

# Kandadji Dam Construction in the Niger Republic: Public Health Implications

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**Abstract:** In West Africa, as anywhere in the Low and Middle Income Countries, dam building allows to control and manage water for promoting sustainable economic growth and poverty reduction. The Niger Republic, accompanied by its partners, has started the building of the Kandadji dam project on the Niger River in 2019, scheduled to end in 2029. This is an old project expected by 80% of the country's people for its multiple advantages. However, as largely reported elsewhere, dams are known to be associated with some serious public health challenges for both people who inhabit the area surrounding dam reservoirs and for resettled people. This paper evokes the possible public health challenges that could arise from Kandadji dam. By suggesting solutions which include environmental control, and collective and individual measures for reducing or even stopping the burden of disease spread, the paper highlights also the necessity to carry out entomological, parasitological, virological, and serological studies for i) inventorying diseases vectors circulating in both areas surrounding the dam and resettled ones, ii) detecting and characterizing viral, bacterial and parasites pathogens which circulate among these vectors, iii) detecting and characterizing, viral pathogens circulating among local populations of natural reservoirs like mice and birds. This approach should allow to have a pattern of possible disease risk emergence for prospective evidence-based prevention measures.

**Keywords:** Kandadji Dam, Reservoirs, Resettlements, Public Health Challenges, Vector-Borne Diseases, Diseases Vectors, Gastro-Enteritis Diseases, Niger Republic

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## 1. Introduction

Dams are world widely recognized as a key factor for accelerating economic growth through increasing energy access and industrialization, increasing potable water access, and promoting food security through increased agriculture [1]. They are essential for water resources control and management [2]. West African regions are characterized by 28 transboundary river basins with the Niger River covering 11 countries as the most important followed by the Senegal

River covering 4, the Volta covering 6, the Lake Chad covering 8, and the Comoé covering 4 countries. Also, there are several billions of three square meter (m<sup>3</sup>) volume of fresh water buried underground as natural groundwater resources of the region [3]. Even with these potentialities, the region suffers from water scarcity, lack of electricity access, and food security, due to the unequal distribution of rainfall, climatic conditions, and the lack of hydraulic infrastructures for Water control [2]. That's why building dams was the government's response to the water control challenge [3]. But

experience has proven that behind the known benefices accompanying dams, serious public health challenge has been always reported from people close to dams and those

displaced and resettled [4–6]. Here, after a description of the Kandadji dam project, we invoke the possible public health challenge that could arise after the implantation of the dam.

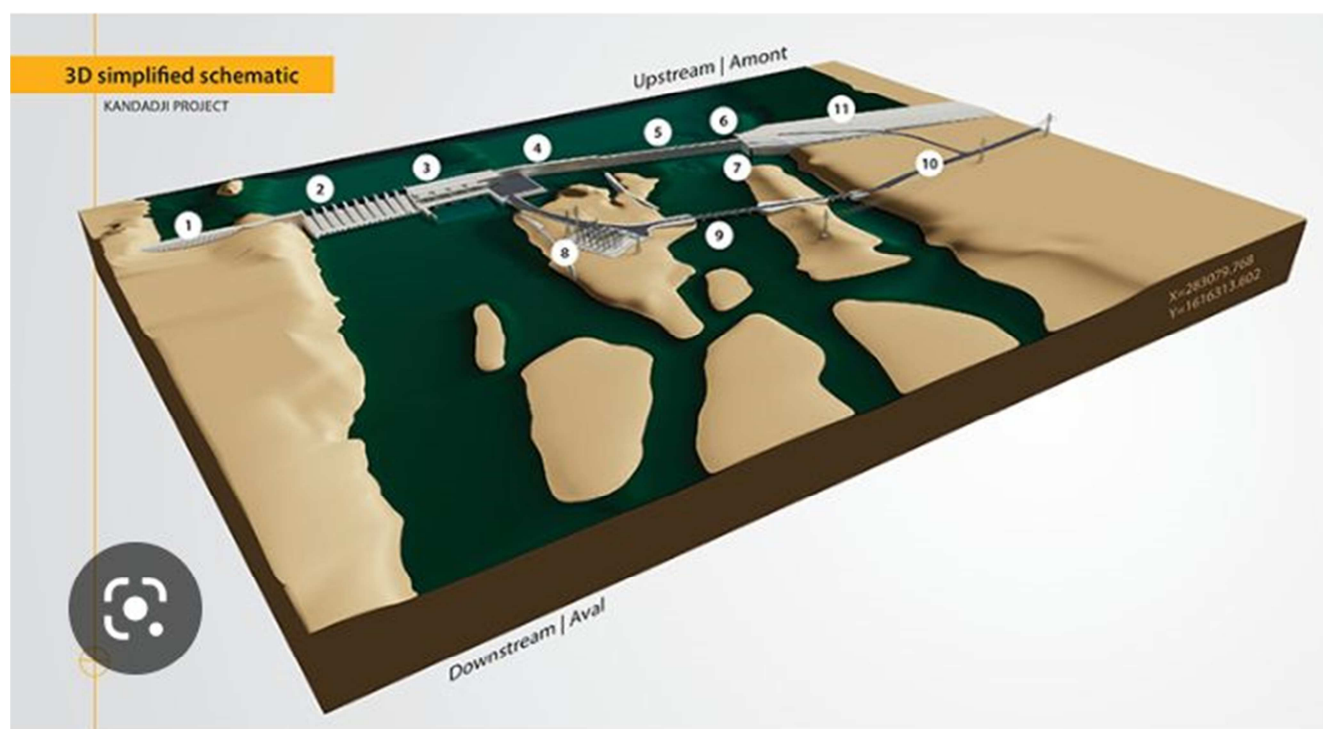


Figure 1. 3D simplified Schematic of Kandadji Project, Copyright World Bank 2020.

## 2. Description of the Kandadji Dam Project

### 2.1. Key Elements Justifying the Kandadji Dam Project in the Niger Republic

In the Niger Republic, the reality is that even with the presence of the Niger River, the country has one of the lowest electrification rates in the world with 10% of the population benefiting from it among which less than 1% are from in rural areas. More than 40% of the population, accounting for more than 9 million people live in extreme poverty [7]. Also, there is scarce access to potable water and sanitation, particularly in rural areas where 44.2% and 7% respectively have access to water and sanitation. More than 11 million people (51.7%) suffer from severe food insecurity (2016-2018) [7]. In front of all of these vulnerabilities, the Niger Republic, in collaboration with its partners, started in march 2019 the construction of the Kandadji dam on the Niger River, which is distant of 187 kilometers from Niamey metropole, of 489 kilometers to the Nigerian border, and of 60 kilometers downstream to the Malian border [7]. (See Figure 1). The end of the project is scheduled for 2029.

Figure Legend: 1. Saddle dam, 2. Spillway & outlet works, 3. Powerhouse I x 4 turbines, 4. Concrete dam, 5. Auxiliary spillway in Roller Compacted Concrete, 6. Water intake for agriculture, 7. Pirogue Sluice, 8. Substation, 9. Access

bridge, 10. Access Road, 11. Earthfill dam [7].

### 2.2. Kandadji dam Project: Expected Benefices and Resettlement Program

The Kandadji dam project is part of the Kandadji Ecosystems Regeneration and Niger Valley Development Programme P-KRESMIN [8]. The aims of the project are to contribute to reducing poverty, improving food security, and increasing energy access [7]. According to the updated summary of the Environmental and Social Impact assessment published in 2018 [8], the main benefits expected at the end of the project are i) regeneration and conservation of river ecosystems on the Nigerien portion of the river allowing a water flow rate of 120 m<sup>3</sup>/s in Niamey ii) irrigating 45.000 ha to improve agricultural production, food security and living conditions of the beneficiary communities; iii) improve potable water access to people, livestock and other users and increasing the incomes of beneficiary communities through a secure system of livestock and sustainable development of agro-pastoral activities and iv) increasing Niger's energy security through the production of electric energy with the construction of a hydropower plant with an installed capacity of 130 MW. In addition to these cited expected benefits, linked to the reservoirs resettlements, the project includes the rebuilding of the town of Ayorou and the building of a dozen new resettlements villages and associated communities infrastructures and services like roads, schools, clinics, markets, 8.000 ha perimeters of irrigation for displaced

farmers, 10,000 new houses, extensive agricultural and non-agricultural livelihood restoration programs, employment opportunities for youth and women, improved water infrastructure for improved health and education outcomes [7]. The resettlement program will concern 9,000 people at the dam site and 50,000 people in the reservoir area related to the reconstruction of the town of Ayorou [7], and almost 12,000 ha of farmland [8].

### 3. Dams Public Health Challenges in the literature and What Can Be Expected in the Context of Kandadji Dam

Behind the known potential benefits of dams in general, and those related to Kandadji particularly, landscapes and rivers ecosystems changing which might result from dams construction are mostly associated with potential health impacts leading to serious public health challenges, as largely reported elsewhere [4–6]. The permanent water of the reservoir leads to an increase in the density of arthropod vectors [9]. Hydroelectric dam construction affects 1) people who inhabit the area surrounding dam reservoirs and 2) those who are displaced and resettled to leave a way for the dam, catchments, and dam-associated infrastructures [10]. Among the “reservoirs communities” or the first group, the most frequent diseases reported and linked to their proximity to reservoirs include parasitic and viral diseases transmitted by most vectors (biologically or mechanically) as such involved in the development of Malaria [11], Schistosomiasis, gastroenteritis [12], Yellow Fever, Lymphatic filariasis (elephantiasis), Japanese encephalitis, Dengue, onchocerciasis (river blindness), trypanosomiasis (African Sleeping Sickness), Visceral Leishmaniasis [10]. In addition, nomadic breeders using the reservoir for watering animals increase their vulnerability to Rift Valley Fever Virus if the virus circulates in the area [9]. In another hand, those who are displaced and resettled are usually challenged to adapt to the new ecosystem which makes them in contact with animals with zoonosis or who are reservoirs of arboviruses [10]. The development activities associated with the resettlement and poor sanitary hygiene related to inadequate water supply and lack of methods of excreta management [9, 10] are in favor of the development of water-borne diseases. There are several diseases reported among resettled people ranging from waterborne diseases to mental health illnesses: Malaria, Dengue, Yellow fever, Schistosomiasis, ancylostomiasis, ascariasis, onchocerciasis, pneumonia and respiratory diseases, gastroenteritis including cholera, diarrhea, dysentery, and others, malnutrition and food insecurity, and mental health concerns [10]. The short and long-term effects of these diseases could with time affect people living in community with the appearance of serious public health sequels, then compromising their economic productivity [10]. In West Africa, several studies have reported increased incidences of diseases after dam construction: for example, after the Diama Dam construction

in Senegal in 1986, Schistosomiasis has become endemic among people living in the Senegal River Basin [13]. Also, the first epidemic of Rift Valley Fever in the region, notably in Senegal in 1987, has been associated with the Diama dam [14]. In Mali, the Manantali dam has increased the prevalence of malaria, Schistosomiasis, and gastroenteritis [12]. A case-control study done in Ghana has shown that the Barekese dam has increased the incidence of Urinary Schistosomiasis, Malaria, and Diarrheal diseases among people living near the dam compared to control people [6]. Globally, those reports and evidences highlight the potential public health challenges associated with dams. In the context of Kandadji, we should expect a similar reality.

### 4. Suggested Solutions from Experienced Cases for Mitigating Diseases in the Context of the Kandadji Dam

By considering the previous details on the dams and diseases, particular attention must be paid in the Kandadji context to the public health implications for the well-being of the targeted populations. Solutions to the health concern were indeed envisaged in component B.B1 of the last updated environmental and social impact assessment of the project [8], but here we contribute to strengthening reflections on possible solutions for better addressing the public health challenges related to the Kandadji dam. Several solutions based on evidence have been suggested from many parts of the world, we try to report most of them as follows:

Housing communities away from reservoirs [15], can allow reducing people exposition to vector bites, particularly malaria vectors. In other term, creating a buffer zone separating populations from reservoirs [16] is more likely to reduce disease transmission.

Systematic fluctuations in water level in reservoirs can reduce breeding sites of malaria, Schistosomiasis, and arbovirus vectors [9];

Among people leaving around reservoirs, latrines should be built at least 15 meters away from any water supply and household to decrease the risk of transmission of water-borne and water-washed diseases [9].

Implementing community education on good health practices, linked to vector-borne diseases and diarrheal diseases, including larval and snail sources destruction, recognition of disease symptoms, and personal protection measures [9].

### 5. Research Perspectives

Further entomological, bacteriological, parasitological and virological investigations should be conducted. Among which, we should consider to contribute in i) describing or characterizing vectors-related-diseases circulating both in the area surrounding reservoirs and the new resettlements area, ii) detecting and characterizing viral, bacterial and parasites pathogens which circulate among these vectors, iii) detecting

and characterizing viruses circulating among natural reservoirs of viruses like mice and birds. This can allow to have a pattern of possible disease risk emergence and take further evidence-based prevention measures.

## 6. Conclusion

The finalization of the Kandadji dam project will allow sustainable development for people including food security, potable water access, electricity, and business. But, for mitigating public health challenges that are naturally associated with dams, environmental control coupled with integrated sanitary measures should be considered in order to best mitigate disease spread and incidence among people. Taking anthropological and social dimensions into account during the process of displacement and resettlement would help to preserve the health of populations.

## Competing Interest

The authors have declared that no competing interests exist.

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