# South Sudan and climate change trends – Looking to 2050

## Better Aid Forum Briefing Paper

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# Introduction – what are climate change scenarios?

The Conflict Sensitivity Resource Facility's (CSRF) **Better Aid Forum** (BAF) is a series of events and discussions with different stakeholders to consider the long-term objectives and ambitions of the aid sector in South Sudan. It focuses beyond the timeframes of ongoing political and security dynamics in order to drive collective analysis about the approaches and principles that should underpin international engagement in South Sudan over the longer term.

In June 2019, a two-day event, the **Better Aid Forum Experts Meeting**, was held in Nairobi to reflect on findings from the Better Aid Forum process thus far, and debate how long-term trends may shape South Sudan's context over the coming decades – and what this means for aid. The CSRF commissioned a number of input briefing papers that consider long-term trends underway in South Sudan, regionally, and globally that are likely to play a role in shaping South Sudan's future. This BAF briefing paper on climate change is the third publication of the BAF briefing paper series that also considers technology and innovation, economy, and demographics.



The author is Philip Omondi, a Kenya-based climate information expert with ICPAC who has written extensively on the impact of climate change on East Africa. The views expressed in this paper are entirely those of CSRF and do not necessarily represent the views of Saferworld, swisspeace or our donors.

The effects of climate change are expected to be greatest in the Horn of Africa countries, particularly those, such as South Sudan, whose populations are reliant on rain-fed agricultural production to meet their food and income needs. As one of the least developed countries in the world, South Sudan's population is dependent on climate sensitive natural resources for their livelihoods, making the country particularly vulnerable to the effects of climate change. South Sudan's future economy will be significantly influenced by climate change and the potential for socio-economic losses and damages due to climate change is one of the largest unknowns in the country's future.

Climate change scenarios are projections used to assess future vulnerability to climate change as a consequence of greenhouse gas (GHG) emissions. These scenarios should be thought of as stories of possible futures, rather than predictions of what 'will happen'.

Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels but is projected to reach 1.5° between 2030 and 2052 if mean surface temperatures continue to increase at the current rate (IPCC 2018). Climate-related risks for natural and human systems are higher for global warming of 1.5°C than at present. These risks depend on the magnitude and rate of warming, geographic location, levels of development and vulnerability, and on the choices and implementation of adaptation and mitigation options.

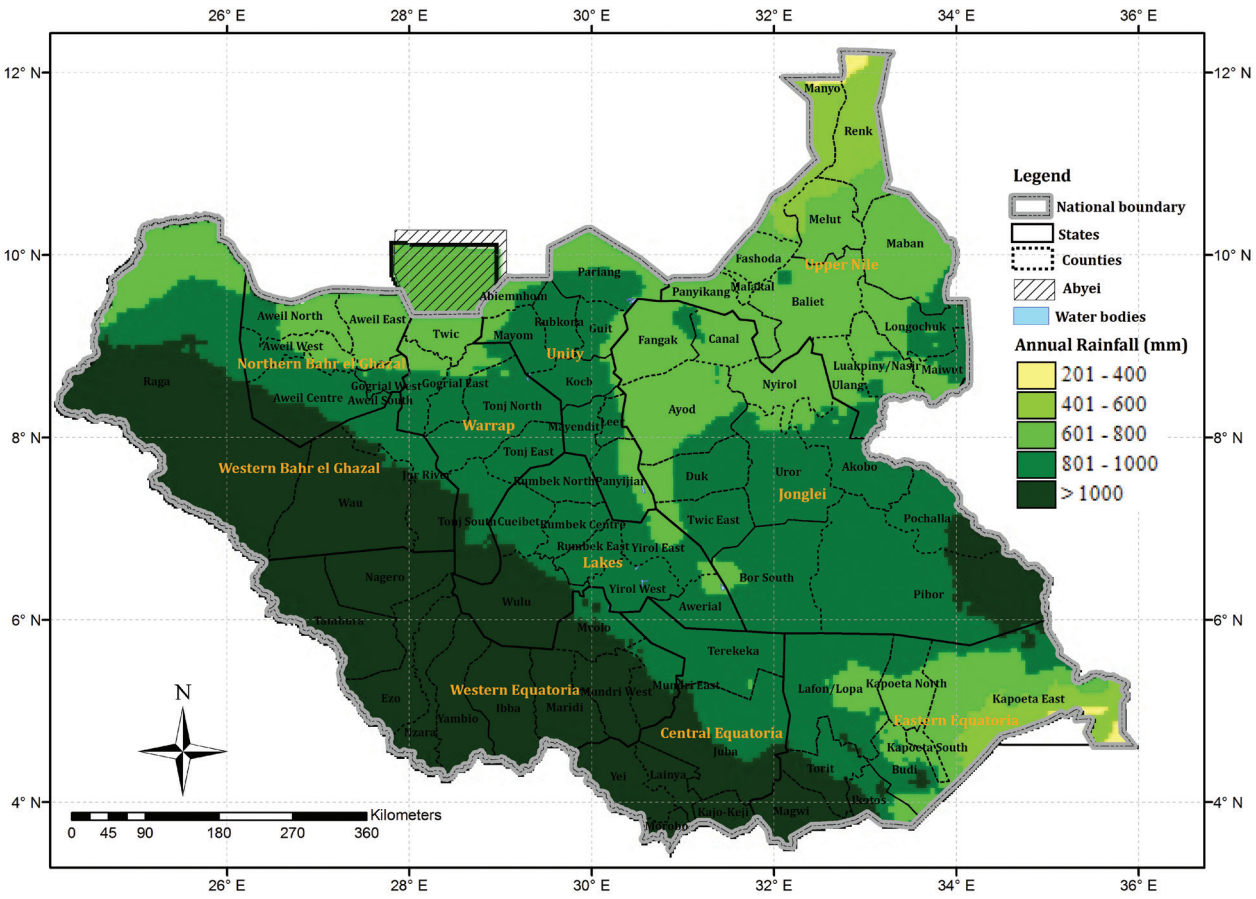
Future climate-related risks depend on the rate, peak and duration of warming. Some impacts may be long-lasting or irreversible, such as the loss of ecosystems, while others may be short term, such as flooding or fires. Climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth are projected to increase with global warming of 1.5°C and increase further if the increase is 2°C above pre-industrial levels.

It is therefore important to use models to understand likely future scenarios for South Sudan. The only way to reduce South Sudan's future climate-related risks would be by upscaling and accelerating far-reaching, multilevel and cross-sectoral climate mitigation steps and by both incremental and transformational adaptation.

# Current climate context and trends

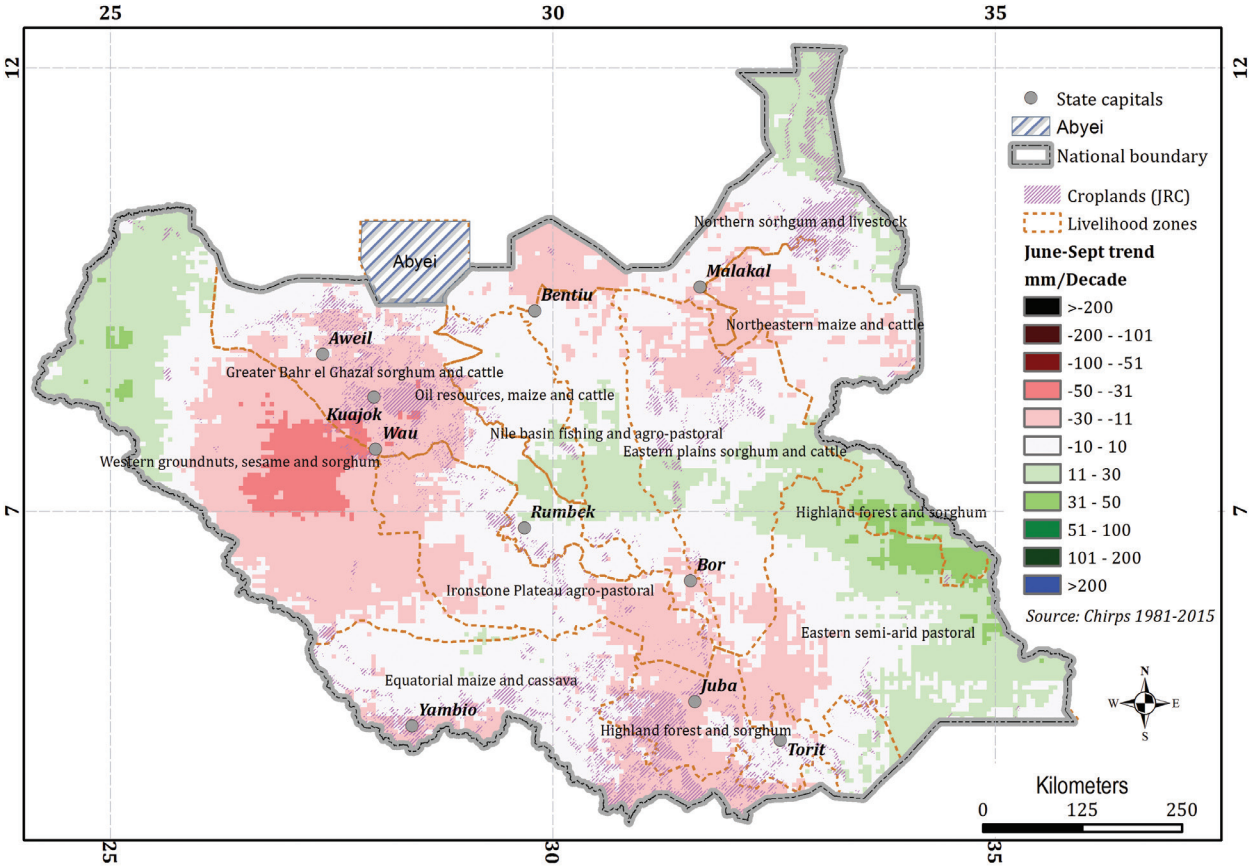
South Sudan has one rainy season (April to October) and one dry season. The tropical rain forest in the Equatorias, has large amounts of rainfall with high humidity followed by a drier season in a year. On average, the rainy season starts in the southern part in March and lasts to November while in the northern parts it lasts from May to October. Rainfall decreases with an increase in latitude i.e. southern parts receive more rainfall (700–1000 mm) than the northern parts (300–700 mm) in a year (**Figure 1**).

**Figure 1: April to October – Mean annual rainfall for South Sudan** (Source: ICPAC-WFP Atlas 2018)



The semi-arid areas in the extreme northern parts are much drier and have two seasons, the dry cold season starting from end of November to February, and the dry hot season starting from March to October. Seasonal rainfall trends are highly variable across the country. Recent rainfall data (1981–2015) show increasing trends particularly in the northern parts of the country and declining rainfall in the western and southern parts of the country (**Figure 2**). In addition, analyses suggest that there has been a shift in the start and cessation of rainfall, leading to more erratic and unpredictable rainfall patterns.

**Figure 2: June–September – Rainfall trend for the period 1981–2015 period** (Source: ICPAC-WFP Atlas 2018)



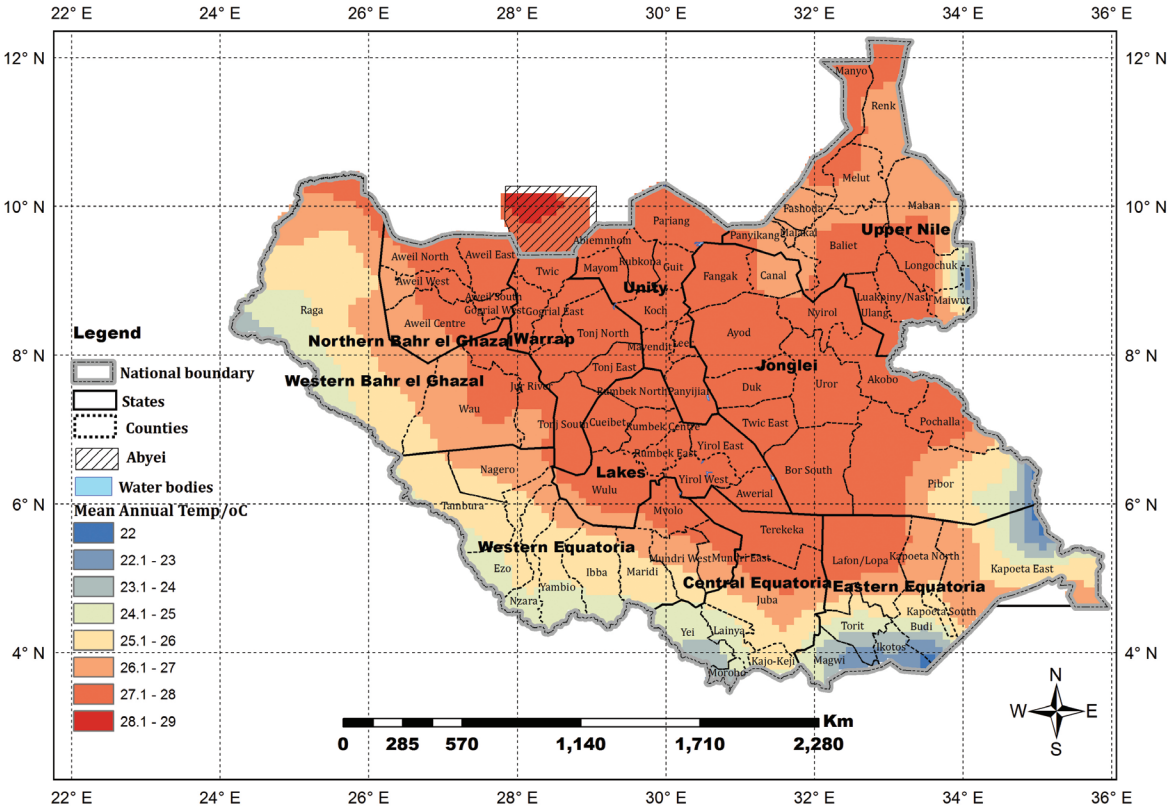

Decreasing rainfall trend in an arc – from the Ethiopian border, along the Sudan/South Sudan border and down along the DRC/Uganda border in the south – is significant, as it encompassed much of South Sudan's productive agricultural and livestock areas.

Combined with observed increases in temperature, this trend can significantly reduce water availability for agriculture and therefore reduce the suitability of certain areas for crop production. The southwestern parts of South Sudan is the grain basked of the country.

There is also evidence of frequent increasingly high rainfall leading to flooding in some agriculturally productive areas in the country. Some traditionally dry areas are getting drier noticeably in the south-eastern and northern semi-arid areas.

Mean annual temperatures vary between 26°C and 32°C across the country (**Figure 3**). Analysis shows steady increasing mean surface temperature over the country.

**Figure 3: Mean annual surface temperature for South Sudan (1971–2000)** (Source: ICPAC-WFP Atlas 2018)




# 'Peering' into the future: climate change in South Sudan by 2050

Using the 25-member regional climate model ensemble from the Coordinated Regional Downscaling Experiment (CORDEX), and comparing to the control period of 1971–2000, projected mean annual precipitation shows similar spatial pattern but varying in magnitude across the country (**Figure 4**). A Representative Concentration Pathway (RCP) is a greenhouse gas concentration trajectory adopted by the IPCC. The pathways describe different climate futures, all of which are considered possible depending on the volume of greenhouse gases (GHG) emitted in the years to come. The RCPs try to capture future trends. They make predictions of how concentrations of greenhouse gases in the atmosphere will change in future as a result of human activities. The four RCPs range from very high (RCP8.5) through to very low (RCP2.6) future concentrations. The numerical values of the RCPs (2.6, 4.5, 6.0 and 8.5) refer to the concentrations in 2100. The projection shows steady drying signal over much of the South Sudan by 2050 with minimal change over western segment for most of the models (> 80%) agreeing on the sign of the precipitation change. The projected change in near surface temperature shows an increase ranging between 1.5°C and 3.0°C relative to the control period (1971–2000), with the lowest increase being projected along the southern parts of South Sudan (**Figure 5**) under all the RCPs scenarios.

Over most parts of the Greater Horn of Africa the mean surface temperature is projected to increase by more than 1.5°C (Indris et al., 2018). For South Sudan, the mean surface temperature is projected to increase by up to 3°C by 2050. The fifth assessment report (AR5) of the Inter-governmental Panel on Climate Change (IPCC) indicated that that global warming will not be uniform across different regions. Global mean temperature increases at 1.5°C and 2°C will be particularly critical in some of the climate change hotspots (IPCC 2014).

**Figure 4: Projected 2050 annual and seasonal changes in rainfall relative to 1971–2000 control period (CTL) based on the ensemble mean of 25 CORDEX under RCPs 26, 45 and 85 simulations over South Sudan**

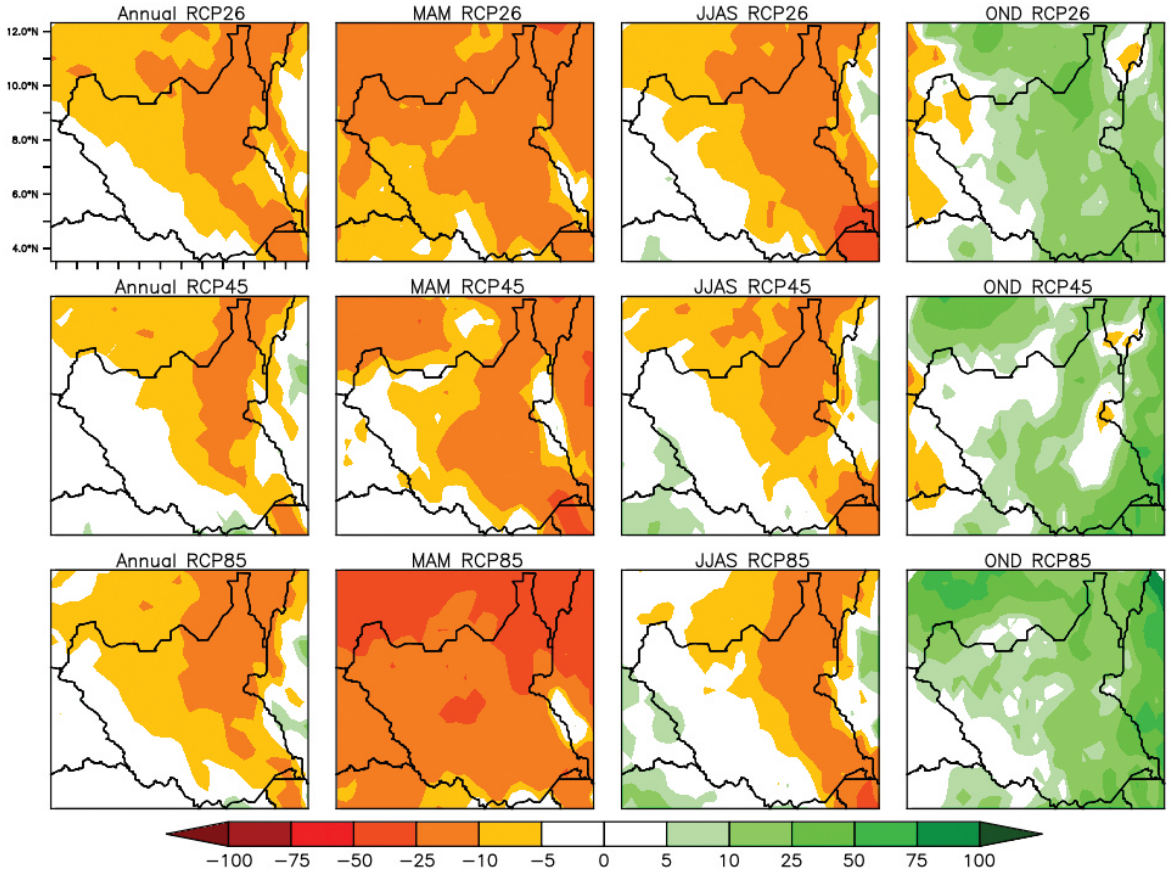
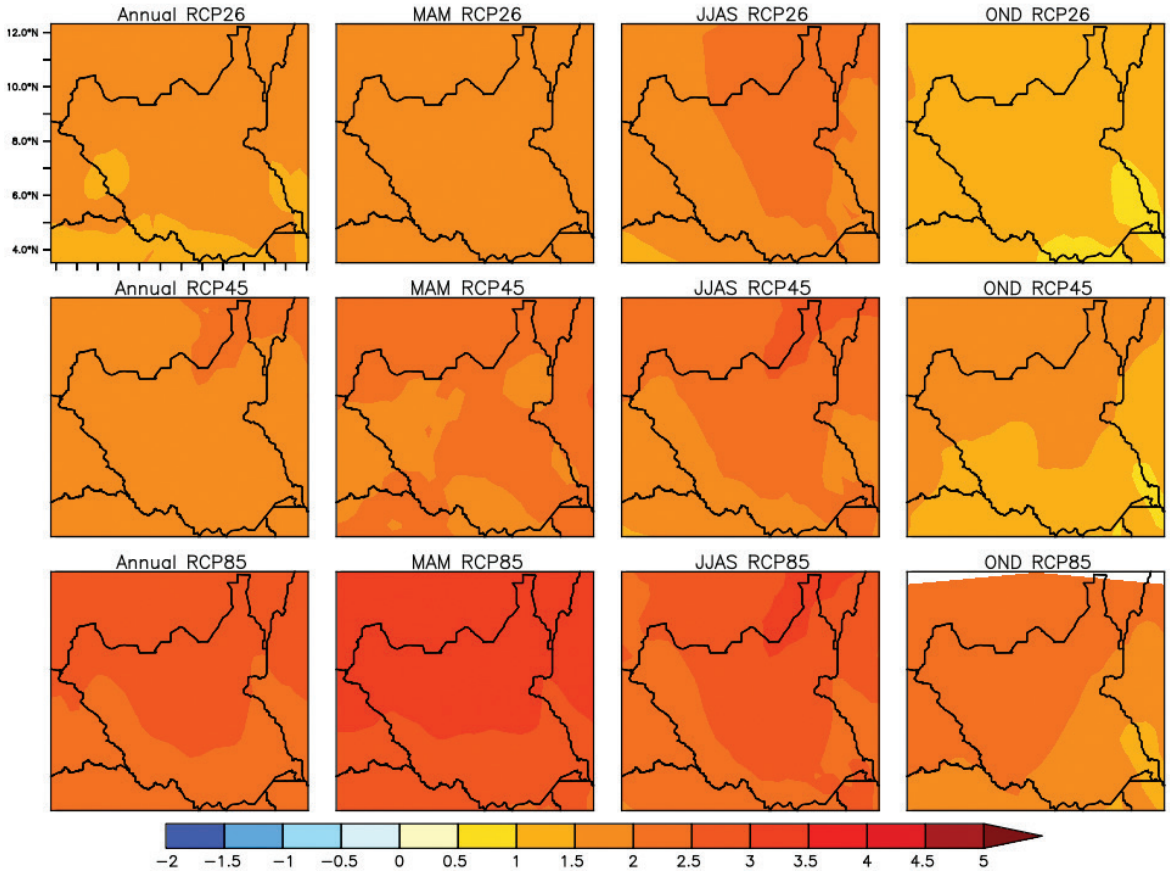



**Figure 5: Projected 2050 annual and seasonal changes in mean surface temperature relative to 1971–2000 control period (CTL) based on the ensemble mean of 25 CORDEX under RCPs 26, 45 and 85 simulations over South Sudan**



# What does all this mean for key economic sectors in South Sudan?

Rainfed agriculture, crops, livestock, and fishing contribute significantly to the South Sudan economy, and are highly dependent on the climate. Changes in the frequency and severity of rainfall/temperature changes poses challenges to farmers and herders and threatens food security.

## How is food production affected by current rainfall variability?

Rainfall is one of the main climatic determinants of food production in South Sudan, with good rainfall years generally associated with higher food production. Grains and cereals – the main staple crops in the country – are especially sensitive to changes in rainfall, and almost 70% of the variability in their production can be explained by variations in rainfall. Similarly, the productive capacity of both livestock and fisheries can be affected by changes in rainfall and temperature, which affects pasture conditions and the availability of water for livestock, as well as the productivity of fisheries in the Sudd and the White Nile tributaries.

## How is access to market impacted?

Access to markets is critical for food security in South Sudan, where households depend heavily on markets during the lean seasons, despite poor roads infrastructure for market access. If seasonal rainfall declines or is poorly distributed, seasonal crop production will also be reduced, increasing households' dependence on markets, or aid agencies, to meet their food needs. Climate-induced food price volatility could also mean that households are required to spend more of their income on food, and/or become more dependent on aid agencies to provide food or cash assistance to meet the shortfall. In addition to reducing food production, climate-related disasters such as flooding would also impact on households' ability to physically access markets.

## What are current impacts of climate to livelihoods?

Climate affects rainfall that supports growth of forages and water availability for livestock leading to declined production of key animal products (milk, meat) and cash incomes from livestock sales that households depend on in some areas. The magnitude of the impact will vary across livelihoods and farming systems. This variability will exacerbate livelihood vulnerabilities and food insecurity trends in the most at-risk areas, such as Torit, Yambio, Yei, Aweil, Rumbek, Wau, and Bor. The rural poor with no access to land and limited income opportunities, particularly women-headed households, are the most vulnerable and will be disproportionately affected.

## How are ecosystems affected?

Climate is an important environmental influence on ecosystems. Increasing temperature forces species to migrate to higher latitudes or higher elevations where temperatures are more conducive to their survival. Additionally, recently logged forested areas has become vulnerable to erosion with increases in heavy rainstorms. Reduced rainfall in neighbouring countries will also impact on the water flow into and through the Sudd, which in turn could negatively affect the size and productivity of fish habitat and the availability of prime grazing land for livestock.

# What does this tell us about the future of climate sensitive sectors in South Sudan by 2050?

## Long-term global, regional, national climate trends and its likely impact on South Sudan by 2050

The evidence for climate change is now considered to be unequivocal, and trends in atmospheric carbon dioxide ($CO_2$), temperature and rainfall, among other climatic variables, are elaborated in the Fourth Assessment (AR4) undertaken by the International Panel on Climate Change (IPCC[1]). Under the IPCC emissions scenarios, higher temperatures are projected to affect all aspects of the hydrological cycle. More frequent and severe droughts and floods are already apparent, and their impact will increase as South Sudan's population grows. Climate variability and change is projected to severely compromise agricultural production, reducing the productivity of both irrigated and rainfed agriculture across the globe. This will negatively impact on access to food in many African countries, including South Sudan.

Africa may be the most vulnerable continent to climate variability and change because of multiple existing stresses and low adaptive capacity. Existing stresses include poverty, food insecurity, political conflicts, and ecosystem degradation. By 2050, between 350 million and 600 million people in Africa (from IPCC) are projected to experience increased water stress due to climate change. Urban population is also projected to triple, increasing by 800 million people, complicating urban poverty and access to basic services. In addition, South Sudan, like many African countries, will experience a youth bulge over the next 30 years, increasing demand on already stressed natural resources.

For South Sudan, both rainfall and temperatures are predicted to become more variable, with a consequent higher incidence of droughts and floods, sometimes in the same place. It will significantly impact agriculture by increasing water demand, limiting crop productivity and by reducing water availability in areas like northern parts of South Sudan where irrigation is currently practiced.

## Future climate impacts on livelihoods, food and water security, infrastructure and ecosystems in the country

Climate stressors in South Sudan, such as temperature increase, rainfall variability, droughts, and floods, will affect the agricultural and livestock sectors and ultimately reduce their productivity. The general increase in temperature will affect rainfed agriculture, aquaculture, natural ecology systems and biodiversity, water resources, and energy. Under climate change much agricultural land will be lost, with shorter growing seasons and lower yields, and the availability of dry season grazing and water for livestock could be reduced or shift geographic locations.

Warmer water temperatures are likely to cause the habitat ranges of varieties of fish species to shift, disrupting ecosystems. Overall, climate change could make it more difficult to grow crops, raise animals, and catch fish in the same ways and same places as in the past. Climate change may also increase the prevalence of parasites and diseases that affect livestock or crops.

1 The Intergovernmental Panel on Climate Change (IPCC) is an intergovernmental body of the United Nations that is dedicated to providing the world with objective, scientific information relevant to understanding the scientific basis of the risk of human-induced climate change, its natural, political, and economic impacts and risks, and possible response options.

Climate changes will likely impact roadways, river transport, vehicles and railways. Higher temperatures can cause pavement to soften and expand, which would need to be taken into consideration when building roads and other transport infrastructure in South Sudan. These changes could make it more costly to both build and maintain roads and highways. Conversely, heavy precipitation may result in flooding, which could disrupt traffic, delay construction activities, and weaken or wash out the soil and culverts that support roads, tunnels, and bridges.

For agricultural produce, climate change will result in additional price increases for the most important agricultural crops – rice, wheat, maize, and soybeans. While this could mean higher 'farmgate' prices for producers, it will have a knock-on effect for the price consumers pay in markets. Similarly, for livestock, changes in the distribution of rainfall could negatively affect the availability of dry season grazing and water points, affecting the productivity of the livestock sector, and potentially fuel conflict over access to increasingly scarce resources. As a result, climate change could reduce the growth in meat consumption and cause a more substantial fall in cereals consumption, particularly for poorer households.

Climate change is an added stress to already threatened habitats, ecosystems and species in South Sudan, and is likely to trigger species migration and lead to habitat reduction. Up to 50 per cent of the country's total biodiversity is at risk due to reduced habitat and other human-induced pressures[2] (Boko et al. 2007). The latter include land-use conversion due to agricultural expansion and subsequent destruction of habitat; pollution; civil war; high rates of land use change; population growth and the introduction of exotic species.

## Climate change, politics and policy in South Sudan

Climate change is exacerbating the civil war in South Sudan[3]. The environmental damage caused by global warming is worsening food shortages, increasing pressure on urban areas, and shifting the availability of key resources such as grazing lands, water and fisheries.

The unplanned expansion of urban areas has resulted in urban environments that will struggle to adapt to or minimize the impact of climate change. Key climate related issues in urban areas are access to water and cooking fuel. The uncontrolled drilling of boreholes to meet increased demand could result in the 'mining' of water tables beyond their recharge rates, while those without access to renewable sources of cooking fuel will continue to resort to the use of wood or charcoal, further exacerbating the problem of deforestation.

While the climate and environmental concerns have been imbedded in South Sudan's Constitution and the Environment Protection Agency Act was passed in 2008 during the CPA period, there has been little progress in the twelve years since then. South Sudan's institutional frameworks in response to climate change are at nascent stages. New institutions mandated to address climate change have been weakened by a lack of technical knowhow and financial resources, and by the low priority assigned to environment and climate change issues by the government due to the ongoing conflict.

## National strategies and plans

The National Environmental Policy[4], a key document governing natural resources, calls for development of a national strategy for climate change adaptation and mitigation; formulation of a climate change policy for South Sudan; and efforts to reduce

2 Boko M, Niang I, Nyong A, Vogel C, Githeko A, Medany M, Osman-Elasha B, Tabo R and Yanda P. 2007. Africa. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Parry M L, Canziani O F, Palutikof J P, van der Linden P J and Hanson C E (eds). Cambridge University Press. Cambridge UK. pp. 433–467.

3 https://www.climatechangenews.com/2014/05/30/climate-impacts-fuelling-south-sudan-war-says-minister/ Published on 30/05/2014, 1:07pm

4 Netherlands Commission for Environmental Assessment. 2015. Climate Change Profile: South Sudan.

communities' vulnerability to climate variability and change. While South Sudan has not yet developed any standalone climate change policy or strategies, adaptation strategies and plans have been incorporated into the country's development plans.

Other policies that include climate change adaptation include:

- The National Policy on Food Security identifies the development of drought- and flood resistant seed varieties as a way to build adaptive capacity.
- The draft (as of 2015) Disaster Risk Management Policy proposes building dikes to prevent floods but says little about building resilience to droughts. Prior to the conflict that began in 2013, South Sudan was also working on its First National Communication to the UNFCCC, National Adaptation Programme of Action (NAPA), National Adaptation Plan (NAP) and National Biodiversity Strategy and Action Plan (NBSAP).

# What does all this mean for politics and policy?

Climate change has already had negative impacts on the livelihoods of many South Sudanese. It has not only affected agriculture, pastoralism, and fishing but also market and transport. These negative impacts are very likely to substantially increase over the next 30 years. Contestations over increasingly scarce land and other natural resources are likely to foster conflict and violence. In order to mitigate some of these negative impacts, policy makers and practicioners needs to start taking some key actions now. The following points refer to some responses raised in this paper and are essential to consider for the longer-term peace and security of South Sudan:

- **Support the Government of South Sudan to develop AND implement a national strategy for climate change adaptation and mitigation**; formulate and implement a climate change strategy and policy for South Sudan that actually helps to reduce communities' vulnerability to climate variability and to conflicts that emerge in relation to climate change.
- **Provide climate sensitive aid**; aid, particularly livelihoods and resilience programs, should consider climate sensitive approaches that will foster communities' resilience to negative impacts of climate variability and to any climate-change related conflicts that emerge.
- **Strengthen the capacity of local mechanisms to settle conflict over natural resources**; climate change is shifting the availability of key natural resources, which will exacerbate conflicts and violence in South Sudan. Local mechanisms that can effectively settle conflicts over natural resources will be critical. With the increase of pressure on natural resources, such mechanisms will come under stress and will need to be supported.
- **Support urban planning and sustainable use of natural resources**; particularly in urban contexts access to services including water and cooking fuel, is likely to exacerbate the unsustainable use of natural resources ('mining' of water and deforestation) and related to this also conflict over the control of and access to these resources. Women will be particularly hard hit by, and could also drive, these conflicts, as they are the users of water and cooking fuel. Urban planning, more sustainable methods and novel approaches of the use of natural resources ought to be supported by the government and the aid community.

**The Conflict Sensitivity Resource Facility (CSRF) develops and tests innovative approaches to helping the aid community in South Sudan better integrate conflict sensitivity into their work. The Facility, which is funded by the UK, Canada, Switzerland and the Netherlands governments, supports the building and practical application of knowledge around conflict sensitivity through research, analysis, trainings, mentorship and dialogue.**

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