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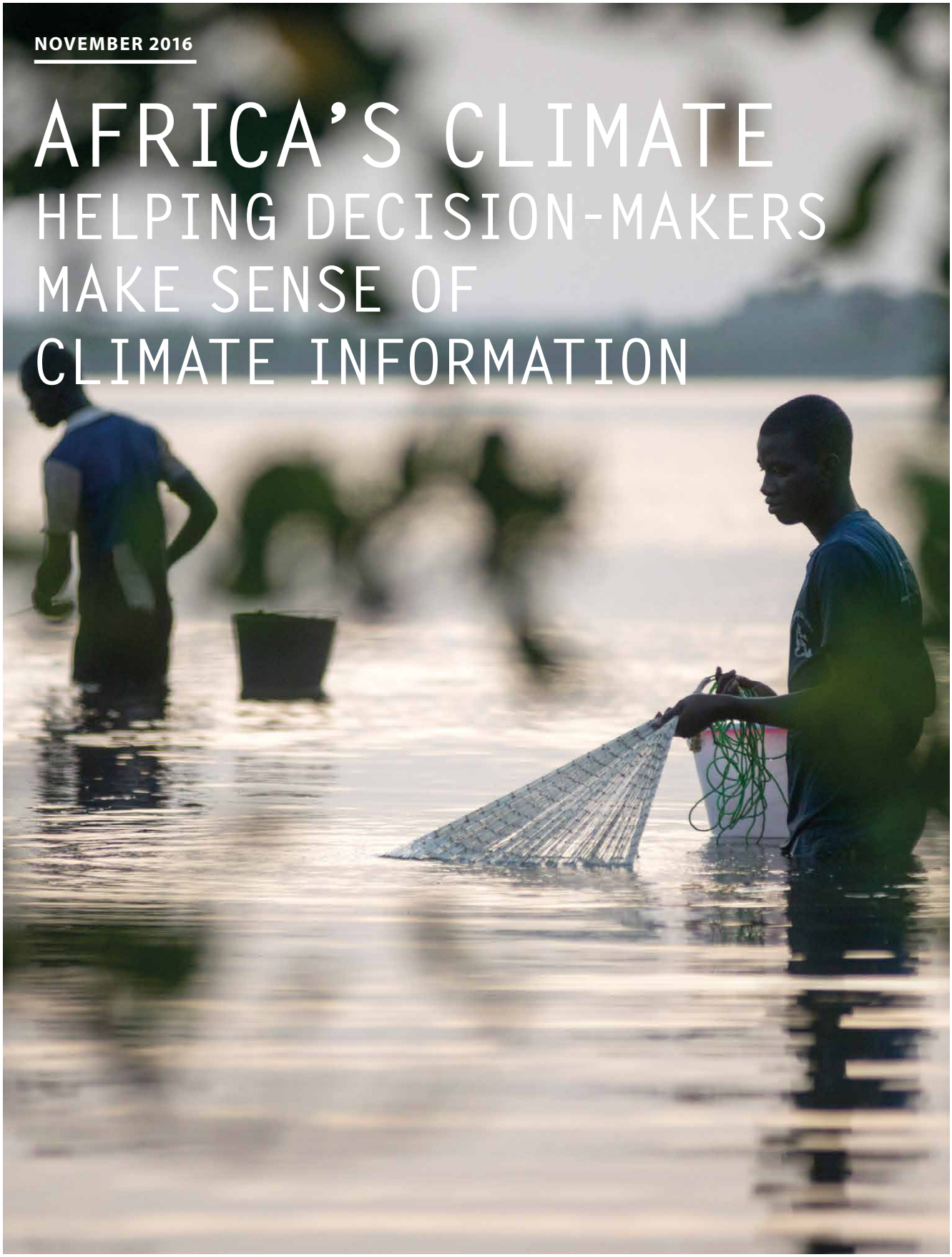
AFRICA'S CLIMATE
HELPING DECISION-MAKERS MAKE SENSE OF CLIMATE INFORMATION



FUTURE CLIMATE FOR AFRICA

GENERAL READERS

UGANDA
COUNTRY FACTSHEET

CURRENT AND PROJECTED FUTURE CLIMATE

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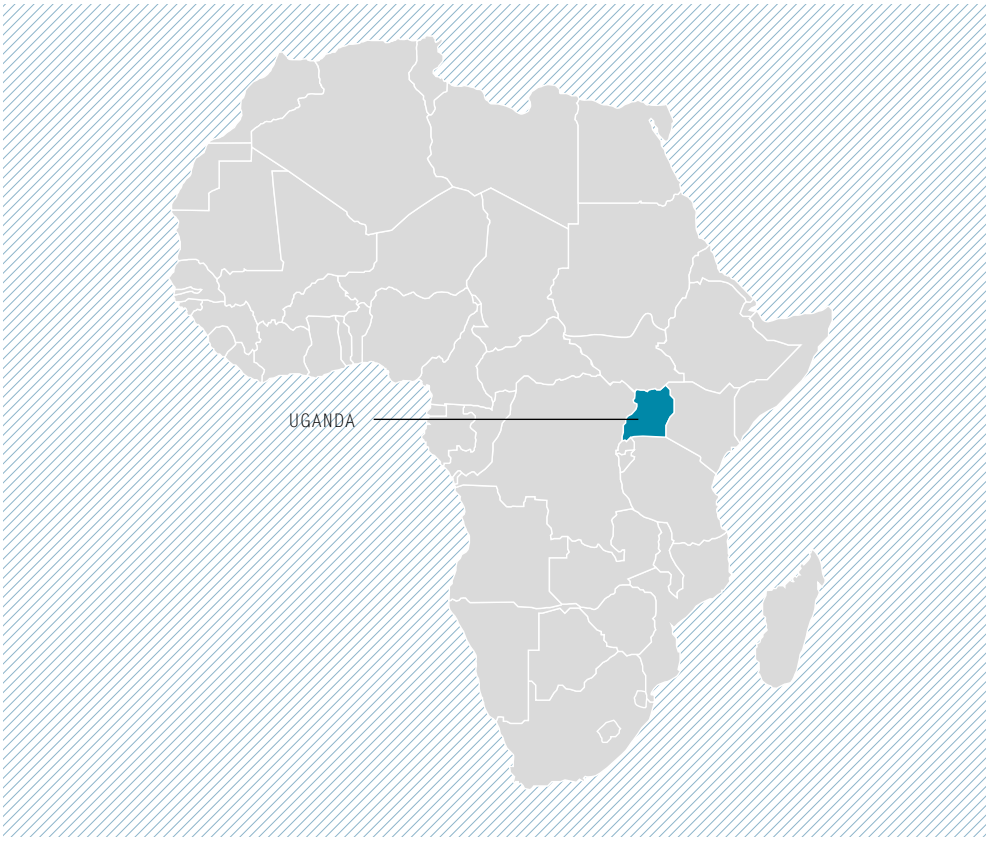
AUTHORS
Nkulumo Zinyengere,
Julio Araujo, John Marsham,
Dave Rowell



NEED TO KNOW

Stakeholders in climate-sensitive sectors in Uganda have varying levels of understanding about climate change and related issues. They therefore need climate information that is produced, packaged, and delivered in a way that meets their various needs, so that they can make decisions on appropriate responses to climate change. This is particularly important when it comes to plans, investments, policies and actions. This factsheet outlines:

- The country's 'natural' climate, and how this appears to be changing.
- How the climate is anticipated to change, outlining the likely increases in temperature, but noting the uncertainty with regards to changes in future rainfall patterns.
- The likely impacts for climate-sensitive sectors, including water, energy, agriculture, fisheries and health.

UGANDA AT A GLANCE

Uganda is a landlocked country located on the east African plateau and lying within the Nile Basin. The country has a unique and wide ranging topography that includes large bodies of water and mountain ranges. Elevation ranges from 620m above sea level in the Nile Valley, to 5,110m at the peak of Mount Rwenzori.

THE CURRENT CLIMATE OF UGANDA

Topography, prevailing winds and lakes cause large differences in rainfall patterns across the country

Uganda lies within a relatively humid equatorial climate zone. Topography, prevailing winds and lakes cause large differences in rainfall patterns across the country (Figure 1). Changes in sea surface temperatures in the distant tropical Pacific, Indian and, to a lesser extent, Atlantic Oceans strongly influence annual rainfall amounts and timing. Rainfall occurs in a significantly varied manner across the country, over two main seasons (March to May, and October to December) in three quarters of the country, and over one season (March to October) towards the north and north-east.

The south-western and north-eastern parts of the country are generally drier. Annual mean rainfall ranges from 400 to 2200mm and averages 1,180mm per year. Annual mean temperature ranges between 16°C and 31°C, with mean daily temperature averages of 28°C. Temperature can be below 0°C in the mountain ranges.[1]

HISTORIC TRENDS IN UGANDA'S CLIMATE

Historic trends show that the climate is changing in Uganda. Average annual temperatures increased noticeably by 1.3°C between 1960 and 2010, with the largest increase occurring

1 Ministry of Water and Environment, 2014. Uganda Second National Communication to the United Nations Framework Convention on Climate Change.

during January and February. The frequency of hot days[2] in the country increased significantly (by 20%) between 1960 and 2003, while the frequency of cold days decreased across all months, except December, January and February.[3]

There do not appear to be any clear changes in annual rainfall trends across the whole country over the past 60 years. A modest decline has however been detected in some northern districts e.g. Gulu, Kitgum, and Kotido.[4] A significant decreasing trend, at the rate of 6mm per month per decade, occurred during March to May.[5,6] Trends in extreme rainfall conditions are mixed, and complicated by a lack of data. There is, however, a significant discernible trend in the changes in heavy rainfall events.[7] Droughts are on the rise in Uganda. The western, northern and north-eastern regions have, over the past 20 years, been experiencing more frequent and longer-lasting droughts than have been seen historically. For example, between 1991 and 2000, there were seven meteorological droughts in the Karamoja region. Droughts also occurred in 2001, 2002, 2005, 2008 and 2011.[8,9]

FUTURE PROJECTIONS OF CLIMATE CHANGE FOR UGANDA

Temperature: a clear signal for increase

Some projections suggest an increase of up to 1.5°C as early as 2030

The evolution of future climates in Uganda will depend on the global growth path, i.e. whether the world follows a high or low emissions pathway. The warming trend is projected to continue in Uganda, with some projections suggesting an increase of up to 1.5°C as early as 2030. Similarly, temperatures could rise between 0.9°C and 3.3°C by the 2060s (Table 1).

Rainfall: much less certainty

Predicting regional rainfall changes in the tropics is a major challenge for climate scientists, and rainfall projections are therefore more uncertain. On average, the projections for Uganda show a slight increase in mean rainfall. However, some models project an increase (of as much as 43%), and others a decrease (16%, according to one model), and therefore there is no robust indication of direction and magnitude of change in rainfall by the 2060s (see Table 1).

There is significant variability across months (some months indicate increases in rainfall, and others indicate decreases). However, rainfall is consistently projected to increase in December, January and February, a commonly dry season across the country. Most of the increase in rainfall is projected for the western shores of Lake Victoria and the Mount Elgon region in the central west, and to the zone extending from Mount Rwenzori to the southern parts of Lake Kioga.[10] However, such projections should not simply be taken at face value as

2 The daily maximum temperature (TX) which is exceeded on the 10% warmest of days in the standard climate period (1970–99).

3 McSweeney, C., M. New, and G. Lizcano, 2010. UNDP Country Climate Profiles: Uganda. UNDP. Available from: http://countryprofiles.geog.ox.ac.uk/UNDP_reports/Uganda/Uganda.hires.report.pdf

4 Netherlands Commission for Environmental Assessment, 2015.

5 McSweeney et al., 2010.

6 USAID, 2015. Climate Change Information Fact Sheet: UGANDA. USAID, Washington D.C.

7 McSweeney et al., 2010.

8 Ministry of Water and Environment, 2007.

9 UNDP, 2013. Climate Risk Management for Sustainable Crop Production in Uganda: Rakai and Kapchorwa Districts. United Nations Development Programme (UNDP), Bureau for Crisis Prevention and Recovery (BCPR). New York.

10 Ministry of Water and Environment, 2014. Uganda Second National Communication to the United Nations Framework Convention on Climate Change.

predicting regional changes in rainfall is very challenging and models may not incorporate all relevant natural forces shaping the climate here.

Extreme events

Extreme events (floods, droughts, heatwaves, and so on) are expected to change and in most cases increase into the future. Annually, the 'hot' days are projected to occur in 15% to 43% of the days by 2060s. Although projections are uncertain, there are suggestions from some models of a 14% increase in heavy rain events by the 2060s (Table 1). Owing to increasing heavy rain events, runoff is projected to increase; the Upper Nile Basin region of Uganda could possibly see an increase in runoff as early as the 2030s.[11, 12]

Table 1: Future climate change projections for Uganda (2060s), across the different seasons.[13] The light blue blocks indicate increases, the dark blue indicate decreases. Min, Med and Max represent the minimum, median, and maximum values of the data range.

		Annual			January to February			March to May			June to September			October to December		
		Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max	Min	Med	Max
Temperature (°C)	High	1.9	2.5	3.1	1.5	2.3	3.3	1.8	2.5	2.9	2.0	2.6	3.2	1.8	2.2	3.1
	low	1.0	1.8	2.2	1.0	1.5	2.3	1.1	1.7	2.2	0.9	1.9	2.4	0.9	1.6	2.1
Hot days % Frequency	High	19	29	43	23	32	62	19	35	50	31	45	58	17	29	52
	low	16	22	30	17	29	32	15	27	34	20	33	43	16	23	38
Rainfall (%)	High	-2	6	21	-16	5	42	-10	7	19	-8	0	43	-4	7	21
	low	-5	4	13	-12	4	34	-9	3	21	-12	1	21	-8	5	11
Heavy rain events (%)	High	1	4	8	-6	4	12	0	3	8	-1	2	14	0	5	9
	low	0	3	5	-1	2	9	0	3	6	-5	1	8	0	2	6

11 Niang, I., O. C. Ruppel, M.A. Abdrabo, A. Essel, C. Lennard, J. Padgham, and P. Urquhart, 2014. Africa. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working GroupII to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Barros, V. R., C. B. Field,D. J. Dokken, M.D. Mastrandrea, K. J. Mach, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma.

12 USAID, 2015. Climate Change Information Fact Sheet: UGANDA. USAID, Washington D.C.

13 McSweeney, C., M. New, and G. Lizcano, 2010. UNDP Country Climate Profiles: Uganda. UNDP. Available from: http://countryprofiles.geog.ox.ac.uk/UNDP_reports/Uganda/Uganda.hires.report.pdf

IMPACTS OF CLIMATE CHANGE IN UGANDA

Climate is a strong determinant of the state and sustainability of natural resources from which the basis of socio-economic development in Uganda is formed. Vital sectors where natural resources are strongly linked include agriculture, fisheries, water, and energy. Other sectors, such as health, are significantly climate-sensitive despite not being linked to natural resources. Table 2 shows the impacts and mechanisms by which climate change will affect these sectors.

Table 2: Impacts of climate change on various sectors in Uganda

Sector	Projected Impact	Mechanism
Water	Flooding	Increased intense rainfall events and possibly higher rainfall will increase risk of flooding, loss of life, property and infrastructure
	Water scarcity	Higher temperatures, with more variability in rainfall may lead to drought stress, higher demands for water, conflict, and biodiversity loss
Agriculture	Change in crop yields	More intense rainfall, soil erosion, high temperatures, and droughts could cause loss in yields; changes in average rainfall may increase or decrease yields
	Livestock changes	Increased droughts could cause losses in livestock; increased rainfall could expand areas suitable for livestock
	Fisheries	High temperatures and changes in water levels can cause reduced spawning
Health	Water borne diseases	Diseases such as diarrhea and cholera are likely to increase with increased rainfall intensity and flooding, largely affecting areas with poor sanitation
	Malnutrition	Reduced food options from low rainfall, high temperatures, and extreme events associated food crop losses will result in malnutrition and famine
	Malaria	Higher temperatures may result in an extension of malaria into higher altitude regions
Energy	Biomass loss	Increased temperatures will increase the risk of forest fires; reduced livelihood options will exert more pressure on forest products
	Hydro capacity	Reduced rainfall would lead to changes in lake levels and river flows

WATER

Conservative estimates suggest that the cost of unmet water demand by 2050 could be in the magnitude of $5.5 billion, with the largest losses expected in the Lake Victoria, Albert Nile, and Lake Kyoga watersheds. In the past, annual economic losses from droughts have

been up to $237 million.[14] Similarly, future droughts will likely have significant negative effects on water supply in Uganda.

ENERGY

The majority of energy supply in Uganda comes from traditional biomass sources. It is expected that climate change will have negative impacts on biomass, estimated at a reduction of up to 10% in wood biomass between 2020 and 2050, thereby placing additional stress on traditional energy sources. A huge deficit between energy supply and demand is expected by the 2050s. Additional energy sources, such as liquified petroleum gas (LPG) will need to be explored, and these may require additional capital investments of $5 to $11 billion to meet demand.[15] Hydropower contributes the largest source of installed electricity capacity (84%), and could be affected by declining lake levels and river flows.

AGRICULTURE

Agriculture in Uganda employed about 66% of the working population in 2009/10, and contributed about 22% to total GDP in 2012

Agriculture in Uganda employed about 66% of the working population in 2009/10, and contributed about 22% to total GDP in 2012.[16] Climate change will have significant effects on this sector. It could see a reduction in the national production of food crops such as cassava, maize, millet and groundnuts by 2050.

Overall losses of food crops by the 2050s could reach up to US$1.5 billion. Major export crops like coffee and tea could also see a reduction in yields leading to combined economic losses of about US$1.4 billion in the 2050s.[17] Fishing provides a source of livelihood for up to 1.2 million people, and employs about 8% of the total labour force.[18] Climate change is likely to stress fisheries, resulting in disrupted livelihoods and significant economic losses.

HEALTH

Uganda is prone to climate-sensitive diseases such as malaria, cholera, and dysentery. Malaria continues to be the most fatal disease, and accounts for up to 50% of outpatient visits. Future climate change could cause the incidence of malaria to rise in high altitude areas where prevalence is presently lower.[19, 20, 21] Extreme weather events have historically had significant

14 Taylor T., A. Markandya, P. Droogers, and A. Rugumayo, 2014. Economic Assessment of the Impacts of Climate Change in Uganda Data Water Sector Report. Water Sector Report. CDKN.

15 Markandya, C. Cabot-Venton, and O. Beucher, 2015. Economic assessment of the impacts of climate change in Uganda: Key results. Climate Change Department, Ministry of Water and Environment, Uganda.

16 Uganda Bureau of Statistics, 2013.

17 Markandya, A. et al., 2015.

18 Uganda Bureau of Statistics Statistics , 2013. Statistical Abstract. Uganda Bureau of Statistics. Kampala.

19 Ministry of Water and Environment, 2010. Climate Change: A current and future threat to the socio–economic development of Uganda. Policy Brief No.1/2010. Climate Change Unit.

20 Ministry of Water and Environment, 2014. Uganda Second National Communication to the United Nations Framework Convention on Climate Change.

21 M. J. Bouma, and M. Pascual, 2011. Epidemic malaria and warmer temperatures in recent decades in an east African highland. Proceedings of the Royal Society B: Biological Sciences, 278(1712), 1661–1669.

effects on the health sector, through injuries, deaths, food insecurities, and malnutrition. Increases in such extreme events will therefore increase the burden on the health sector.

CLIMATE INFORMATION USE

Stakeholders in climate sensitive sectors have varying levels of understanding about climate change and related information. Yet, they need to make decisions on appropriate responses (actions, plans, investments, polices, and so on) to climate change. As such, there is a need to ensure that climate information is produced, packaged and delivered to meet the varying needs of stakeholders in climate sensitive sectors in Uganda. This is especially true for the water, energy, agriculture, fisheries, and health sectors.

There are barriers to the use of climate information in Uganda. These include a lack of technologies and the capacity to utilise them appropriately, lack of weather and climate monitoring infrastructure, limited technical capacities in climate modelling and forecasting, inconsistent messaging from various organisations in the climate and development space, and a lack of data, amongst others. As such, Uganda's 'national adaptation programmes of action' (NAPA) identifies the need to develop systems for climate change-related information to inform practice and decision-making processes in the country as a vital component of the country's climate change response.[22]

Efforts have already been underway to improve information use in various sectors. The Climate Change Adaptation and ICT (CHAI) project, for example, improved climate information delivery and use through the use of information and communication technologies (ICT), such as mobile phones, to provide adaptation information to users in the agricultural sector here.

The ICT-based system used information from 46 local market outlets, daily weather data from 22 weather stations in target districts, interactive radio, mobile phones, and community meetings for information dissemination. The system provided localised seasonal weather forecasts and agricultural information, weekly livestock and crop market information, guidance on low cost rainwater harvesting techniques, and timely information on drought and flood coping mechanisms. This information reached over 100,000 people in three languages and three districts, enabling farmers to take appropriate response actions.[23]

22 Ministry of Water and Environment, 2007. Climate Change: Uganda National Adaptation Programme of Actions, Department of Meteorology, Government of Uganda.

23 Gebru B., and E. Mworozi, 2015. Improved access to climate information reduces crop loss and damage in Uganda. IDRC, Canada.

FCFA'S HYCRISTAL PROJECT

Project objectives

Availability of water is fundamental for development in east Africa. However, this vital resource is already under stress from land degradation, pollution and overfishing. Climate change adds to these problems, greatly increasing the vulnerability of the poorest people in the region.

Climate projections show a warming trend in east Africa in the decades ahead, but changes in rainfall and weather extremes are currently uncertain. HyCRISTAL will tackle current uncertainties which exist around climate change projections for the region, concentrating in particular on what they mean for the availability and management of water.

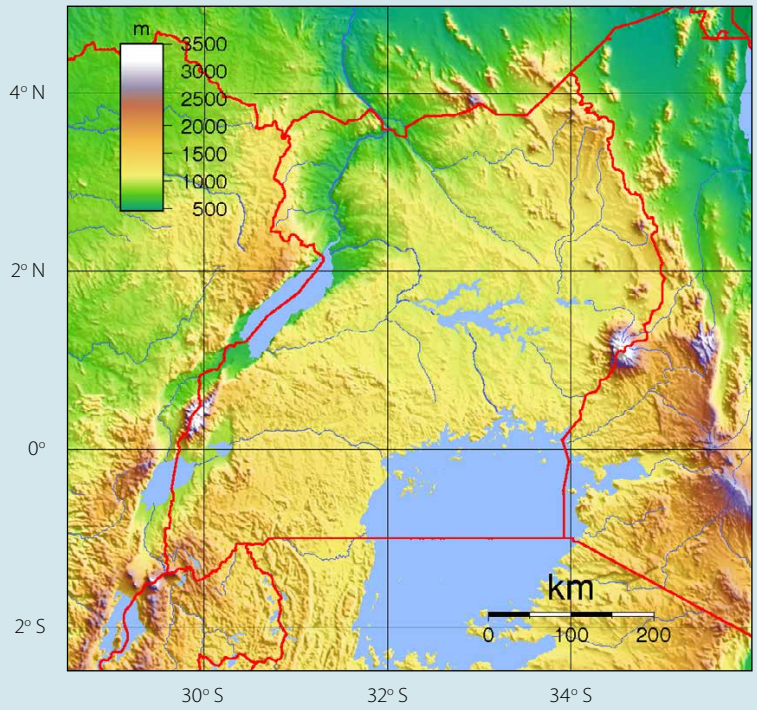
HyCRISTAL will develop new understanding of climate change and its impacts in east Africa, working with the region's decision-makers to manage water for a more climate-resilient future. See www.futureclimateafrica.org/project/hycristal/

The institutions involved in HyCRISTAL are:

- University of Leeds
- African Centre for Technology Studies
- British Geological Survey
- Centre for Ecology and Hydrology (UK)
- Evidence for Development
- Jomo Kenyatta University
- Loughborough University
- Met Office (UK)
- National Centre for Atmospheric Science (UK)
- National Fisheries Resources Research Institute (Uganda)
- North Carolina State University
- Practical Action
- Stony Brook University
- Tanzanian Meteorological Agency
- Ugandan National Meteorological Authority
- Ugandan Ministry of Water Resources
- University of Connecticut
- Makerere University
- Maseno University
- Walker Institute
- University of Reading (Africa Climate Exchange)

FIGURES

Figure 1[24]
Topography of Uganda



24 https://commons.wikimedia.org/wiki/File:Uganda_Topography.png

CONTACT US

Future Climate for Africa
Jean-Pierre Roux, Manager
CDKN Africa / SouthSouthNorth
55 Salt River Road
Salt River
Cape Town 7925
South Africa
+27 21 447 0211
Email: info@futureclimateafrica.org

@future_climate
www.futureclimateafrica.org

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