



WATER RESOURCES AND GLOBAL CLIMATE CHANGE: CRITICAL CONDITIONS WITHIN THE SALOUM & CASAMANCE CATCHMENTS OF SENEGAL & AN OPPORTUNITY FOR MANAGEMENT AND RESTORATION OF WETLANDS AND LIVELIHOODS

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Global climate change is recognized as a threat to species survival and the health of natural systems. Wetland systems are vulnerable to natural and man-induced alterations in their watersheds. Climate change, particularly in areas subject to man-induced stressors such as drainage, impoundments and redirected flows will make future efforts to restore and manage wetlands and watersheds in these areas more complex. This is now the case within the 58,000 sq.km. Saloum and Casamance watersheds in western Senegal where the negative effects of climate change reducing rainfall and man-made stressors on the natural hydrological systems such as dams, land clearing and drainage have resulted arid, hyper-saline conditions and recently the loss of thousands of hectares of major wetland complexes including mangroves, brackish estuaries, freshwater wetlands and once productive agricultural areas. Red and black mangrove forests that once vegetated the extensive flats along the tidal floodplains far inland are now mostly restricted to the deltas. The ecological character of the 730 sq. km. Sine-Saloum National Park, which is also the Deltas du Saloum Ramsar site is also located within a larger Biosphere Reserve is critically threatened. The livelihoods of thousands, who are dependent on the ecological services of these wetlands, are now in peril. The future sustainability of this region is linked to the successful restoration and management of these systems.



Senegal is a low-income, food-deficit country of 14 million people. Approximately 80 percent of the population works in agriculture, depending on exhausted soils and rainfall that fluctuates from year to year.

This has led to food shortages and poverty such that 26 percent of the population is undernourished and chronic malnutrition levels are particularly high among children under five.



Senegal is a poor country of approx 13 million people in west Africa. This semi-arid country like Mauritania, Mali, Burkina Faso, Niger, Nigeria, Chad and Sudan is on the edge of the Sahel and are living climate change.

This is where our late season north Atlantic hurricanes are typically born which is a topic for another paper.

Three of the world's greatest challenges over the coming decades will be biodiversity loss, climate change, and water shortages. Biodiversity loss will lead to the erosion of ecosystem services and will increase vulnerability to the impacts of climate change.



This is the arena where the Ramsar Convention, the STRP and many of its 160 member countries are now working on water resource issues and the livelihoods of those people who directly depend on the ecosystem services provided by their wetlands. It's a life and death situation, unlike most of us in our society that can subsidize the loss of our natural capital.

The *Millennium Ecosystem Assessment* showed that over the past 50 years human activities have changed ecosystems more rapidly and extensively than at any comparable period in our history.



Ecological History of the region is important as it will give us the needed context to understand the forces at work on this landscape that have resulted in the current conditions of habitat degradation and destruction of the livelihoods of thousands who farmed the land and once harvested a productive fishery.



Land-use alterations during colonial times resulted in widespread land clearing and drainage activities much like Europe and later North America experienced to harvest timber and develop farmland.

Like our own similar experiences with these poorly planned land-use changes the landscape was cleared, surface water was drained and groundwater levels were lowered to improve growing conditions for crops like rice, millet, and groundnuts.

Little or no attention was given to the impact those activities would have on the ecological services of the wetlands.

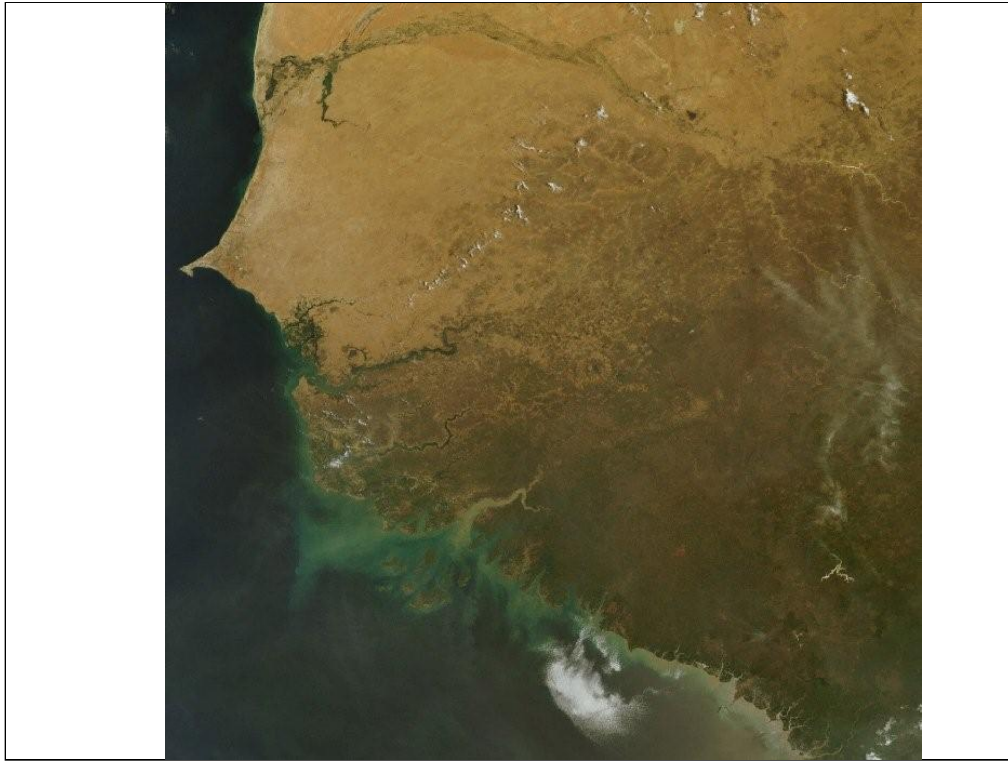
Table 1.1. Six Climate Threats, and the 12 Countries Most at Risk

Low Income		Middle Income		
Drought	Flood	Storm	Coastal 1m	Agriculture
Malawi	Bangladesh	Philippines	All low-lying Island States	Sudan
Ethiopia	China	Bangladesh	Vietnam	Senegal
Zimbabwe	India	Madagascar	Egypt	Zimbabwe
India	Cambodia	Vietnam	Tunisia	Mali
Mozambique	Mozambique	Moldova	Indonesia	Zambia
Niger	Laos	Mongolia	Mauritania	Morocco
Mauritania	Pakistan	Haiti	China	Niger
Eritrea	Sri Lanka	Samoa	Mexico	India
Sudan	Thailand	Tonga	Myanmar	Malawi
Chad	Vietnam	China	Bangladesh	Algeria
Kenya	Benin	Honduras	Senegal	Ethiopia
Iran	Rwanda	Fiji	Libya	Pakistan

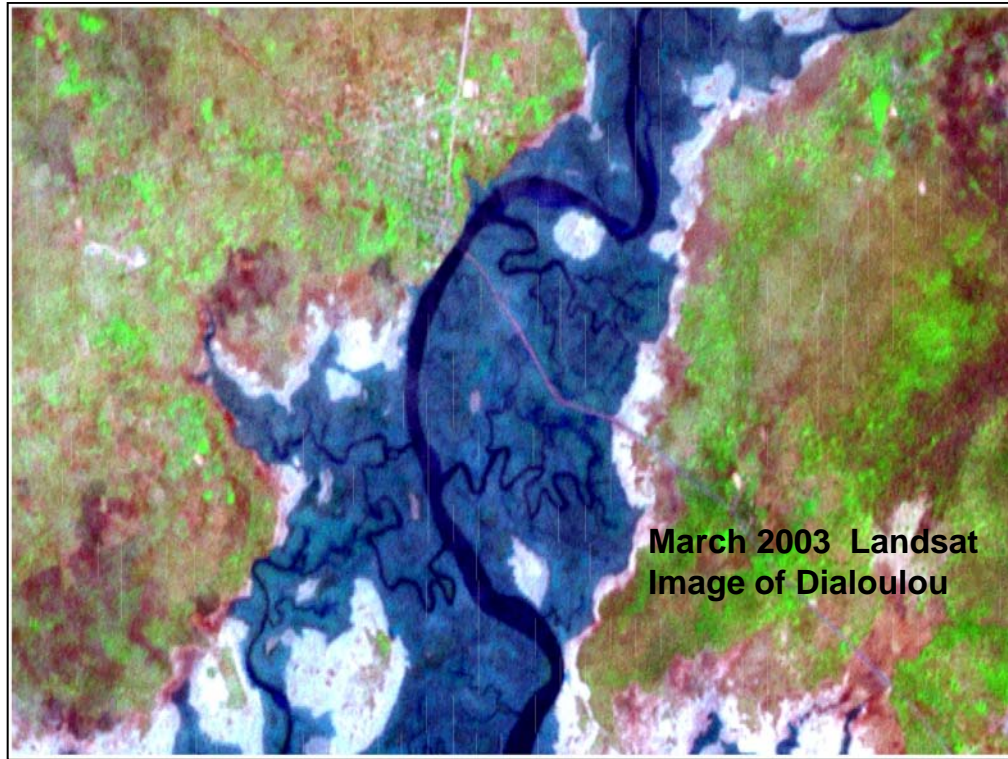
Climate change. The once abundant rainfall of the region exceeded 1000mm during the extended monsoon season, meaning when it started to rain it didn't stop for any significant period of time.



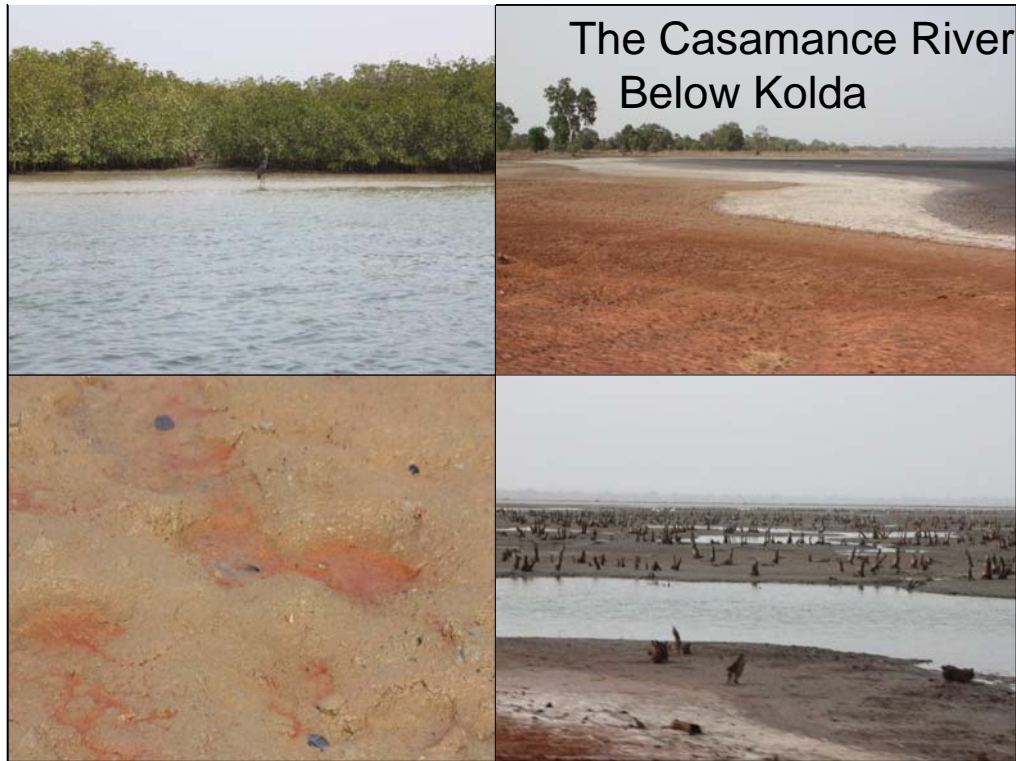
And rising sea levels are quickly compromising shoreline activities such as this 40 year old rice paddy on the Casamance River shore with water 3 to 5 times the salinity of sea water.



Rainfall has diminished over the past three decades from approximately 1000mm annually to the current levels of approximately 300 to 500mm with long dry periods between heavy rains that cause many problems related to erosion and crop destruction. It's not just the amount of rain that is critical but the timing of the rainfall.



These temporal changes in precipitation are occurring world-wide and have wide ranging effects on wetlands and the ecosystem services (defined by Ramsar as “the benefits to humans derived by the wetland)



This is critical now in the Saloum and Casamance watersheds with temperatures increasing in an area that was always subject to extreme heating by the sun but, there was enough water on the landscape to produce humidity which buffered what would normally be a high PET and also created more local rains.

We now have less rain, more heat and unfavorable winds that are enhancing the arid conditions now found in the area.



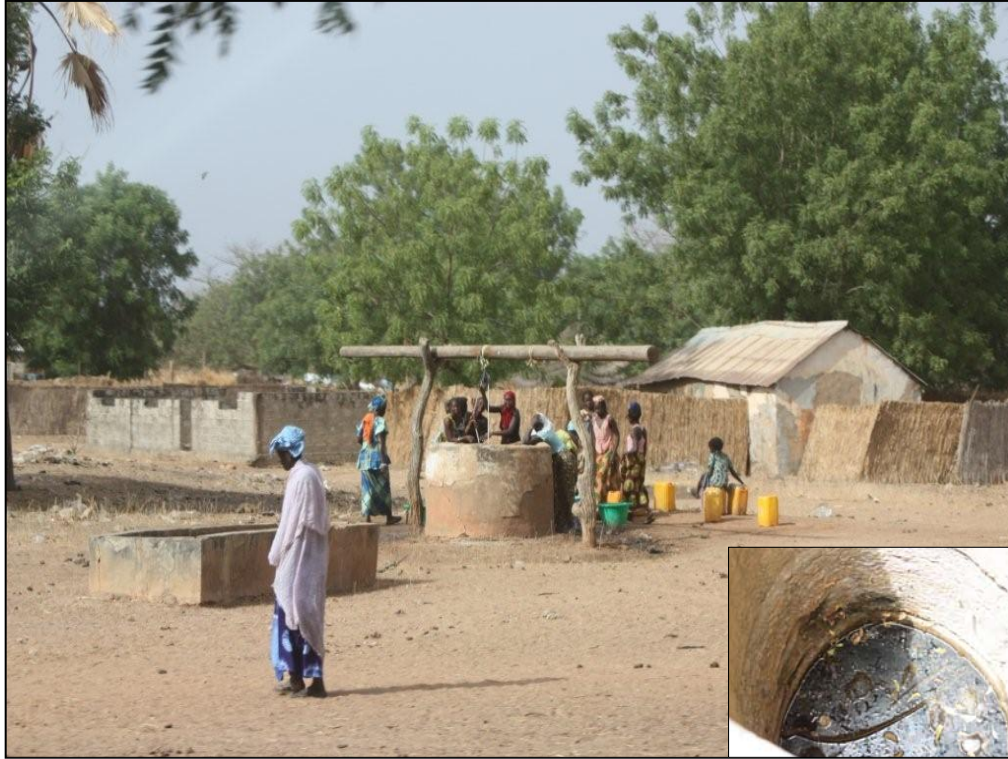
Existing conditions of the two watersheds. It's important to understand the significance of the watershed or catchment in terms of it being the body of a once sustainable system that historically managed to take care of itself without any outside interventions basically because the hydro-patterns within the area were stable.



Impacts on livelihoods of local people

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*Already there is significantly reduced mangrove habitat,
poor agricultural productivity creating migrations to the south and conflicts with those
residents,
reduced fisheries (oysters and fish),*



Not enough water to adequately recharge the aquifers. The drinking water supply is typically from shallow wells that are now subject to a wide range of increased salt and other minerals eventually making the groundwater unsafe to drink.

Too little water to create hydroelectric power so the dams now sit idle and people are without power.



The politics and economic drivers. *The separatist rebellion in the Casamance in southern Senegal is West Africa's longest-running civil conflict. Yet, compared with wars elsewhere in West Africa, it is virtually unknown in the outside world. Decades of civil war in the Casamance (always separated by The Gambia) has isolated this region economically*

and it stands to become a greater problem for its central gov't when the residents of outlying villages make exodus to tother more stable villages and the cities because they need food, water, grazing land, employment, medical assistance and shelter.



Wood fuel is now limited to taking endemic species, with too little water to support typical plantation stock. Even river reeds such as these used to thatch roofs are now scarce putting people in conflict over diminishing resources that were historically abundant and collected freely .

The most vulnerable people are typically those whose livelihoods directly depend on nature and on the ecosystem services that their wetlands provide.



A local fish drying cooperative near the mouth of the Casamance River

My interviews with elders of the villages throughout the region produced reliable info on the spatial and temporal nature of these impacts (without understanding the science). That was all the data available.



What was once thousands of hectares of productive, healthy wetlands has become unfertile, arid land.

What is the prognosis with and without appropriate ecological intervention? What needs to be done to avoid undesirable outcomes for 1.1 million people of the Casamance?

Comprehensive evaluation of watershed health and implementation of a consensus plan for ecologically engineering select areas within the region with climate change, restoration and enhancement of ecosystem health and education as a focus.



As far as the mangroves of Senegal are concerned, take a good look now, as they're existence will soon be limited to the immediate coastal areas along the Atlantic shore.

Consider joining the SWS- Ramsar Section.....



Thank you!