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BACKGROUND

In Senegal, the supply of drinking water to satisfy population needs is one of the biggest issue. To overcome deficit on water supply, Senegalese authority turned to the exploitation of the Lake Guiers. It is a shallow reservoir located on the right bank of Senegal River, between latitudes 16°23'N and 15°55'N, and longitudes 16°12'W and 16°04'W. The Lake Guiers is mainly fed by Senegal River through Taouey canal (Figure 1). Its water is used for **irrigating crops (90.000 ha)** and as a **drinking water resource for urban centres (165.000 m³/days)** for a population of **5 Millions** inhbt.

Basin Area: 45,119 Km²

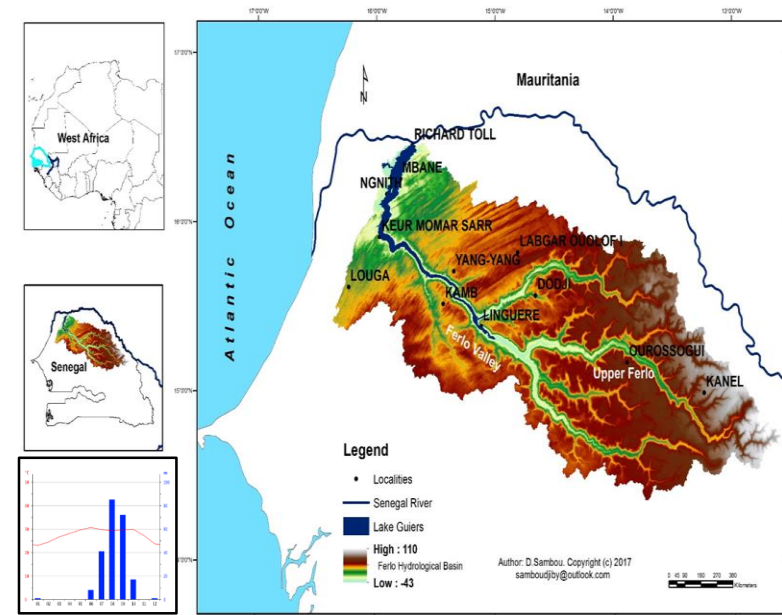
Lake Area: 232 Km²

Climate: Sahelian

Shorline: 50 Km ; **Breadth:** 7 Km

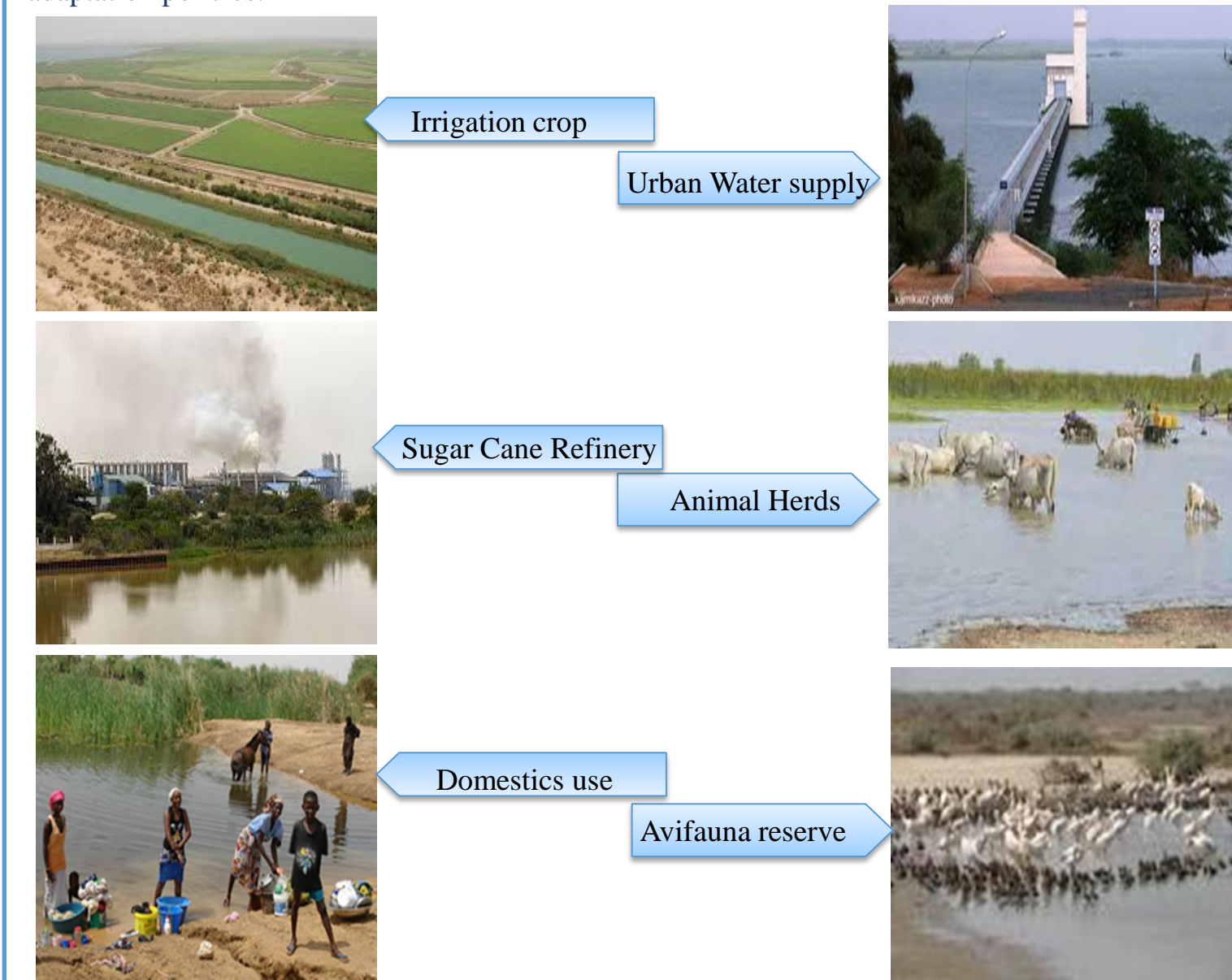
Max depth: 4 m ; **Water Level:** 2.5 m

Riparian Pop: 138,743inhbts



In the last decades, the Lake Guiers basin was subject to several changes. These changes concern socio-economic factors like growth of population and increased agro-industrial farming as well as hydrological changes in the Senegal River basin and the impacts of climate change.

Despite all these emerging issues, there is limited knowledge of the Lake's resources and how it might respond to global changes. There has been little assessment of the impacts of climate change and population growth in Lake Guiers which has much relevance for the formulation of climate adaptation policies.



OBJECTIVES

This study investigates climate change detection and projections for Lake Guiers Basin by analyzing precipitation, evaporation and air temperature-related to observed extremes. It assesses also water availability in the reservoir under climate change scenario.

The aim of this study is to provide information on observed and projected extremes in Lake Guiers Basin, in support of its water resource managers, for an efficient long-term planning and management.

MATERIALS & METHODS

DATA SET : Hydrological data (discharge), (1976-2005) ; CORDEX (Coordinated Regional Climate Downscaling Experiment) data : Daily data (Pmm; T°C ; Etpot)
-IPCC Scenarios, RCP 4.5 and RCP 8.5. -50km x 50km -Period 2005-2030; 2051-2100
Data was aggregated by **sum** for each year, then **averaged** for years, regions and climate models.

TOOLS: R and RCLimDex (1.0) program Zang et al.(2004) ; WEAP (Water Evaluation and Planing),

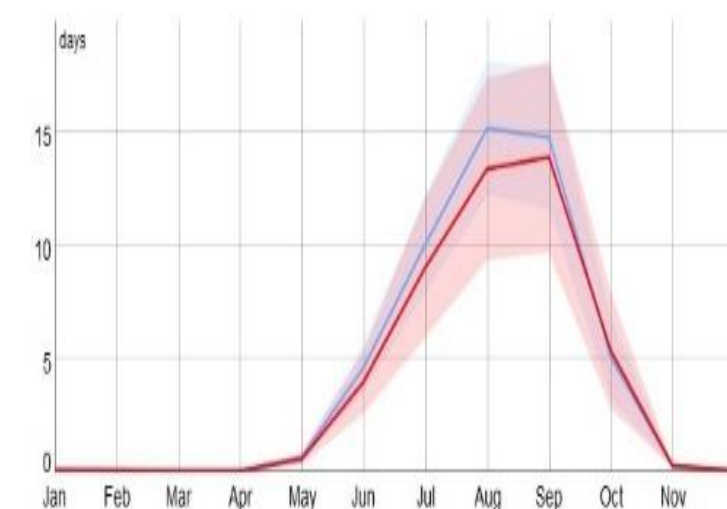
METHOS:

Trends Analysis :Pmm, Temperature, ETo

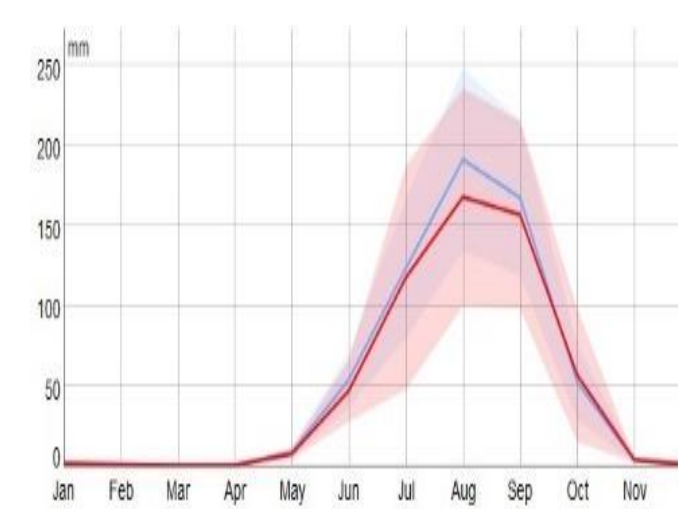
Scenario Analysis: 2 IPCC scenarios: RCP 4.5 and RCP 8.5 from CORDEX with 50km x 50km gridded and a length period of 2002-2030; 2051-2100

RESULTS

1- Temperature and Rainfall projections in the basin of Lake Guiers 2050-2080



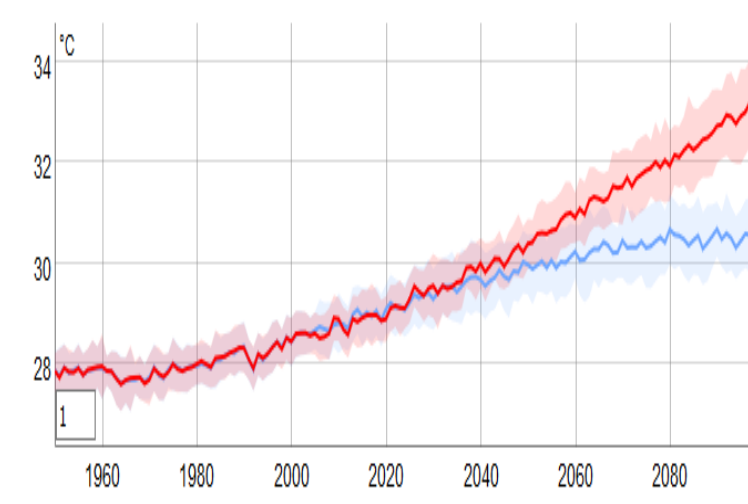
Monthly nb of rainy days in Lake Guiers Area



Monthly Total Rainfall



Monthly Mean Temperature in Lake Guiers Area

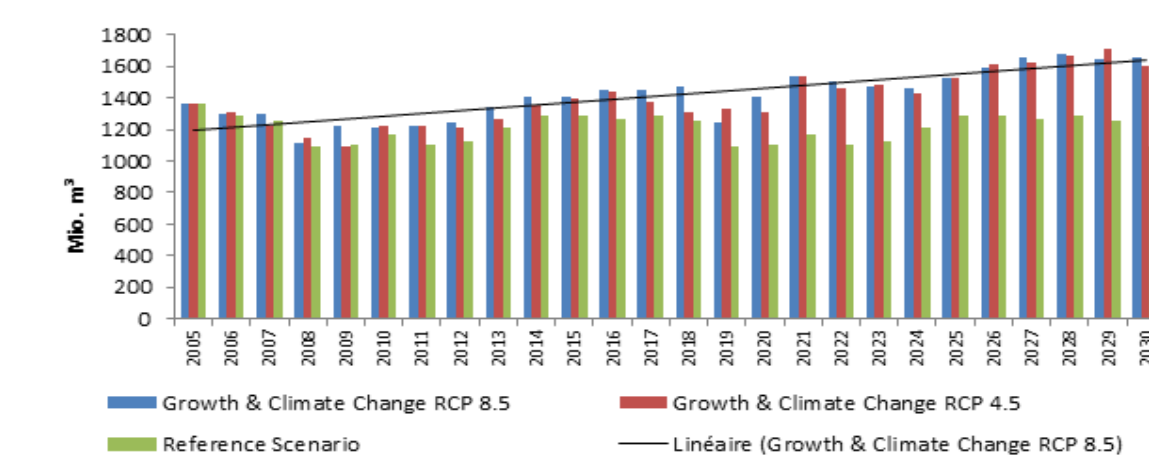


Evolution of Mean Temperature in Lake Guiers Area

2- Climatic water balance

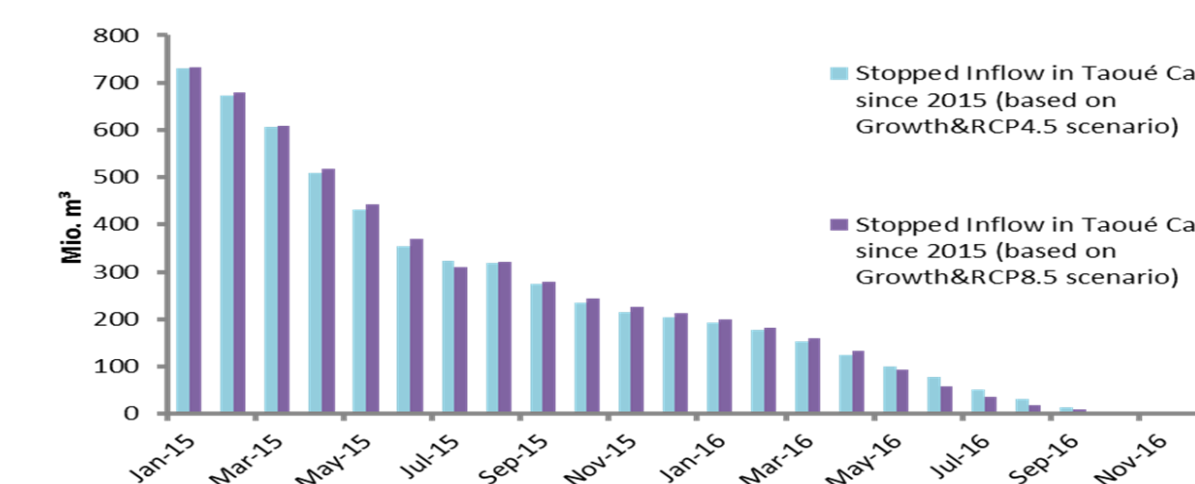
Year	RCP4.5			RCP8.5		
	Etpot (mm/year)	PRCPT (mm/year)	ΔV (mm/year)	Etpot (mm/year)	PRCPT (mm/year)	ΔV (mm/year)
2030	2 020.88	414.40	1 606.48	2 052.55	283.21	1 769.34
2040	2 305.98	203.77	2 102.21	2 441.23	111.77	2 329.46
2050	2 168.95	276.22	1 892.73	2 449.55	120.44	2 329.10
2060	2 356.95	61.85	2 295.11	2 366.06	381.71	1 984.35
2070	2 386.19	192.72	2 193.47	2 240.27	633.32	1 606.95
2080	2 448.47	280.93	2 167.54	2 524.82	189.04	2 335.79
2090	2 352.25	206.11	2 146.14	2 910.61	251.64	2 658.97
2100	2 538.80	125.78	2 413.02	2 916.82	102.56	2 814.26

3- Impacts of climate change on water availability in Lake Guiers reservoir

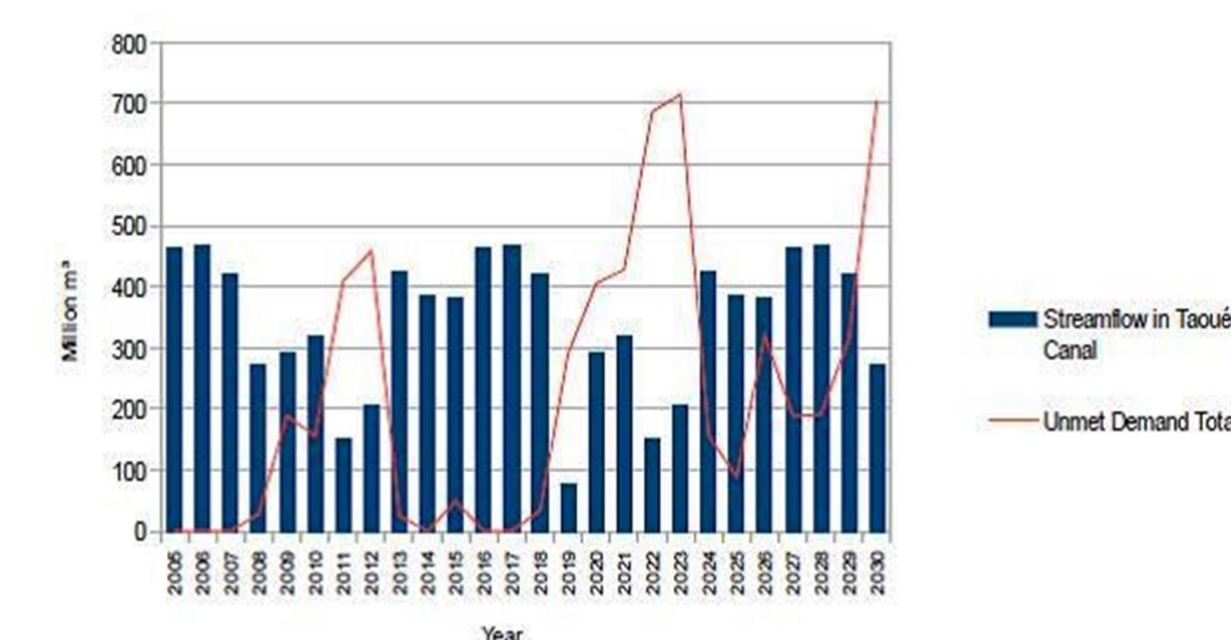


Annual stream flow in Taouey Channel under RCP8.5 or RCP4.5 scenario

Reservoir: It was tested, in case of a limitation of inflow (**4,177,274.8 m³/day**) from the Senegal River, how long the water stored in the reservoir (**655,616,099.3 m³**) will be sufficient when all projects are implemented.



Storage Volume in Lake Guiers with stopped inflow beginning in January 2015, combined scenarios of growth and climate change RCP 4.5 and RCP 8.5.

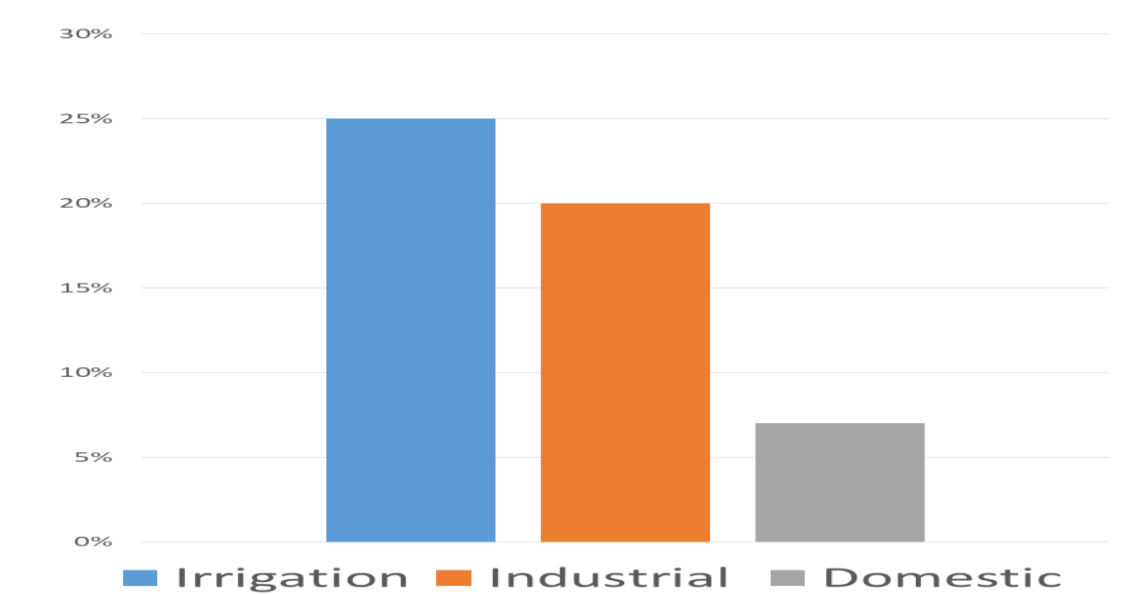


Annual streamflow in Touey canal and Total Unmet demand

CONCLUSION

The results show that the available amount of water in the reservoir is potentially high enough to satisfy users demand. The scenario analysis with WEAP reveal potential conflicts about water shortage. These shortages occur in both climate scenarios RCP 4.5 and RCP 8.5 with the decreasing of Taouey canal inflows.

In general, the future climate of Lake Guiers Basin seems to be exposed to more severe conditions and water availability will be under much greater stress.



Total water demand per user type in m³

Rigorous monitoring of the physical conditions in local hydrologic systems, in particular, will be needed to provide early warnings of change as well as baseline information with which to support future management decisions, especially in light of the limitations of local-scale and seasonal climate model projections..

Data input uncertainties and constraints apply to water supply. The CORDEX data (spatial resolution 0.25°; raster data) has been used for simulating evapotranspiration. The modelled demand might be underestimated as we don't take account to ground water data due to the lack of data availability.

Water availability and water supply situation could be ensured and achieved by using different management methods. Taouey canal should be adjusted in order to mitigate or anticipate unmet demand. In addition to increasing the reservoir capacities, other efficiency measurements should be applied: Adopt a basin approach, taking into account the adjacent ecosystems.

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