Title: Exploring Technologies for Sustainable Transboundary Water Resource Sharing in the Era of Climate Change: A Case for the River Nile Basin Riparian States

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Conference Theme Area 5: Extreme Hydrology and Climate Change

Welcome All

Introduction

- This paper explores technologies for sustainable transboundary water resource sharing in the era of extreme climates in and across the River Nile Basin riparian states.
- Climate change has been attributed to both natural and anthropogenic causes
- Manifestations of weather Variability and Climate Change include:

- Changes in temperature conditions
- Changes in precipitation patterns
- Increased frequency of occurrence of drought and floods hence, the hotter and longer spells of dry periods will be harmful
- Higher and increased frequency of rainstorms
- Sea level rise
- Frequent floods in areas where the changes will result in an increase in precipitation

The Impacts of climate change include:

- Changes in the hydrological cycle that influences the flow of water in rivers, soil, and underground storage reservoirs
- Higher temperatures will result in higher rates of evapotranspiration that eventually affect rainfed and irrigated agriculture
- Higher precipitation will result in floods that result in environmental degradation, siltation of water resources hence scarcity of water for domestic and irrigation purposes
- Changes in temperature conditions will result in emergence of pests and diseases with cost implications for their management
- Higher water temperatures will directly affect aquatic plants and animals which in turn will indirectly affect livelihoods
- Continuous ocean warming will affect the Nile delta hence reverse the gains and defeat the logic of continuous negotiations on the use of the Nile waters

Global Efforts

- The adverse impacts of changing weather patterns have resulted in global efforts towards mitigation and adaptation through the United Nations Organization
- World Meteorological Organization, (WMO), the United Nations Environmental Programme (UNEP) and the Inter-Governmental Panel to Climate Change, (IPCC) are notable world organizations.
- Treaties, Conventions and Conference of Parties (COPs) also address extreme weather and climatic conditions.
- Examples include the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.
- The landmark declarations of the COP 2021 (Paris Agreement) in which nations committed to address anthropogenic causes of climate change
- Nations also committed to adaptation and mitigation funding as a step towards this end.
- Regional bodies include the Intergovernmental Authority on Development (IGAD)

Climate Models

- Most models predicting future emission pathways show increasing temperature trends.
- Such trends will impact on the environment including water resources, the hydrological cycle and community livelihoods
- This will in turn cause famine and poverty thereby resulting in large numbers of climate refugees.
- For Africa and specifically the Nile Basin riparian states, all models show that most parts of continent will reach the 1.5 degree limit by 2023.
- Some parts of the region have already seen a temperature increase of 2.5 degrees (IGAD Climate Prediction and Application Center (ICPAC, 2020))
- For rainfall, the models are predicting an upward trend
- This will impact on settlements along the Nile basin through displacements and destruction of infrastructure, crops and livestock
- Floods will also increase or emergence of waterborne diseases

The Nile Basin

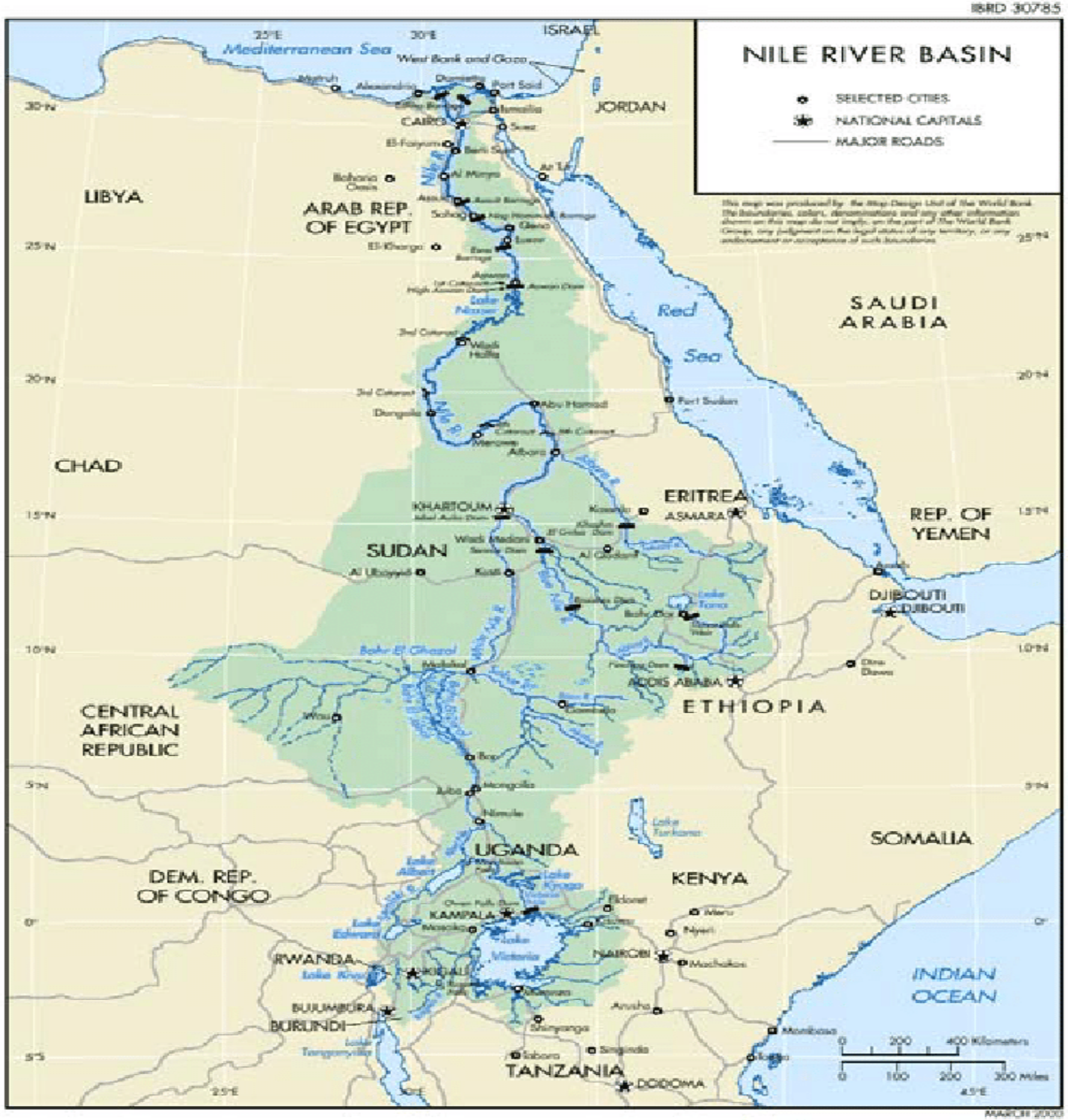
- The Nile Basin which covers over 10% of Africa's landmass in 11 countries including Ethiopia, Sudan, South Sudan, Egypt, Rwanda, Tanzania, Uganda, Burundi, the Democratic Republic of Congo (DRC), Eritrea and Kenya is a development engine across the Nile riparian states.

- A combined population estimated at 257 million, which is 53% of the Nile Basin countries depend in one way or the other on the waters of the Nile.

- The predicted extreme weather and climate scenarios will therefore spell doom in the form of famine, hunger and migration.

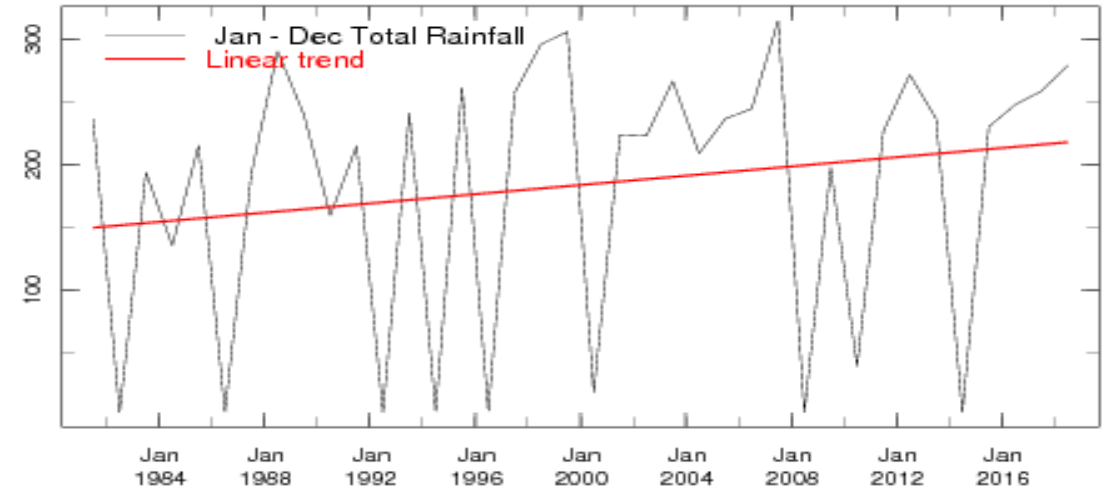
- Extreme weather patterns manifested in the form of floods would push further the poverty levels and cause degradation of water towers feeding River Nile.

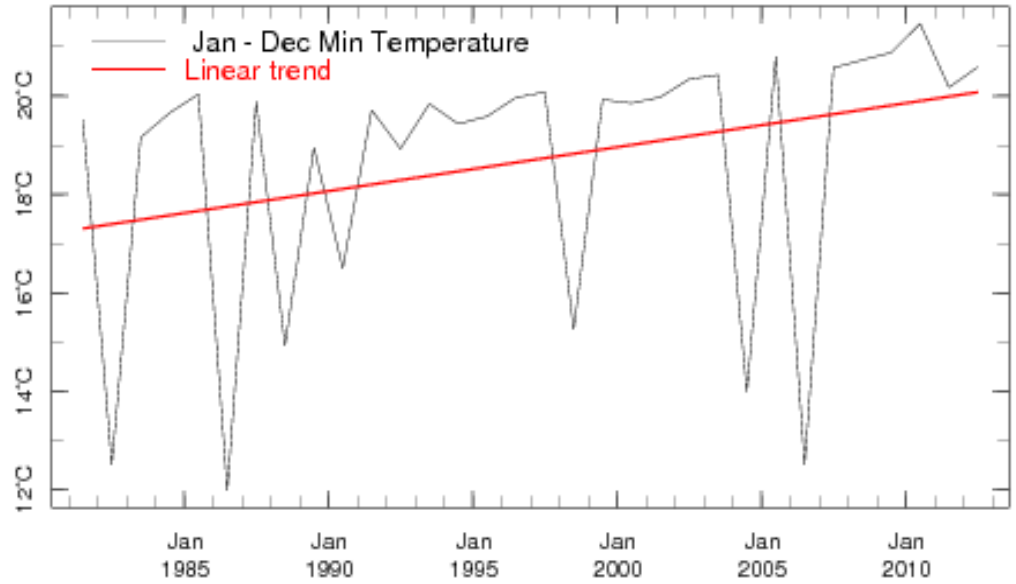
- As negotiations on the sharing of the Nile waters continue, the riparian states should include clauses to ensure that this precious resource will be there tomorrow and that the current efforts will not be in vain.

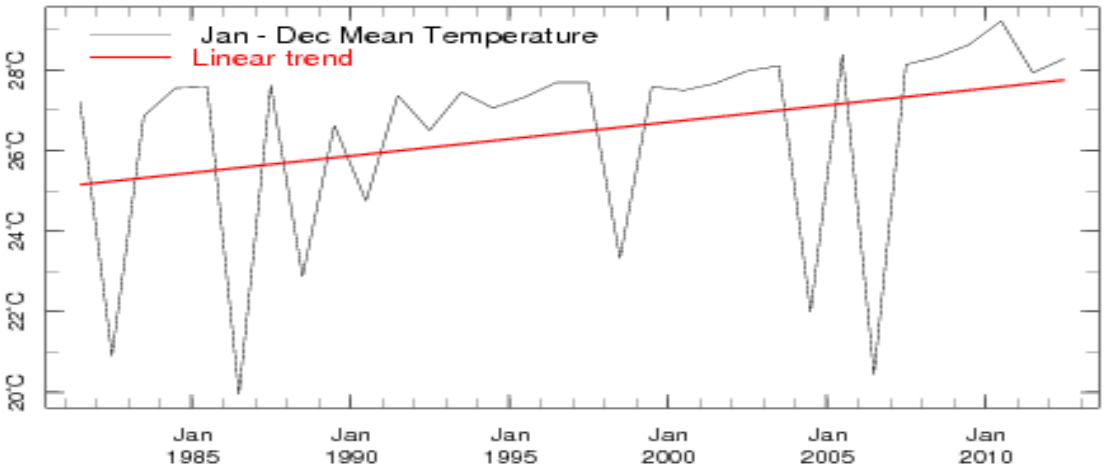


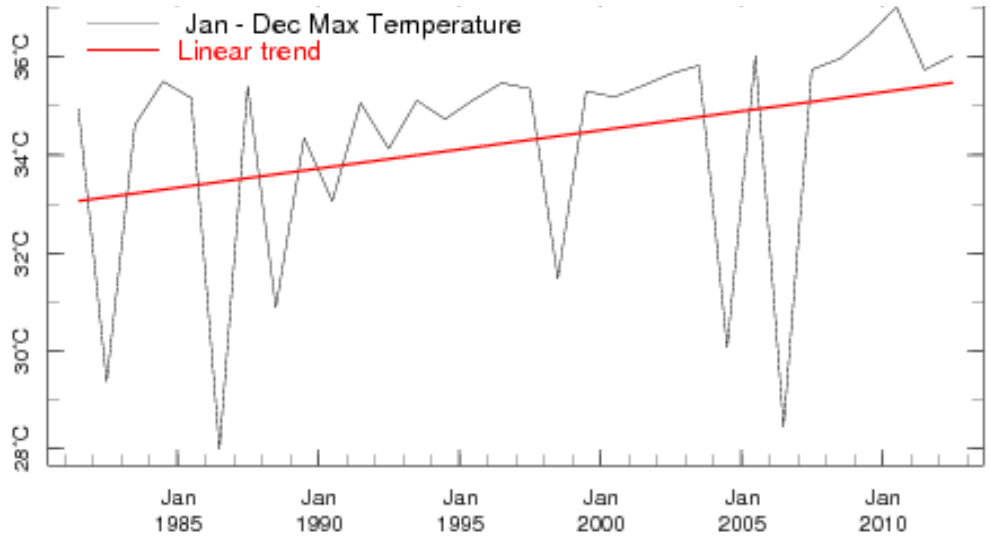
Source: www.nilebasin.org

Observed Trends in Weather Patterns in the Nile B







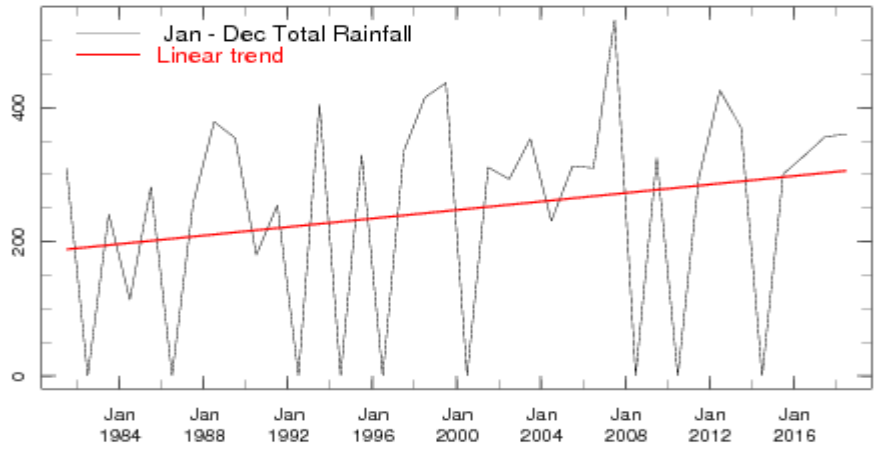


Source: IGAD, ACPA, 2020

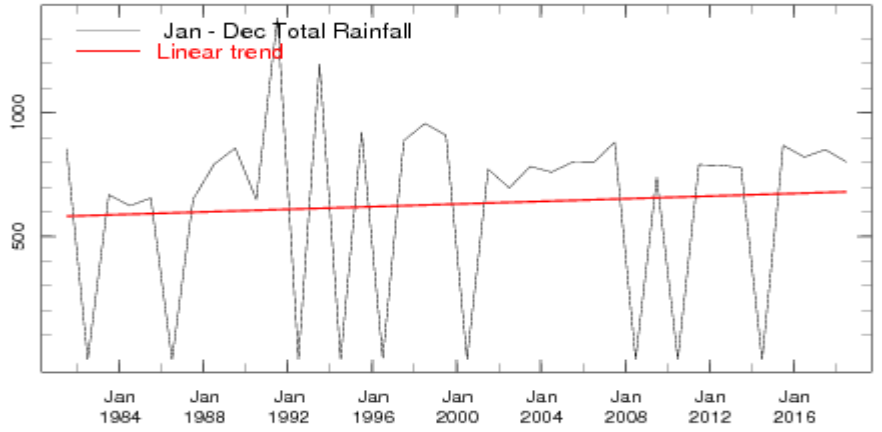
Observation: Ethiopia's Rainfall trend is slightly upward, probability of exceedance is high, there is marked rainfall anomalies showing erratic rainfall patterns that is an indicator of climate and weather variability, temperature trends are upward

Rainfall Patterns for the White and Blue Nile

- ❑ The Blue Nile rises in Ethiopia and provides 85 percent of the overall flow of the River Nile.
- ❑ The white Nile flows north from Kenya's Lake Victoria, Africa's largest lake, and runs through Uganda and into Sudan, where it meets with the Blue Nile at the Sudanese capital Khartoum. The Nile then flows north toward Egypt.
- ❑ Both rivers are therefore the lifeblood of the Nile River and also that of Egypt



White Nile Rainfall Trend



Blue Nile Rainfall Trend

Source: IGAD, ACPA, 2020

Observation: Rainfall trend in the White and Blue Nile is slightly upward, there is marked rainfall anomalies showing erratic rainfall patterns that is an indicator of climate and weather variability

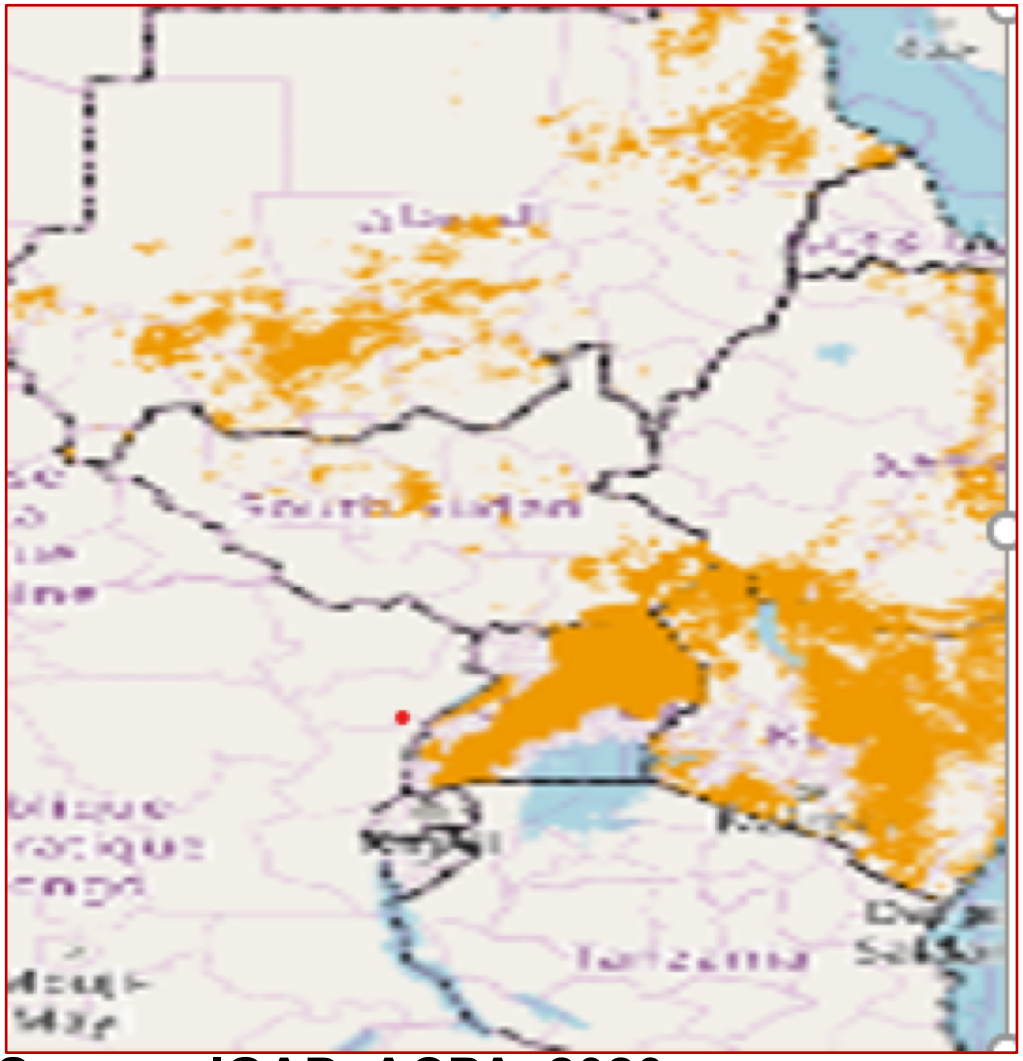
Summary of Observed Trends of Weather Patterns in the Riparian States in the Nile Basin

- The Nile Basin receives annual average rainfall of about 650mm, though regional disparities exist
- Rainfall is slightly on the upward trend except for Kenya which shows a downward trend among the riparian states in the Nile Basin
- Probability of exceedance of rainfall is greater in Ethiopia, Sudan and South, lower in Kenya and Uganda
- Rainfall pattern in both the White and Blue Nile shows greater variability with outliers indicating extreme weather events of drought and floods
- Water scarcity is common due to temporal and spatial variations in rainfall
- Maximum, minimum and mean temperatures are on upward trend in all the selected riparian states in the Nile Basin
- There are marked anomalies in rainfall and temperature trends in all the five selected riparian states in the Nile Basin
- This in line with ICPAC, 2020 predictions for temperature increase of 2.5 degrees for the region

Impacts of Weather Patterns in the Nile Basin

- Increasing rainfall results in increasing frequency of floods and displacement of people depending on existing hydrological structures in each member state
- Floods damage existing structures and wash away crops and livestock and this results in famine, hunger and therefore food insecurity
- Floods and drought cause an increase in the number of pests and diseases that will eventually affect livelihoods and environmental health in general
- Drought has become not only frequent but also prolonged in a greater part of the riparian states and Increasing temperatures are a threat to existing livelihoods

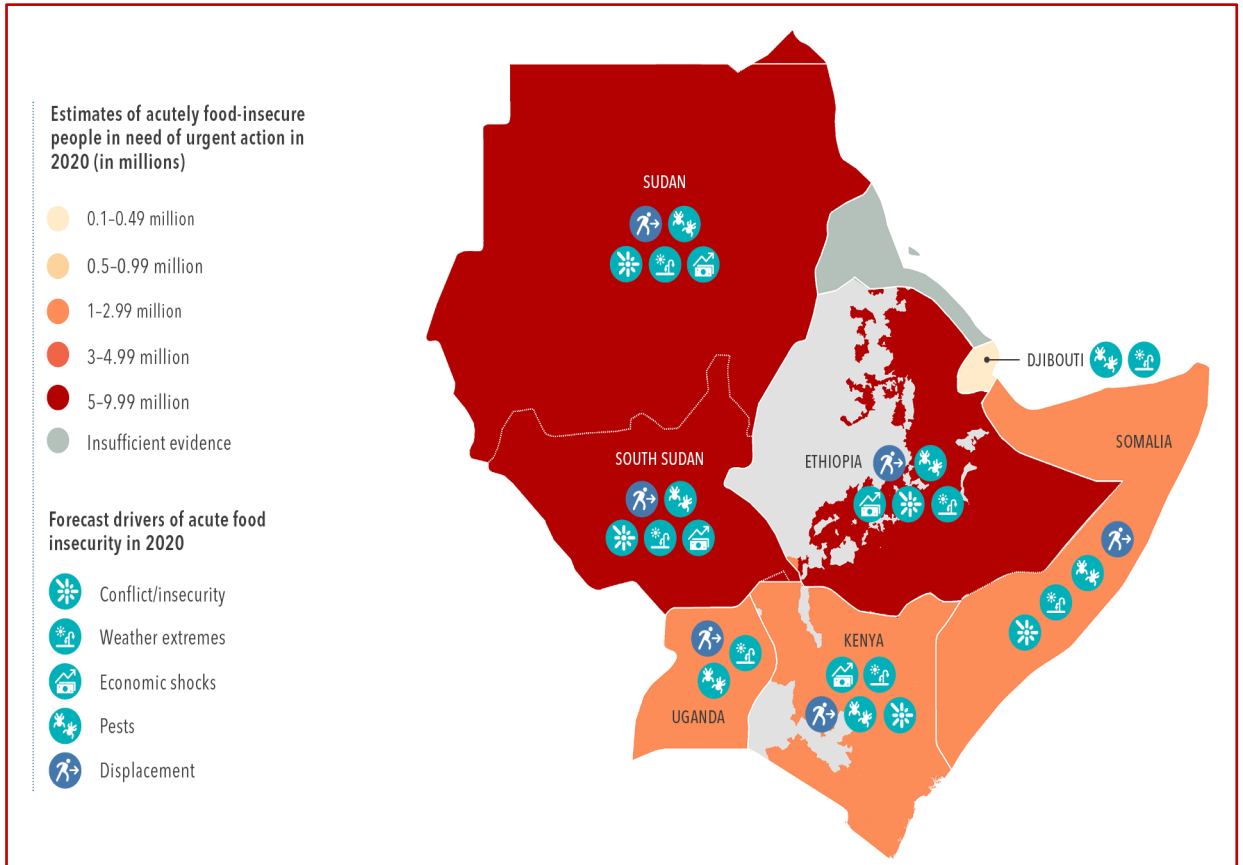
Drought Prone Areas in the Nile Basin Riparian States



Source: IGAD, ACPA, 2020

Estimates of Food Insecurity:

Approximately 24–25.4 million people will face acute food insecurity requiring urgent action in 2020



Source: FSIN GRFC March 2020.
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
This map reflects analyses produced before COVID-19 became a pandemic and does not account for its direct and/or indirect impact on acute food insecurity.

The Future of the Nile Basin Riparian States

Global warming will translate into higher temperatures and very dry and hot years, warming of the region will continue, Ethan and Justin 2020- severe wet and dry years will occur in quick succession

- The hot and dry years have become more common over the past four decades in the Upper Nile basin and that this trend is likely to continue.
- These hot and dry conditions will be similar to those that have resulted in crop failures, food shortages and humanitarian crises in the region over the past decades.
- By the late 21st century, the frequency of these hot and dry years may rise between a factor of 1.5 and 3.
- In the past, hot and dry years occurred about once every 20 years; but this increase in frequency means that in the future a hot and dry year could occur once every six to 10 years, making them a common experience for people in the region.

- In addition to becoming more frequent, they will also become more severe. Temperatures during heat waves in the region could rise between 2°C and 6°C, putting far more stress on people, animals and crops than occurs today.

Efforts by Riparian States

- ❑ Participation in global discussions on climate change mitigation
- ❑ Participating on adaptation discussions
- ❑ Preparation of National Action Plans (NAPA) to prepare for adaptation
- ❑ Preparation of policies on climate change adaptation and mitigation
- ❑ Preparation of National Appropriate Action (NAMA)
- ❑ Examples include:
- ❑ Ethiopia's Climate Resilient Green Economy initiative to sustain low emissions of greenhouse gases, and aims to acquire funding for sustainable and green development through the Clean Development Mechanism.
- ❑ Other Nile riparian states have similar plans have been developed in other Nile countries.

Transboundary-Level Adaptation Measures

- ❑ Preparing for climate change requires taking action at local, national, basin-wide, and global levels.

- ❑ Coordinated interstate transboundary level adaptation to include coordinated reservoir operation, strengthening inter-basin agricultural trade, interconnecting power grids, developing joint mechanisms for soliciting climate-change adaptation funds, operating joint hydro meteorological monitoring programmes, and conducting joint research.

Exploring sustainable strategies and technologies that could be employed to address pertinent issues arising from changing weather patterns in relation to hydrology of the Nile valley:

- Desktop search method was used to mine data on technologies associated with climate and weather variability

These included:

- Technologies for water resources management
- Technologies for climates mart agriculture
- Technologies for soil management
- Technologies for value chain addition for sustainable livelihoods in the era of changing weather patterns

Technologies

The need for appropriate technology in mitigation and adaptation to climate change cannot be understated. The following observation by Dina Zayed; Edited by Edmund Blair and Michael Roddy confirms the need for adoption of climate smart technology for sustainability in the Nile riparian states:

“Agriculture accounts for at least 80 percent of all water consumption in the basin. Experts call for better and more integrated use of water resources, saying many countries have been slow to adopt improved irrigation techniques. The most common method remains flood irrigation, which has been found to be inefficient and wasteful”.

- Sources: Reuters, Nile Basin Initiative, World Bank, United Nations Environmental Program, United Nations Educational, Scientific and Cultural Organization.

Areas where Technology will be required

- ❑ Capacity building on modelling of climate change, weather variability, adaptation and mitigation
- ❑ Creating awareness on climate change
- ❑ Water resources management

- ❑ Environmental conservation and afforestation/reforestation and pasture management for sustainable water resources
- ❑ Construction of small and large water reservoirs to increase water storage capacity.
- ❑ Protection of catchment areas and integrated river basin and flood management minimize impact of floods

- ❑ Primary production systems and especially agricultural production
- ❑ Harnessing of renewable energy resources, green technology and diversification of energy sources to minimize reliable on climate sensitive hydro-power
- ❑ Enhancing food storage capacity
- ❑ Trade and value chain addition

- ❑ Soil moisture conservation and irrigation
- ❑ Mainstreaming climate-change adaptation and mitigation in all national development sectors
- ❑ Increasing research into crop varieties, including disease- and drought-resisting varieties, high-yielding varieties, quick-maturing varieties

What Technologies are Required?

- Geospatial technologies will be significant in climate smart adaptation and mitigation mechanisms and efforts
- The application of GIS (GIS and GPS agriculture/Application of Remote Sensing (Satellite imagery)
- Drone and Aerial Photography/Imagery
- Climate Smart Agricultural Techniques - Precision Farming
- Indigenous knowledge techniques
- Water resources Onsite reuse technologies for water, Green Infrastructure and Big Data
- Farming software and online data.
- Merging datasets.

Case Studies on Application of Technologies

Flood Control: Researchers develop flooding prediction tool by Texas A&M University: Use of Algorithm

Solar-powered water supply and irrigation system, Chanyauru, Tanzania - UNDP

Rainwater harvesting and spring development for quality water, Senyi Landing Site, Uganda - UNDP

Integrated rainwater harvesting and management in pastoral communities, Rift Valley Province, Kenya - UNDP

Recycling of waste water for paddy irrigation farming, Moshi, Tanzania - UNDP

Kenya is home to 25 percent of agritech start-ups in sub-Saharan Africa, and the figure could rise further thanks to the presence of a robust innovation ecosystem.

FarmBiz TVAfrica for Marketing Farm Produce

Technologies for Sustainable Water Use and Management

- ❑ Sprinkler and Drip Irrigation
- ❑ Fog Harvesting
- ❑ Rainwater Harvesting
- ❑ Soil Management
- ❑ Slow-forming Terraces
- ❑ Conservation Tillage
- ❑ Integrated Nutrient Management

Soil Management

- ❑ Slow-forming Terraces
- ❑ Conservation Tillage
- ❑ Integrated Nutrient Management

Source: UNEP, 2011

Sustainable Crop Management

- ❑ Crop Diversification and New Varieties
- ❑ Biotechnology for Climate Change Adaptation of Crops
- ❑ Ecological Pest Management
- ❑ Seed and Grain Storage

Sustainable Livestock Management

- ❑ Livestock Disease Management
- ❑ Selective Breeding via Controlled Mating
- ❑ Sustainable Farming Systems
- ❑ Mixed Farming
- ❑ Agro-forestry

Capacity Building and Stakeholder Organization

- ❑ Community-based Agricultural Extension Agents
- ❑ Farmer Field Schools
- ❑ Forest User Groups
- ❑ Water User Associations

Technology Adoption Will Require Funding

- This will be required to establish climate smart technologies
- The 2015 Paris Agreement agreed on a formula to fund adaptation and mitigation strategies in developing countries
- Negotiations and mechanisms should therefore be put in place to enhance existing strategies and to introduce new sustainable technologies
- UNDP
- Global Environmental Facility
- AUDA-NEPAD
- African Climate Change Fund – African Development Bank
- Global Green Grants Fund
- National and Regional Governments

Challenges

- ❑ Political good will
- ❑ Inter-State Conflicts
- ❑ Difficulty in securing funds
- ❑ Issues related to resistance to change
- ❑ Inadequate research
- ❑ Low technologies

Conclusions

- Technologies are key to future survival of the populations in the Nile Basin Riparian States

- Every effort should be put in place to ensure most up-to-date technologies are adopted in line with experiences from different states.

Recommendations

- Appropriate policies

- Support from the international community
- A prioritized ‘no-regret’ measure is to expand water-storage infrastructure in the Nile region.

- Sourcing for funds

- THANK

- YOU

- ALL