected. In Silé 1, 25 farmers using the Logone River and mini-boreholes were interviewed. Borehole and mini-borehole irrigation represents 10 farmers using pressurised irrigation in Goulmoune. Additionally, 34 agricultural water users were met, totalling 104 people encountered.

The saturation principle was also applied: interviews were stopped once responses no longer varied. In Biliam-Oursi, surveys were concluded after fifteen (15) interviews.

RESULTS

The *focus group* conducted in Casiers A and B of Bongor brought together 70 farmers. This group discussion aimed to summarise the key challenges of water management in the casiers and to highlight the gender dimension in governance.

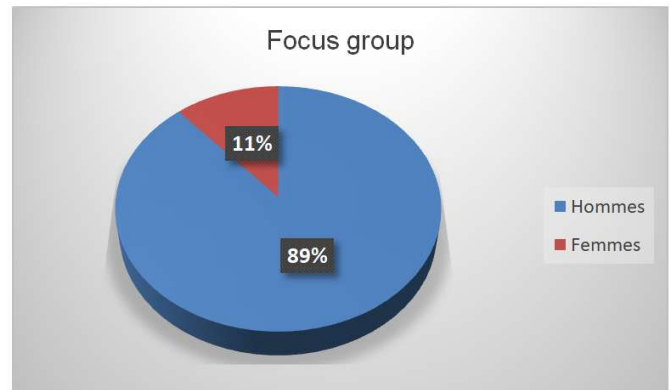


Figure 4. Focus group

Analysis of Figure 4 shows that women were under-represented in the group. Only eight (8) women (11%) attended the meeting, compared to 62 men (89%). Women spoke on only two occasions. This is an indicator of the limited role that women occupy in agriculture and water management in the study area. The challenges faced by these farmers are largely similar to those mentioned during the preceding 70 individual interviews. An important observation during this discussion was the growing awareness of some farmers throughout the exchange. Some participants noted the increasing number of motorised pumps and mini-boreholes used for agriculture. They became aware that the falling water table results from multiple factors and that their own pump usage contributes significantly. When individual impacts are combined, the total volume of extractions becomes as significant as that of other activities.



Plate 1. Use of motorised pumps on mini-boreholes for irrigation

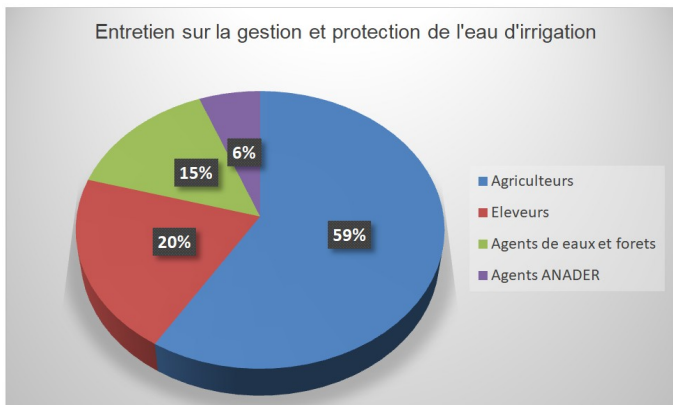


Figure 5. Interview on the management and protection of irrigation water

Another meeting took place on 29 December 2024 in Silé 1 neighbourhood, Casier B. This meeting with the local casier management council and water users recorded the participation of 20 farmers (59%), 7 herders (20%), 5 water and forestry agents (15%) and 2 ANADER agents (6%). The primary objective was to gather information on water management and protection. The targeted farmers and herders stated verbally that it is impossible to carry out their activities and ensure the sustainability of their livelihoods without caring for natural resources (water, soil, etc.). This meeting was larger in scale than a focus group, with a minimum of 34 participants.

Pesticide Use in the Casiers

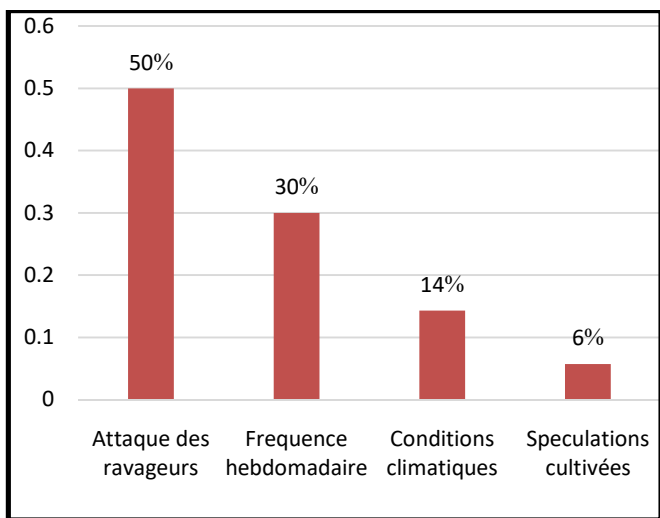


Figure 6. Frequency of phytosanitary product application in the casiers

Analysis of Figure 6 shows that 50% of farmers reported treating their crops only in the event of pest attacks or symptom appearance, while 30% adopted a weekly treatment frequency. Pesticide application frequencies rarely account for climatic conditions (14%) or crops grown (6%). Another requirement of Good Agricultural Practices is the ecologically sound application of phytosanitary products. According to the market gardeners interviewed (Figure 7), quantities depend on the pesticide (70%), the crop (23%) and, to a lesser extent, manufacturer instructions (1.5%). However, some market gardeners reported applying fixed quantities regardless of the pesticide or crop; for example, 7% systematically applied half a litre per hectare. Furthermore, farmers reported variable application frequencies. Some carried out preventive treatments, applying phytosanitary products up to four times per week.

IWRM Principle: Farmers are broadly unfamiliar with the principle of Integrated Water Resources Management.

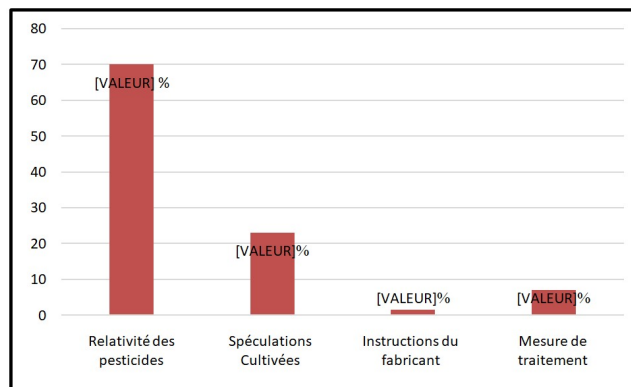


Figure 7. Application of ecologically sound quantities of phytosanitary products

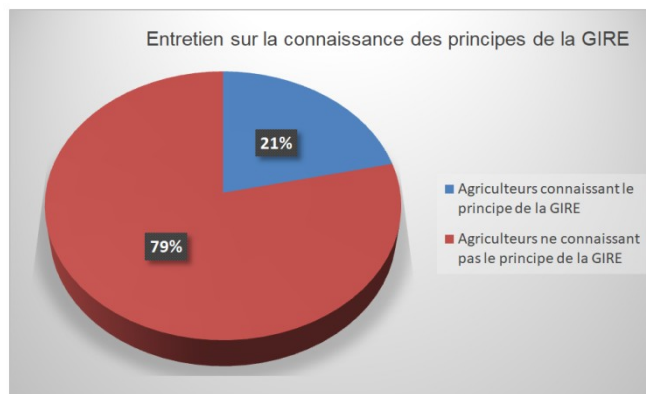


Figure 8. Interview on knowledge of IWRM principles

Analysis of the pie chart (Figure 8) shows that of the 70 farmers interviewed, only 15 stated that they were familiar with water management. Thus, 79% of farmers were unaware of the IWRM principle, compared to 21%. This percentage shows that very few truly understand the concept of Integrated Water Resources Management. Following this question, the IWRM definition was provided and the principle explained clearly to participants. The majority of farmers expressed interest in the principle. Most noted the importance of water in their livelihoods: without available water, they cannot cultivate, and without water in the future, their children will not be able to work the family lands. Farmers acknowledged that investing in better water management would benefit them and expressed interest in incorporating IWRM into their practices.

Transposing IWRM from National to Local Level: Having highlighted the challenges of implementing IWRM in agriculture, it is important to situate the responsibility of the Chadian government in transposing IWRM to Casiers A and B of Bongor. This requires: Effective decentralisation in Chad, grounded in the Constitution of 31 March 1996 adopted by referendum (Title 11: On Decentralised Territorial Communities, Articles 204 to 213) and major organic laws, notably those of 2000, 2006, and most recently Organic Law N°014/CNT/2024, adopted in July 2024, setting out the number, boundaries and statutes of autonomous communities and redefining territorial communities. The Water Code and other laws governing water use under Law No. 016/PR/99 of 18 August 1999, as amended, supplemented and specified by implementing decrees, orders and ordinances, including:

Ordinance No. 018/PR/2011, amending and supplementing Law No. 016/PR/99 of 18 August 1999 on the Water Code;

Order No. 12/PR/PM/ME/MSP/2011, on procedures for the initial analysis of water from catchment works intended for human consumption;

Order No. 13/PR/PM/ME/MSP/2011, defining accreditation conditions for laboratories conducting sampling and analysis of drinking water;

Order No. 22/MHUR/2011, defining the national strategy for the installation and attribution of drinking water points;

Order No. 24/MHUR/2011, defining and regulating village contributions to the construction of drinking water infrastructure.

"In accordance with the Constitution of the Republic of Chad, every citizen has a duty to preserve water resources. Exploitation is designed and carried out with due regard to the state and availability of water resources and the necessity of managing them sustainably, safeguarding natural ecosystems, and making optimal use of water works and hydraulic infrastructure."

Proposed IWRM Operational Framework for Casiers A and B of Bongor:

The development of the IWRM plan proceeds in six main stages (Figure 9). The first stage consists of conducting a situational assessment of the study area. The second stage identifies the key challenges in the area. The third stage focuses on defining long-term objectives and monitoring indicators based on the challenges identified in the previous stage. The fourth stage involves developing an action plan. The fifth stage implements the plan. Monitoring and evaluation are then carried out using the selected indicators. Finally, the process begins again once actions have achieved the expected results, in order to continuously improve resource management.

Figure 9. Digram of Integrated Water Resources Management (Gangbazo, 2011 in Florence, 2019)

Following the situational assessment and identification of challenges in the area, a framework is proposed targeting priority issues. It is designed to be concise and achievable. One to two objectives are proposed for each management level: national, regional, local and plot level (Tables 3-6).

Table 3. Legislation and Implementation

Objective 1	Update legislative texts in line with IWRM principles and ensure their enforcement
Level	National
Timeline	Long-term (5 years)
Actors	State Ministry of Water and Energy Water Resources Directorate
Indicators	New Water Code incorporating IWRM Number of agents enforcing the Water Code (Water Police)
Target	A new version of the Water Code adapted to IWRM principles is published A water officer is present in the casiers
Actions to achieve this objective	Enactment of appropriate legislation Creation of a law enforcement service

Table 4. Training and Knowledge

Objective 2	Establish training programmes for improved water resources management
Associated challenges	Instability of water management projects in the area
Level	Regional
Actors	Ministry of Water and Energy Water Resources Directorate National Agency for Rural Development (ANADER)
Indicators	Number of trained agents
Target	All ANADER agents are trained
Actions to achieve this objective	Design field training programmes on water resources management for field agents Deliver agent training sessions

Table 5. Local Water Committee (LWC)

Objective 3	Establish a Local Water Committee (LWC)
Associated challenges	Absence of participatory management
Level	Local
Timeline	Short-term (1 year)
Actors	Water Resources Directorate (WRD) Sub-prefect Mayor Chadian Water Company (STE) Farmers Herders
Indicators	Number of meetings held
Target	Hold meetings at the end of each month
Actions to achieve this objective	Establish a local water management committee for Casier A and strengthen the existing committee of Casier B Organise meetings to foster participatory management

Table 6. Awareness Raising

Objective 3	Develop a water demand model tailored to the main soil types and irrigation methods in the areaone
Associated challenges	Wastage of water resources
Level	Plot level (Casiers A and B)
Timeline	Short-term (1 year)
Actors	-ENSA - National Higher Institute of Agronomy, Laï and Sarh
Indicators	Number of irrigation methods and soil types in the casiers covered by a water demand model
Target	Each irrigation method and soil type in the casiers is covered by a crop water demand model
Actions to achieve this objective	Develop a crop water productivity model and disseminate it

DISCUSSION

The results of our work on phytosanitary product use (50% of farmers treat their crops only in the event of pest attacks or symptom appearance; 30% adopted a weekly treatment frequency; application frequencies rarely account for climatic conditions (14%) or crops grown (6%)) are almost similar to those obtained by (Diop, 2013) who are 48.1%, 30.5% adopted a weekly treatment frequency; application frequencies rarely account for climatic conditions (4.5%) or crops grown (1.9%). Furthermore, Cissé and his team (2003) noted variable application frequencies, with some farmers applying phytosanitary products preventively up to four times per week. These results are consistent with our results. Also, the proposal of the IWRM Scheme by Florence. L (2019) is almost similar to our scheme. Our proposal for a National IWRM Plan for Chad and its application in Casiers A and B of Bongor confirms that: since the International Conference on Water and the Environment held in Dublin in 1992, Integrated Water Resources Management (IWRM) has emerged as the dominant benchmark for global water governance (ICWE, 1992). Institutionalised by the Global Water Partnership (GWP, 2000), it proposes coordinated management of water, land and associated resources, reconciling economic efficiency, social equity and ecological sustainability.

However, beyond its apparent universality, IWRM can be analysed as a "travelling concept" (Molle, 2008), that is to say, a normative framework circulating at the international level, carried by multilateral organisations and donors. In this perspective, IWRM is less a neutral technical tool than a politico-institutional device structuring water sector reforms. (Biswas 2004, 2008) highlights the conceptual ambiguity of the term "integrated", which can simultaneously refer to sectoral, territorial, institutional or participatory integration without a clear hierarchy. This polysemy contributes to its political appeal but weakens its operational scope. IWRM may thus be interpreted as a hegemonic discursive framework, embedded in the global diffusion of sustainable development norms. Empirical evidence shows that IWRM performance is closely linked to national institutional capacities. In France, river basin management structured around water agencies represents an early form of functional integration (Barraqué, 1995). Robust institutions, autonomous financial mechanisms (levies) and a tradition of centralised administration facilitated operationalisation of integrated principles. In institutionally weaker contexts such as Burkina Faso, donor-supported IWRM frameworks reveal a phenomenon of "formal compliance": adoption of laws and creation of basin bodies without sufficient technical or financial capacity (Lautze et al., 2011). Molle, 2008 qualifies IWRM as a "nirvana concept", that is to say, an ideal representation masking socio-economic power relations. Participatory mechanisms can be captured by local or technocratic elites, marginalising vulnerable populations. Furthermore, the recognition of water as an economic good (Dublin principle) introduces pricing mechanisms likely to exclude the poorest users if compensatory mechanisms are not established (Rogers & Hall, 2003).

The tension between market logic and the human right to water is a central debate. The intensification of hydrological extremes associated with climate change is testing conventional integrated planning. (Pahl-Wostl, 2007) proposes a transition towards adaptive governance, based on social learning, institutional flexibility and polycentricity.

CONCLUSION

To achieve the objective of our work, we used tools such as field surveys, literature review and meetings with several experts. National and local policies relating to the agricultural environment and the principles of IWRM were analysed. Water actors in the casiers as well as their uses were identified. We were also interested in the state of application of IWRM policies in agricultural practices during the field surveys; we thus produced a portrait of the situation of these principles in casiers A and B of Bongor. All this made it possible to make recommendations for agricultural water management in the form of a management scheme. Several key findings emerged from this work. Chad has no National Integrated Water Resources Management Plan, and IWRM is either unknown or barely known in Casiers A and B of Bongor. As a result, very few water resources management techniques are in place in the area. These findings made it possible to propose recommendations in the form of a water resources management scheme. These recommendations aim to be a starting point for the long-term implementation of good water resources management in the area. First, at the national level, it is important to update the legislation in connection with the principle of IWRM and the implementation of controls in connection with this legislation. The Water Code of Chad did not include the question of IWRM and is not applied. The State must find a way to enforce laws to allow better water management. As for the regional level, the knowledge of actors regarding water management must be reinforced. For example, through the training of field agents who can communicate good water management practices to farmers. Regarding the local level, a local water committee (CLE) must be set up to allow a space for communication between all actors in the area and create participatory management. Lastly, at the plot level, a model of crop water requirements for each soil type and irrigation mode should be produced to provide a tool for farmers with the aim of reducing their water consumption. This tool could also be used by field agents in contact with farmers. The involvement of area stakeholders will be paramount in achieving the set objectives. This work constitutes a first diagnostic assessment of IWRM in the area and should serve as a basis for follow-up action. Casiers A and B of Bongor are vulnerable with respect to water availability. It is time to move beyond awareness-raising, analysis and studies, and to concretely implement tools for Integrated Water Resources Management.

REFERENCES

- Barraqué, B. (1995). Les politiques de l'eau en Europe.
- Biswas, A. K. (2004). Integrated Water Resources Management : A Reassessment
- Biswas, A. K. (2008). Integrated Water Resources Management : Is it working?
- CapNet (2008). Integrated Water Resources Management for River Basin Organisations: Training Manual. UNDP/CapNet.
- Cissé, I., Tandia, A. A., Fall, S. T. & Diop, E. H. S. (2003). Usage incontrôlé des pesticides en agriculture périurbaine : cas de la zone des Niayes au Sénégal. Cahiers Agricultures, p. 181-186.
- Diop, A. (2013). *Diagnostic of pesticide use practices and quantification in the Niayes area of Dakar (Senegal)*. (Doctoral thesis) Université du Littoral Côte d'Opale, France
- FAO (2012). Coping with water scarcity: An action framework for agriculture and food security

- Florence L. (2019). Mise en œuvre de l'approche GIRE par la proposition d'un schéma de gestion de l'eau agricole dans la commune de Darou Khoudoss au Sénégal.
- Gangbazo, G. (2011). Guide pour l'élaboration d'un plan directeur de l'eau. Québec: Ministère du développement durable, de l'environnement et des Parcs. Retrieved from <http://collections.banq.qc.ca/ark:/52327/2220497>
- Geoffrion, P. (2009). Le groupe de discussion. Dans Recherche sociale : de la problématique à la collecte des données (5e éd., p. 391-414).
- Global Water Partnership (2000). Integrated Water Resources Management. TAC Background Papers N0.4. Stockholm : GWP
- ICWE (1992). The Dublin Statement on Water and Sustainable Development.
- Lautze, J., et al. (2011). Integrated Water Resources Management in Africa.
- Law No. 16/PR/1999 of 18 August 1999, enacting the Water Code of the Republic of Chad
- Leduc, C., Favreau, G., & Schroeter, P. (2001). Long-term rise in a sahelian water-table. Nature.
- Loi organique N° Organic Law No. 014/CNT/2024 of July 2024, setting out the number, boundaries and statutes of autonomous communities.
- Louis P. (1970). Contribution géophysique à la connaissance géologique du bassin du lac Tchad.
- MahamatNour A. (2019). Fonctionnement hydrologique, chimique et isotopique du principal affluent du lac Tchad: le système Chari-Logone. PhD Thesis, Aix-Marseille Université, Marseille, France. Mémoires ORSTOM. Paris : ORSTOM. Retrieved from <http://www.documentation.ird.fr/hor/fdi:04666>
- Molle, F. (2008). Nirvana concepts, narratives and policy models.
- Olivry, J.C. (1996). Variabilité climatique en Afrique. Hydrological Sciences Journal.
- Pahl-Wostl, C. (2007). Transitions towards adaptive water management.
- Pahl-Wostl, C., et al. (2012). Adaptive governance in water management.
- PIAS J. (1968). Contribution à l'étude des formations sédimentaires tertiaires et quaternaires de la cuvette tchadienne et des sols qui en dérivent (République du Tchad)
- Rahaman, M.M., & Varis, O. (2005). Integrated Water resources management: evolution, prospects and future challenges. Sustainability: Science, practice and policy.
- RGPH2, (2009). 2^e General Population and Housing Census. INSEED Report.
- Rogers, P., & Hall, A. (2003). Effective Water Governance.
- UNESCO (2009). The United Nations World Water Development Report 3: Water in a changing World. Paris: UNESCO.
