

Investigation of Anthropogenic Activities along the Mamouwol River in the Urban Commune of Mamou (Republic of Guinea)

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Abstract: The monitoring of our watercourses for their preservation must be an imperative concern of the whole population. The aim of this study is to describe the main causes of degradation and destruction of the natural resources of the Mamouwol River in the Mamou commune. Data were collected using a survey method (questionnaire, interviews and observations). The study revealed that extensive agro-pastoral activities are the main socio-economic activity of the population, accounting for 78.5%-90% and 20.30% respectively. Fishing follows (1.2%). Related activities include handicrafts and petty trade; Other human activities: hunting (11%), charcoal burning (58%), brick making and firing (45.6%). Riverbanks and water resources in the vicinity of dwellings are damaged and polluted by socio-economic activities and the use of agricultural inputs. The absence of industrial units on the path for the data collection

Key words: Natural resources, human activity, degradation, Mamouwol River, Mamou.

1. Introduction

Water, energy and chemistry are considered the three fundamental elements of life [1, 2]. The Republic of Guinea, a West African country recognized as the water tower of Africa, has a rich and varied hydrology distinguished by two seasons (the dry and rainy seasons) with a humid tropical climate lasting from 5 to 7 months depending on the region, and a hydrographic network of nearly 1,161 watercourses [2, 3]. However, anthropogenic activities (extensive agro-pastoral activities along these watercourses, bush fires, brick making and firing, etc.) mean that all of these water resources, including Mamouwol, are suffering, while others have disappeared with rapid population growth. Natural vegetation is being transformed for agricultural production, grazing and other uses to meet ever-increasing demand [4]. This anthropization of ecosystems has led to changes in land cover [5] and the alteration

of at least half of the Earth's land surface. This situation has even prompted geoscientists to coin a new term, the Anthropocene, to describe a new era in which human influence on the global environment has become so significant and active that it rivals some of the great forces of nature in its impact on the functioning of planet Earth [6]. Indeed, the clearing of forests by humans for the use of their resources is at the root of the loss of vast forest areas on the planet. Between 1990 and 2015, the FAO (Food and Agriculture Organization) reported that terrestrial forest cover fell from 31.6% to 30.6% on a global scale, while in sub-Saharan Africa it fell from 30.6% to 27.1% [7]. Natural and human factors such as the filling in of the Niger riverbed, the drought of the 1970s and 1980s, the regression of vegetation cover, the anarchic settlement of populations on the river banks and the human activities carried out in the basin are the aggravating factors in flooding caused by high water and the surging of the river's

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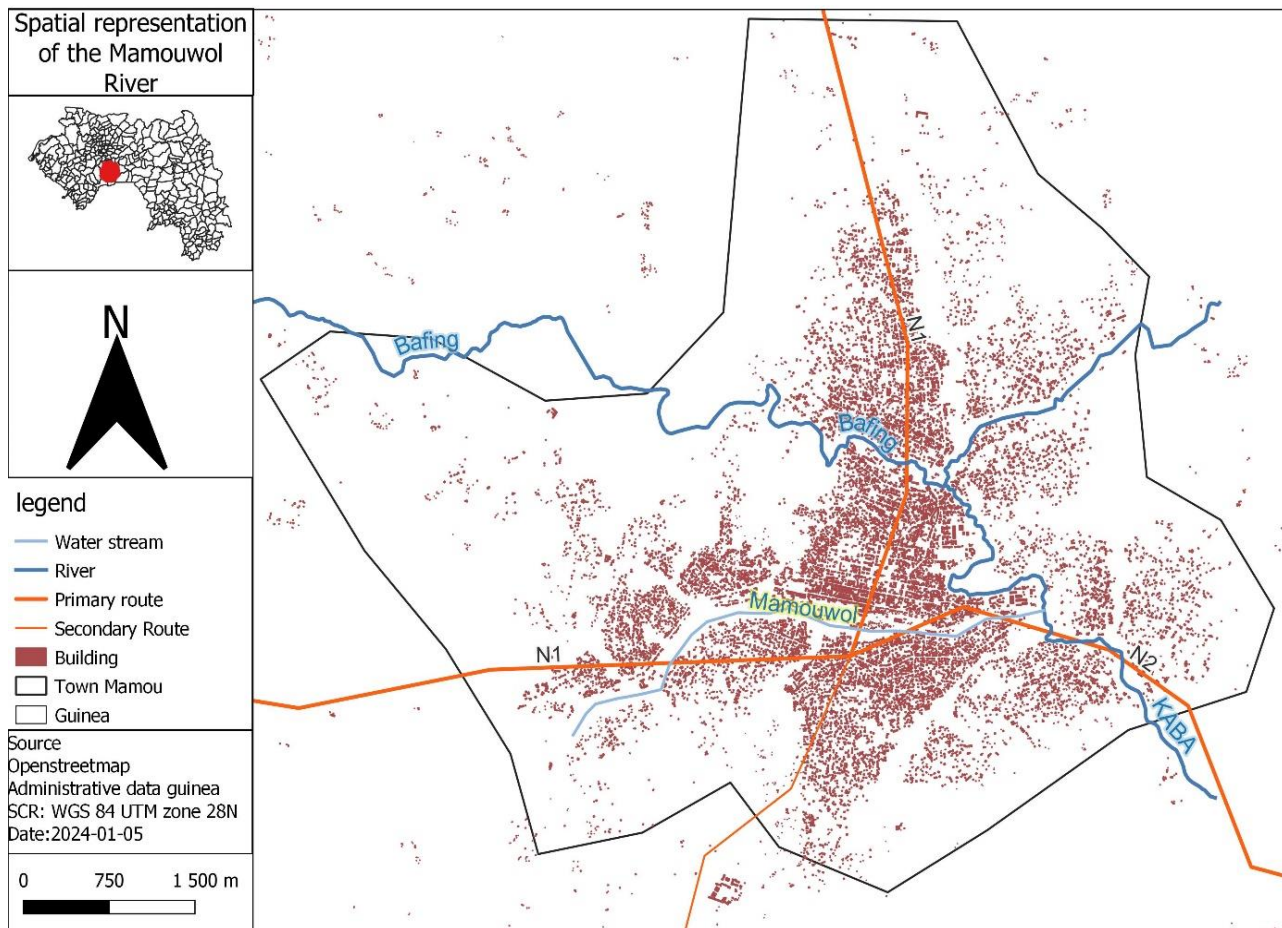


Fig. 1 Special view of the Mamouwol River, showing settlements, the Bafing River and the study area.

waters into the flood plains during the months of August to September [8]. Even more alarmingly, ecologists predict that habitat decline would lead to the extinction of 50% of species, representing the loss of an entire trophic level and all the ecosystem services it can provide [9]. The water sources of the Mamouwol River in the Republic of Guinea must therefore undergo environmental protection and basic treatment if they are to be consumed without health risk, as the lives of a high density of the human population of Mamou in the Republic of Guinea are linked to this river (Fig. 1).

Numerous studies have reported on the pollution of water sources worldwide, as well as in the Republic of Guinea [2, 10-13]. As an extension of these studies, we report in the present work: Investigation of anthropogenic activities along the Mamouwol River to

provide baseline information that could be used in monitoring environmental quality in the city of Mamou and other regions.

2. Materials and Methods

2.1 Presentation of the Study Area

This study was carried out in the Mamou prefecture. According to the administrative division, the Mamou prefecture is the capital of the Mamou Administrative Region, and comprises 13 sub-prefectures plus the urban commune. It comprises 28 districts. It covers an area of 17,074 km² with a population of 340,956 inhabitants (RGPH, 2016) including 43 inhabitants per km². The Mamou prefecture lies between 9°54' and 11°10' North attitude and between 11°25' and 12°26' West longitude with a foutanian climate and an alternation of two (2) seasons: A dry season from

November to April and a hot season from May to October rainy season from May to October. This study covers a 35-km stretch of the Mamouwol River in the urban district of Mamou. This river was chosen for three reasons: (i) accessibility, (ii) lack of previous studies and (iii) human population density on the banks.

2.2 Study Framework

Biology Laboratory of Higher Institute of Technology of Mamou was used as the study site for this work.

2.3 Sampling and Equipment Used

For data collection, we carried out guided field visits, during which we made direct observations, interviews with riparian communities. Figs. 2 and 3 show some of the aggressive activities carried out on the river by riparian populations.

2.4 Equipment Used

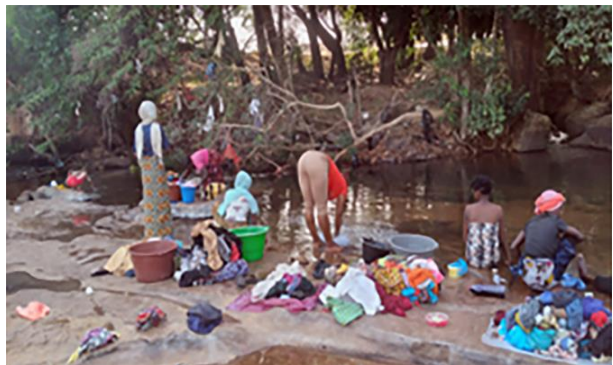
- Measuring centimeter
- GPS unit (GARMIN 72)
- Personal Protective Equipment (PPE)
- Motorcycle (ZT-125)
- Dictaphone
- Pen
- Notepad

2.5 Observation Mechanisms

Direct observations were carried out following a protocol that enabled us to note the following elements: bank slope, bank vegetation cover, wood use, bank use, water uses, distances between dwellings, latrines and the river, distance of public infrastructures from the river. A pivot table in Excel software was used to analysis the data.



(a)



(b)

Fig. 2 Machine washing (a) and leaching (b) activities in the river during the dry season.



(a)



(b)

Fig. 3 Wood being cut (a) and stacked for charring (b).

Table 1 Field findings in the study area.

No.	Sections		Elements of appreciation	
1	Bank slope	Low 0-10%	11-30% average	High > 30%
2	Plant cover	Herbaceous	Trees	Shrubs
3	Use of riverbanks	Homes	Crops	Pastures
4	Water uses	Laundry, dishes	Bathing, watering	Laundry, gardening
5	Distances of dwellings from the river	(< 35 m)	(35-100 m)	(> 100 m)
6	Distance of public infrastructures from the river	(< 35 m)	(35-100 m)	(> 100 m)

3. Results and Discussion

This study revealed the diverse anthropogenic activities responsible for the degradation of the Mamouwol River's resources at Mamou, including uncontrolled urbanization, agriculture, livestock farming and logging. This observation is confirmed by Mamadou [14], who states that most large basins, with their freshwater ecosystems covering 70% of the planet's surface, are today subject to strong anthropic pressure (deforestation, agricultural and mining activities, urbanization, industrialization). This results in an alteration of the soil and forest cover, leading to changes in the hydrological and geochemical characteristics of surface runoff, but can also lead in turn to an alteration of the climatic regime, with the destruction and reduction of biotopes and the diversity of biocenoses [14]. The combined effects of climatic variability and cover alteration influence transfer processes in watersheds. Demographically speaking, the population of Mamou rose from 139,764 in 1983, to 318,981 in 2014 (RGPH General Population and Housing Census) [15] and 340,956 (RGPH, 2016), representing a density of 43 inhabitants per km². This dizzying increase in population will inevitably lead to a high demand for natural resources by the local populations.

3.1 Observation and Interview

Field observations and interviews took place from November 10 to 20, 2023. They provided information, at 32 separate points, on the characteristics of the river in its communal area. All the districts in the commune through which the river flows were visited: Horé

mamou, Thiagui, Thiewel, Sabou, Pâel, Boulbinet, Tambassa and Dounkiwal. Observations in the field produced the assessments shown in Table 1.

3.2 Environmental Characteristics of the Study Area

Analysis of the characteristics of the river bed and banks reveals several aspects: A wetted width of less than 6 m. The river's immediate surroundings are mostly flat, with 57.90% of the slope being gentle (0 to 10%). In places, however, the terrain is uneven, with 26.80% medium gradient (11% to 30%) and 15.3% steep gradient (greater than 30%). The types of plant formations encountered in the study area include: trees and shrubs cover 45% of the area, the association of trees, shrubs and herbs represents 42%. The remaining 13% corresponds to areas covered only by herbaceous plants.

3.3 Occupation of the Riverbank

Occupation of riverbanks by local residents shows that 56% of areas are occupied by housing, crops and grazing, 18% by housing and crops, 3% by crops and grazing and 11% by housing only. Only 12% of areas remain unoccupied for human activities (Fig. 4).

In relation to the river, 57% of dwellings are less than 35 m away, 3% between 35-100 m, 23% more than 100 m away. Only 17% remain unoccupied. However, the commune does have a waste management company, which only cleans the main market and certain administrative districts. At neighborhood level, public garbage cans as such rarely exist. On more than half of the sites observed, there are garbage dumps not far from the river, at least 35 m away, and generally in the immediate vicinity of the river. Overall, we found that

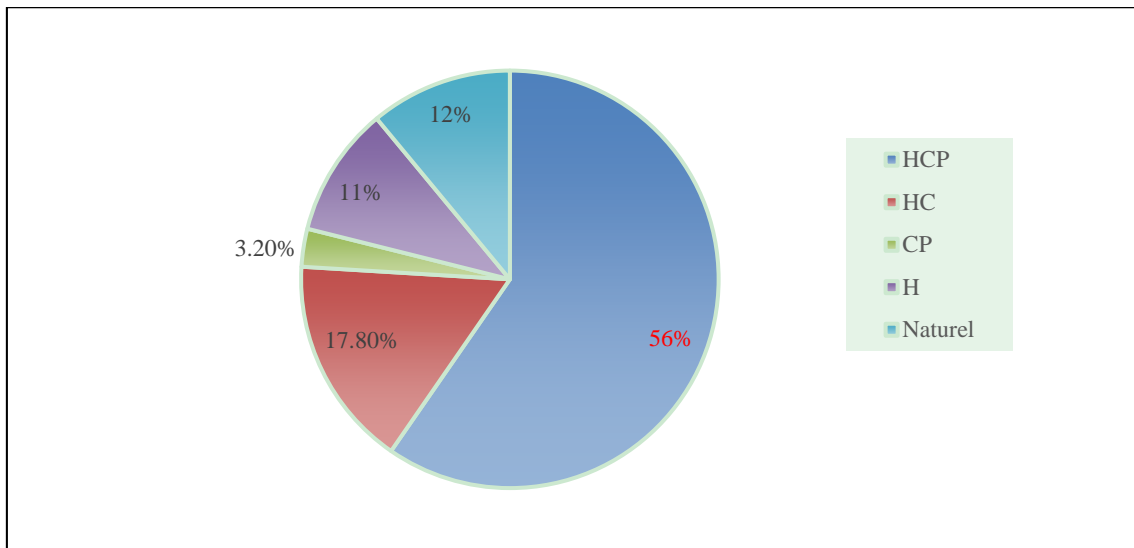


Fig. 4 Diagrams showing some of the results of bank observations on occupancy (H = Dwellings, HC = Dwellings and Crops, CP = Crops and Pastures, HCP = Dwellings, Crops and Pastures, and area unaffected by human activity).

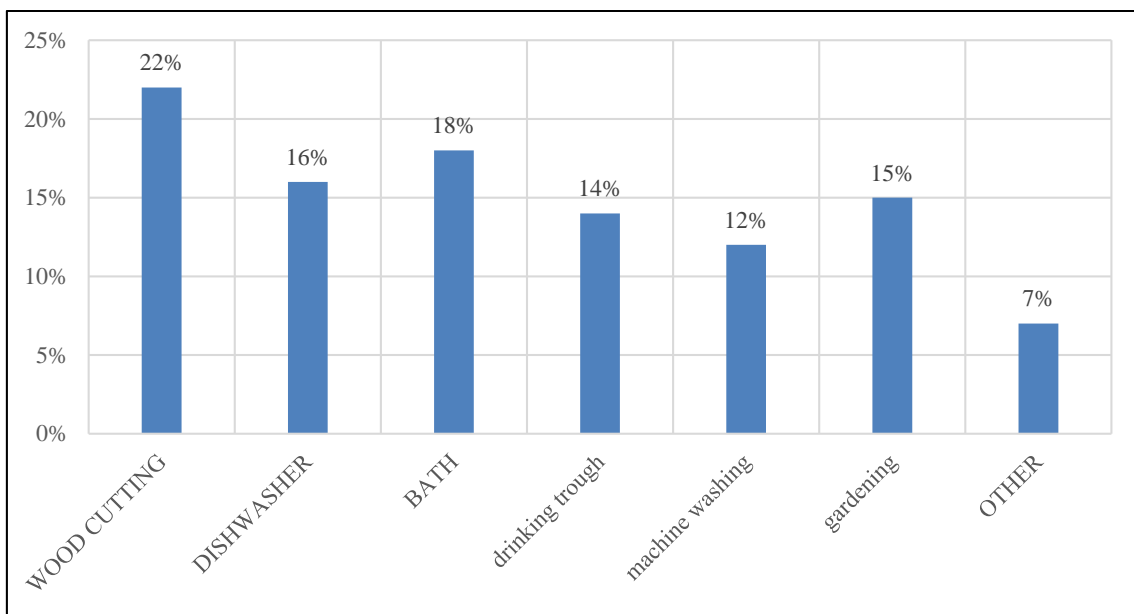


Fig. 5 Diagram showing how river water is used.

the further away the dwellings are, the further away the garbage dumps are from the river. The same applies to latrines, most of which are dry. In winter, they are completely swallowed up by the river. We noted the absence of any public establishments on the way to the river (market, school, hospital, mosque or other) within 35 m, except for Boulbinet elementary school and Tambassa cemetery, which are all within 100 m of the river.

3.4 Water Use

Water use on the river is shown in Fig. 5.

According to Fig. 5, river water is used for washing clothes, washing dishes, bathing, watering livestock, washing machinery and gardening. Among other things, the water is also used to make mud bricks. The most common domestic activities are washing, bathing and dishwashing (Fig. 5), as the river does not cover the entire water zone. This indicates a management

problem with adverse effects on the population. According to Ref. [15], the same management problems are found in Kankan, the second largest city in the Republic of Guinea after Conakry, where the Milo River does not supply all districts with drinking water. According to Selly and Abdelkader [16], the main user of water in the Republic of Guinea is the agricultural sector, whose volume of water used is estimated at 1,518 million m³. Statistics for 2014, indicate that 52.4% of the rural population against 79.6% in rural areas had access to drinking water. However, the main sources of degradation of natural resources in general and water resources in particular in Mamou are indicated in Fig. 6.

3.5 Sources of Degradation of Natural and Water Resources

According to some of the citizens we met, the anthropogenic activities leading to the degradation of natural resources include: abusive wood cutting (22%), poor cultivation practices (24%), carbonization (17%), the making of baked bricks (15%), bush fires (18%), and poor hunting practices (4%) (Fig. 6). These results show a percentage of degradation ranging from 15%-24%, with an average of 5.75%. These factors are

among those causing changes in rainfall patterns, with a water deficit 36.4% below current norms by 2050 [16]. In Mamou, riverbank farmers use chemical products for market gardening and lowland rice cultivation: mineral fertilizers, pesticides, insecticides, weedkillers, without any agricultural advisors or studies. Unlike Niamey, in Niger, doses of N-P-K and P-K fertilizers are used to amend the soil after consulting an agricultural advisor [17]. Anarchic urbanization has led to abusive logging along water sources in Mamou, such as the Mamouwol River, which has destroyed the Mamou ecosystem as houses have been built up to a distance of less than 35 m from the river. These phenomena have been observed in various parts of Africa [18-21]. This proximity presents risks of direct contamination of water through garbage dumps, sewage, latrines, puddles of stagnant water, run-off channels and the like. The work of Mint Mohamed Salem et al. [22] highlighted the very high presence of germs indicative of faecal contamination, following the proximity of dwellings to water sources in our cities, which is a threat to the inhabitants who draw water from these sources for their needs. According to [23], the most obvious consequence of poorly designed forestry practices, particularly along rivers, is an increase in

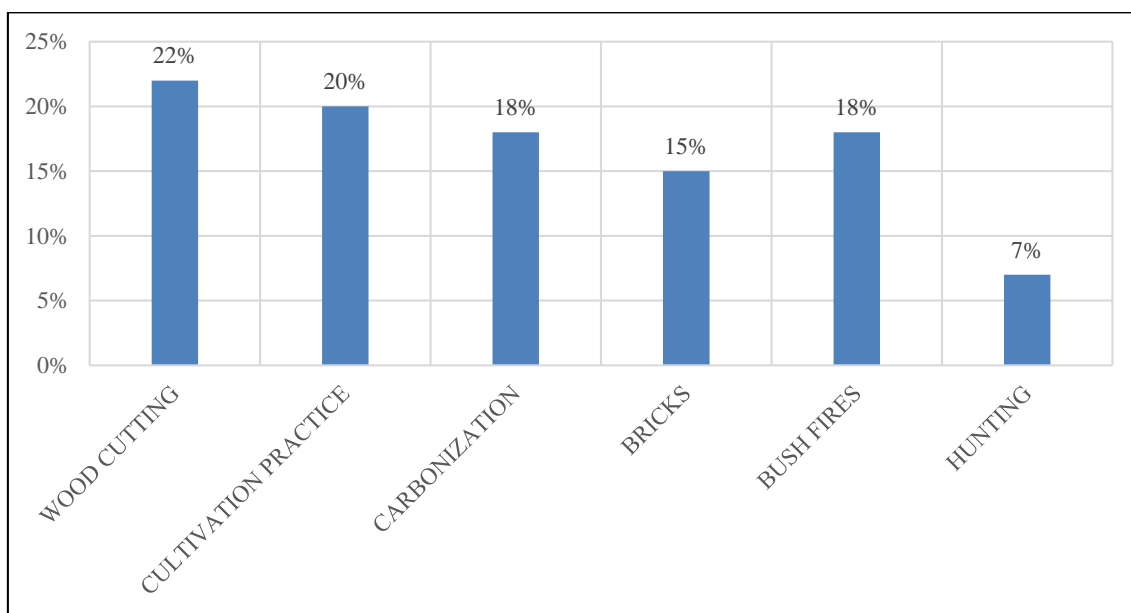


Fig. 6 The sources of natural resource degradation.

erosion and sediment deposition, resulting in damage to habitats, river-dwelling organisms and water clarity. However, in the study area, no industry of any kind was encountered in the course of the Mamouwol River at Mamou, from the source in the village of HoréMamou through the town center to Dounkiwal, 9 km from the center, which is also a source of intensified industrial pollution near rivers [23, 24].

4. Conclusion

As a result of this study, the potential sources of destruction of the Mamouwol River in its communal course are geomorphological and anthropological. According to our findings, different types of aggression on the natural resources of this river in Mamou have been identified, such as: abusive logging, extensive agriculture, anarchic urbanization, carbonization, etc. This study shows the aggressiveness of the Mamouwol River in Mamou through these various anthropogenic activities. Further studies are recommended on the water quality of this river, and the implementation of an environmental monitoring and management system.

References

- [1] Abdoul G. B. 2016. "Study of the Marine Alluvium Aquifer of the Dubrêka Prefecture for the Supply of Drinking Water to the Population." Thème de licence en géologie géologique, ISMGB- Boké Republic of Guinea.
- [2] Mamadou, M., Sow, Aicha, C., Adama, M, S., and Cellou. 2023. "Removal of Nitrate and Phosphate Ions from the Bafing River by an Adsorbent Obtained from the Shells of Mango Cores." *Journal of Geoscience and Environment Protection* 11: 67-78.
- [3] Selly, C., and Abdelkader, B. 2017. "Valorisation of Water Resources in Guinea for Economic, Social and Sustainable Development." *Journal of Water and Environmental Sciences* 1: 106-14.
- [4] Ouedraogo, I., M., Tigabu, P., Savadogo, H., Compaore, P, C, Oden, J, M., and Ouadba. 2010. "Land Cover Change and Its Relation with Population Dynamics in Burkina Faso." *West Africa Land Degradation & Development* 21 (5): 453-62.
- [5] Bewket, W., and Abebe, S. 2013. "Land-Use and Land-Cover Change and Its Environmental Implications in a Tropical Highland Watershed, Ethiopia." *International Journal of Environmental Studies* 70 (1): 126-39. <https://doi.org/10.1080/00207233.2012.755765>.
- [6] Steffen, W, J., Grinevald, P., Crutzen, J., and McNeill. 2011. "The Anthropocene: Conceptual and Historical Perspectives." *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 369: 842-67.
- [7] FAO. 2018. *la situation des forêts du monde. Les forêts au service du développement durable*. FAO: Rome, Italy. (in French)
- [8] Adjakpa. 2017. "les facteurs naturels et le forçage anthropique des inondations en zone sahéenne dans le bassin du niger au benin (afrique de l'ouest)." *Journal of Water and Environmental Sciences* 1 (22): 77-83. (in French)
- [9] Dobbs et al. 2011. le télescope du pôle sud (spt) est un télescope grégorien à grand champ de 10 m de diamètre, doté d'une caméra bolométrique multicolore à ondes millimétriques de 966 pixels. il est situé sur le site de l'amundsen. (in French)
- [10] Sow, F. 2017. "évaluation de la pollution chimique et bactériologique des eaux de la réserve de biosphère du haut niger (faranah)." programme des bourses de recherche de l'unesco-mab pour les jeunes scientifiques, direction nationale de la recherche scientifique et technique (d.n.r.s.t.), mesrs, république de guinée. (in French)
- [11] Naushad, M., Sharma, G., Kumar, A., Sharma, S., Ghfar, A. A., Bhatnagar, A., Stadler, F. J., and Khan, M. R. 2018. "Efficient Removal of Toxic Phosphate Anions from Aqueous Environment Using Pectin Based Quaternary Amino Anion Exchanger." *Int. J. Biol. Macromol.* 106: 1-10.
- [12] Saravanan, R., Gupta, V. K., Mosquera, E., and Gracia, F. 2014. "Preparation and Characterization of V₂O₅/ZnO Nanocomposite System for Photocatalytic Application." *J. Mol. Liq.* 198: 409-12.
- [13] Sharma, G., Alothman, Z. A., Kumar, A., Sharma, S., Ponnusamy, M., and Naushad. 2017. "fabrication et caractérisation d'un hydrogel nanocomposite pour la dégradation photocatalytique combiné d'un mélange de vert malachite et de colorant vert rapide, nanotechnol." *Environnement. Eng.* 2: 4. (in French)
- [14] Mamadou, A, S. 2023. "hydrologie et géochimie des transports fluviaux dissous et particuliers dans le bassin versant du milo (république de guinée) hal open science." PhD thesis, l'université de toulouse. (in French)
- [15] la région de mamou en chiffres, Ministère du plan et du développement économique. 2020 [https://www.google.com/search?q=La+r%C3%A9gion+de+Mamou+en+chiffres%2C+Minist%C3%A8re+du+plan+et+du+d%C3%A9veloppement+%C3%A9conomique+\(2020\).&oq=La+r%C3%A9gion+de+Mamou+en+chiffres%2C+Minist%C3%A8re+du+plan+et+du+d%C3%A9vel](https://www.google.com/search?q=La+r%C3%A9gion+de+Mamou+en+chiffres%2C+Minist%C3%A8re+du+plan+et+du+d%C3%A9veloppement+%C3%A9conomique+(2020).&oq=La+r%C3%A9gion+de+Mamou+en+chiffres%2C+Minist%C3%A8re+du+plan+et+du+d%C3%A9vel)

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- [16] Selly, C., and Abdelkader, B. 2017. "valorisation des ressources en eau en guinée en vue d'un développement économique, sociale et durable." *J. Wat. Env. Sci.* 1 (22): 106-14. (in French)
- [17] Adamou, M, M., Tankari, D,B, A., Ibrahim, E,D., Abdourazakou, M, H., Przemyslaw, C .,Switoniak, M (2022) Diagnoses Of The Potential Sources Of The Anthropic Pollution Of The Niger Stream Around The City Of Niamey (Niger), *International Journal of Advanced Research (IJAR)* 10 (10) 518-532
- [18] Bah, A.L., Oueda, A., Barry, A., Kabbre, G. (2016). Diagnostics des Sources Potentielles de Pollution du Fleuve Niger à Faranah (GUINEE). *European journal of scientific research*, 141 (2), pp.171-183
- [19] Adamou M, M (2016). Etude des propriétés physico-chimiques des sols et eaux des rives du Niger : Evaluation de la salinisation des rizières urbaines (Lossa-goungou, Kirkossoye et Saga). Mémoire de master en Sciences de l'Environnement à l'Université Abdou Moumouni de Niamey, 121p.
- [20] de Joux, (1988) : la pollution des eaux africaines continentales, expérience acquise, situation actuelle et perspectives. éditions orstom.
- [21] N'diaye a. d., Mint Mohamed Salem K., Brahim El Kory M., Ould Sid' Ahmed Ould Kankou M. and Baudu M (2014) contribution à l'étude de l'évolution spatio-temporelle de la qualité physico-chimique de l'eau de la rive droite du fleuve Sénégal. *J. mater. environ. sci.* 5 (1) 320-329.
- [22] Mint Mohamed Salem, K., N'diaye, A. D., and Kankou, M. O. S. A. O. 2011. "Evaluation de la qualité de l'Eau de la rive droite du fleuve Sénégal." *science lib* 3: 111002. (in French)
- [23] Kone A., et Kotschoubey N., (2005) : évaluation pour le suivi de la qualité de l'eau dans le bassin du Niger/unops : banque mondiale.
- [24] Nedau, E. J., Merritt, R.W., and Kaufman, M. G. 2003. "The Effect of an Industrial Effluent on an Urban Stream Benthic Community: Water Quality vs. Habitat Quality." *Environ pollut.* 123 (1): 1-13.