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IN THIS ISSUE

Thematic Focus: Ecosystem Management, Climate Change

Food Security in the Horn of Africa: The Implications of a Drier, Hotter and More Crowded Future

Why is this issue important?

The Horn of Africa is one of the world's most food-insecure regions. The eight countries – Djibouti, Ethiopia, Eritrea, Kenya, Somalia, Sudan, South Sudan and Uganda – have a combined population of 160 million people, 70 million of whom (or nearly 44 per cent) live in areas prone to extreme food shortages (1). Between 1970 and 2000, these countries were threatened by famine at least once each decade (1). In the future, the impacts of climate change, as well as growing populations and declining per capita agricultural capacity, are expected to further threaten food security[1]. As one of the least developed areas in Africa, there is limited capacity to respond to drought or food crises. To prevent humanitarian emergencies, the Horn of Africa needs to strengthen its ability to build long-term resilience and tackle the root causes of the region's vulnerability.

[1] Food security has a variety of definitions. Common to these are issues of food availability, access and use (35). The World Food Summit adopted the following definition, "Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (36). According to the Food and

Agriculture Organization, food insecurity exists when people do not have adequate physical, social or economic access to food as defined above (36).

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Figure 1: Cattle losses and forced cattle sales at low prices for lack of feed and water have been reported across the pastoral areas in the Horn of Africa. Photo: Andrew Havens / Flickr

The Horn of Africa is currently facing a humanitarian crisis. Nearly 13 million people were in need of assistance in September 2011 (2, 3). Not since the 1984/85 famines in Ethiopia and Sudan, during which over 1 million people died, has there been such a widespread food emergency (4). In Somalia alone, 4 million people were suffering from acute food crisis or outright famine in September 2011 (5). If the response is inadequate by October, 750,000 people risk dying in the following four months (5). Tens of thousands of people have already died, half of whom are children. In Ethiopia, 4.5 million people have required emergency humanitarian assistance due to poor rains and extremely high food prices (6). In Kenya, 3.75 million people are considered food insecure. Although the onset of rains in October is expected to bring some relief, pastoral conditions continue to deteriorate and underlying causes of food insecurity remain (7).

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Figure 2: Women queue for water near Moyale in the Oromiya region, just east of the Ethiopian Highlands. This area is one of the worst affected by the 2011 drought. Photo: Andrew Havens / Flickr

A variety of factors contribute to food insecurity in the Horn of Africa, including drought, environmental degradation, poverty, conflict, population growth, land fragmentation and stagnating agricultural development (1, 8, 9, 10, 11). Food supplies in large parts of the developing world are locally derived and much of the agriculture is rain-fed (9, 10). As a result, rainfall and temperature changes directly influence food supply. Water shortages and heat stress limit crop growth and development, reducing yield (12). Since the mid-1980s, rainfall during the main growing season has declined by 15 per cent across eastern and southern Africa (10). Over the same period, per-capita cropped area declined by 33 per cent while the population of eastern and southern Africa doubled (Figure 3) (10). While droughts are naturally occurring phenomena in the Horn of Africa, changes such as population growth as well as environmental degradation, land fragmentation and conflict, have increased vulnerability and decreased the adaptive capacity of communities. Rainfall declines and erratic weather may thus tip households over the edge into livelihood crises (1, 11).

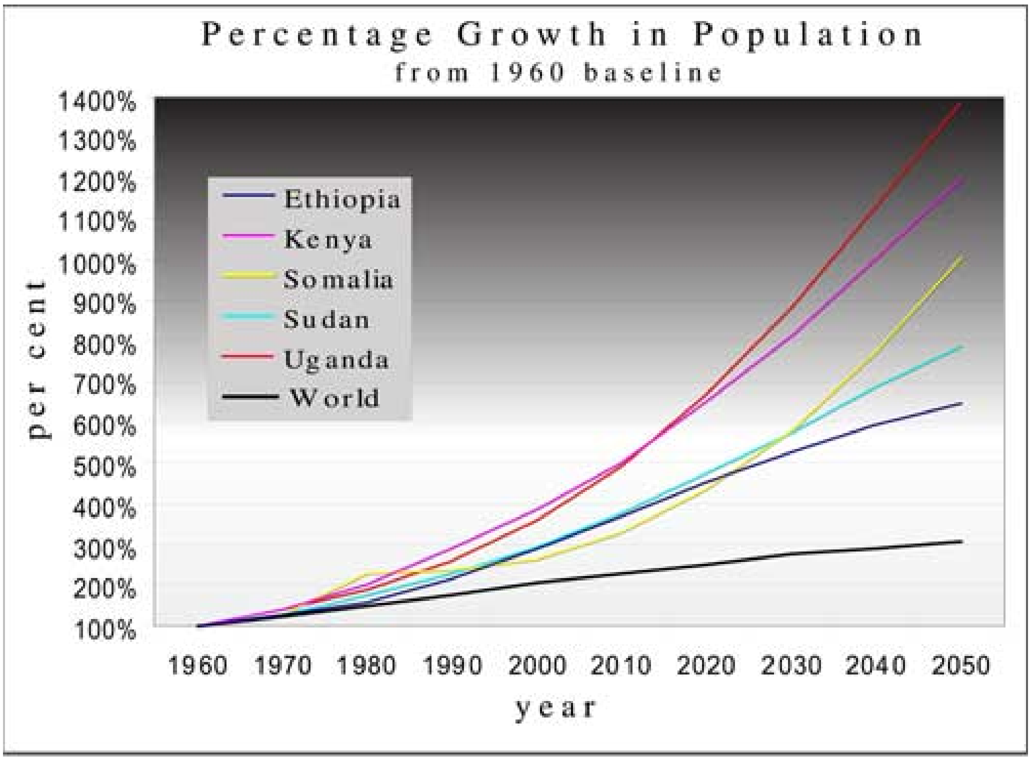

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Figure 3: Since 1960 population growth across the horn of Africa has dramatically outpaced global population growth. Uganda's population is projected to grow to 14 times its 1960 population by 2050. Data: UN Population Division 2011

Case Study: Sudan and South Sudan

According to a Famine Early Warning Network (FEWS NET) climate analysis, Darfur in western Sudan and much of South Sudan have experienced a 10-20 per cent decrease in long-rains since the mid-1970s (18). The long-rain season, the period during which relatively heavy and steady rains are common, typically occurs in Darfur and South Sudan from June through September. Long-rains are crucial to the region's main harvest. Since the 1960s, however, drought has become more frequent and more widespread during these months (19, 20). Between the 1960s and late 2011 the area receiving adequate rainfall (500 mm) to support agro-pastoralist livelihoods had been reduced by 18 per cent due to the reduced rainfall trend (Figures 4 and 8) (18). In these semi-arid and dry subhumid zones, rain-fed agriculture is already tenuous due to the seasonality of rainfall, intermittent dry spells and frequent drought years (21). In addition to the 30-year trend of declining precipitation, there is evidence that variability in amount and timing of rainfall from year to year is increasing, which would further compound food insecurity in the region (20, 22, 23).

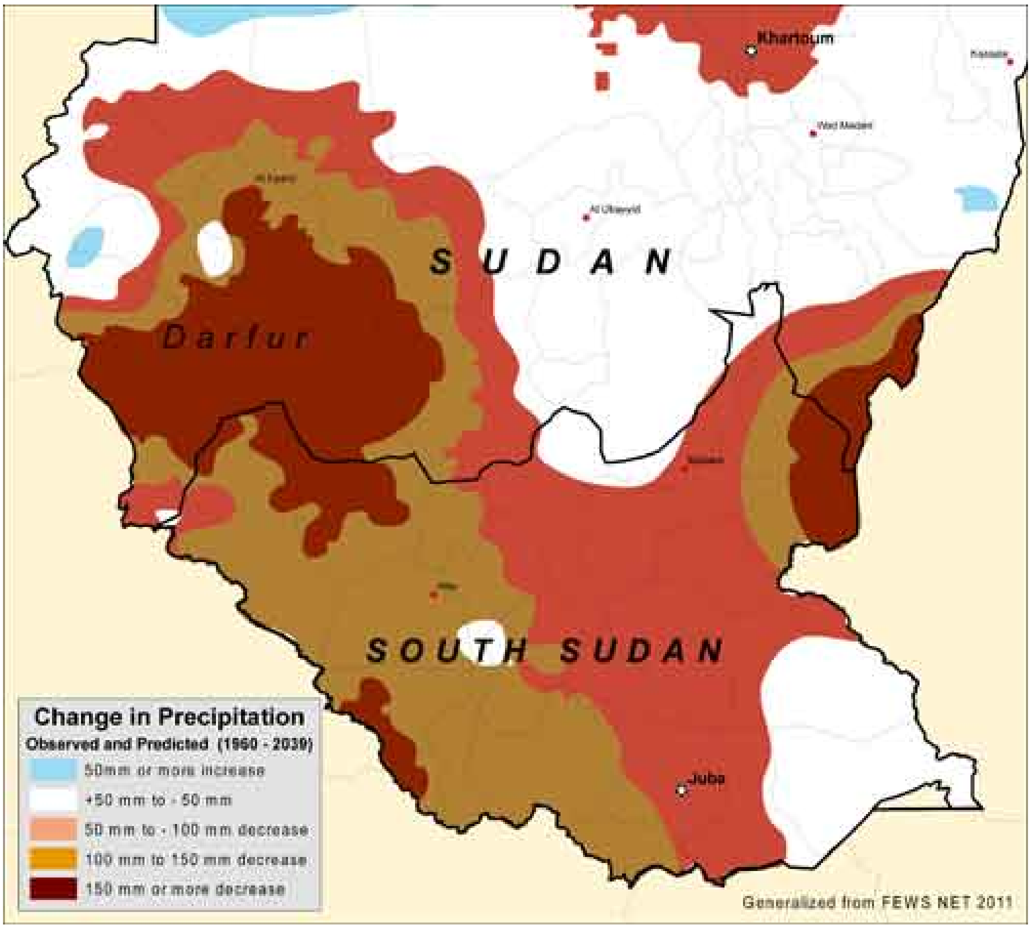

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Figure 4: Combining observed reductions in rainfall since 1960 with predicted reductions between 2010 and 2039, some areas of South Sudan and a large portion of Darfur in Sudan would see reductions of over 150 mm in June – September rainfall. Most of this change (63 per cent) already occurred between 1960 and 2009.

An accompanying trend of higher temperatures (18, 20) (Figure 5) – estimated to be equivalent to an additional 10 to 20 per cent reduction in rainfall in its impact on crops (18) – has exacerbated the reduced and increasingly variable rainfall. Air temperatures in the area have increased by over 1.0° C since the 1970s (18). As with rainfall, there is evidence that average annual temperatures have become more variable as well (20).

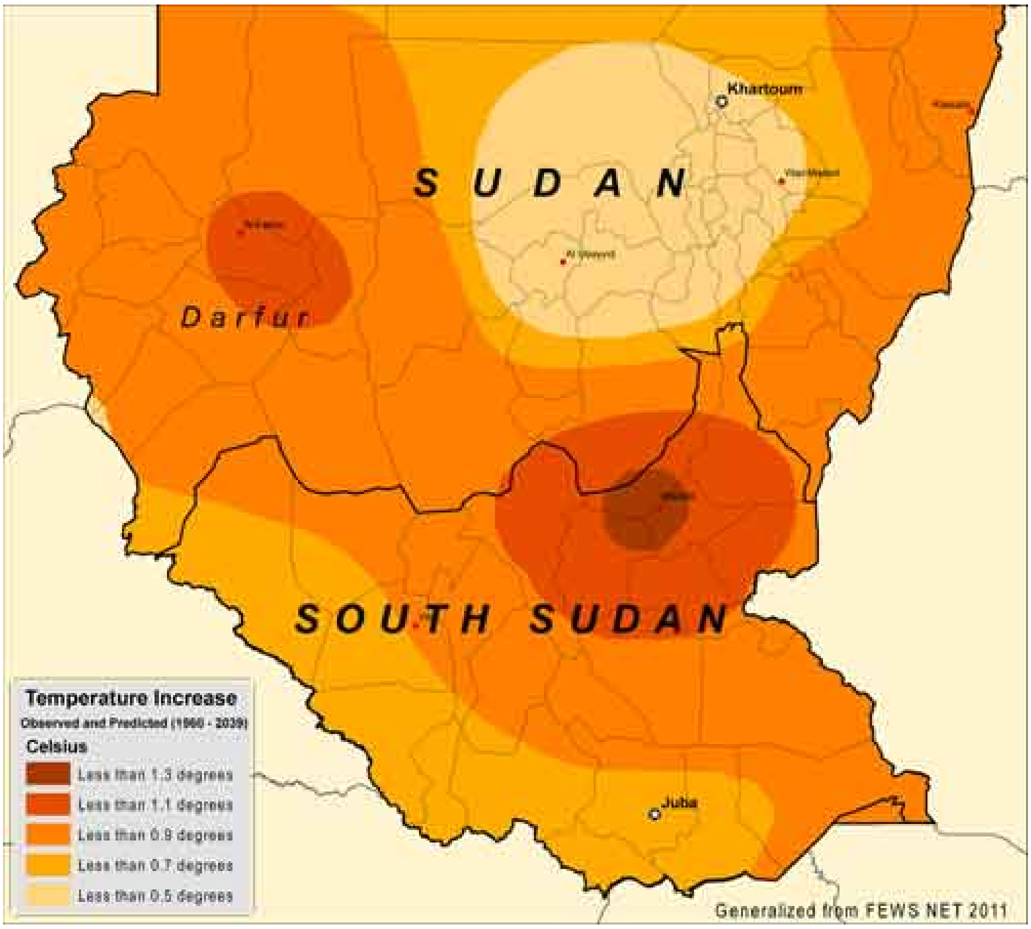

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Figure 5: Adding temperature increases already observed in Sudan and South Sudan with predicted increases through 2039, most of the area shown above will experience an increase of between 0.5° C and 1.3° C from 1960 to 2039.

During roughly the same time that these trends in temperature and rainfall have made rain-fed agriculture less secure, the combined population of Darfur and South Sudan has roughly tripled (24, 25). Since 1960, the population of the area that is now South Sudan has grown from around 2.5 million to over 7.5 million and Darfur's population has grown from around 1.5 million in 1960 to an estimated 6.7 million by 2010 (24, 25). Population in the two areas is expected to grow by an additional 1.4 million people by 2015 (24). The vast majority of people in these areas rely on some type of agro-pastoralism (26).

Sudan is not alone

The downward trend in long-rains extends to other countries across the Horn of Africa and is particularly strong to the east of the Ethiopian Highlands and in Central Kenya (15). FEWS NET released a report for Kenya in August 2010, based on similar methodologies and data sets. The authors used historical data from 70 rainfall stations and 17 air temperature stations to interpolate the long-rains precipitation and temperature trends for all of Kenya from 1960 to 2009 (27) (Figures 6 and 7). In Kenya, long-rains traditionally occur between March and June. The authors report that Kenya has experienced the same trend of decreasing rainfall and rising temperatures as Sudan. In Central Kenya, one of the countries key agricultural regions, the area receiving adequate rainfall to support reliable rain-fed agriculture has declined by roughly 45 per cent since the mid 1970s (27) (Figure 7).

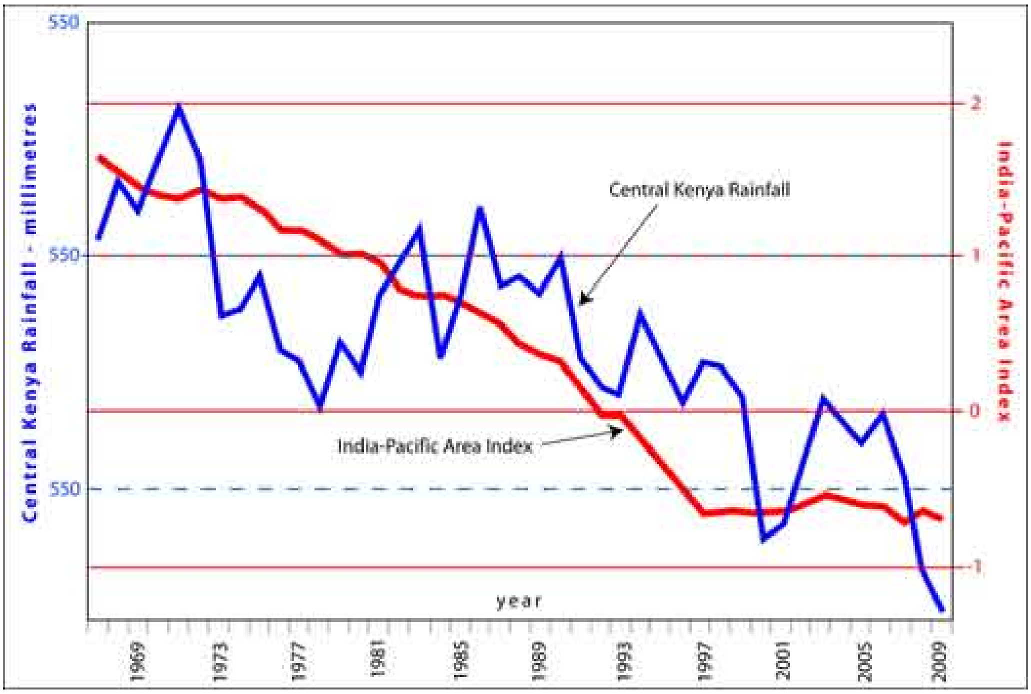

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Figure 6: The trend in rainfall for Kenya since the 1960s tracks the trend in the Indian-Pacific Area circulation index–a measure of temperature and precipitation over the Indian and western Pacific Ocean.

A FEWS NET report published in 2005 concluded that south-western Ethiopia has also seen a long-term post-1960s downward trend in rainfall (19). More recent, yet to be published, analysis based on 110 years of observation from 215 rainfall gauges indicates that, since the mid-1970s, rains may have declined by 15-20 per cent in some areas of Ethiopia (28). The spatial pattern of decline appears to coincide with heavily populated areas of southern and south-eastern Ethiopia, and may have adversely affected crop yields and pasture conditions. Substantial warming across the entire country may have also occurred, exacerbating the dryness (28).

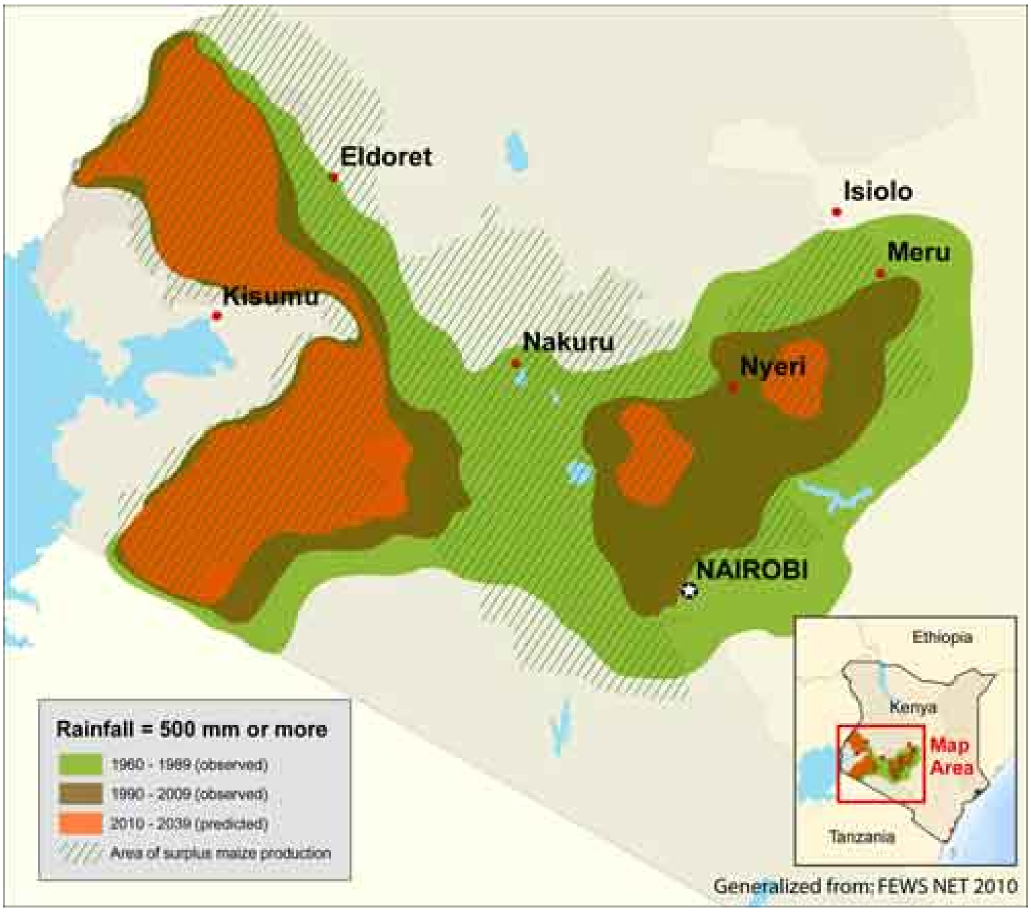

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Figure 7: The area of west-central Kenya receiving 500 mm of rain or more has shrunk since 1960 and is likely to keep shrinking over the next 30 years.

Another FEWS NET preliminary analysis of data from Uganda appears to show that seasonal rains have decreased over the past 25 years there as well. Between 2000 and 2009, the average March-to-June and June-to-September rainfall in maize growing regions was about 8 per cent lower than the 1920-1969 mean (29). Such rainfall declines may threaten food production in the west and northwest. Observed warming of more than 1.0° C may have also affected crops and pastures, with adverse impacts on coffee production in the south (29). The final FEWS NET reports on Ethiopia and Uganda are expected to be published soon.

What will the future bring?

There is widespread consensus that climate change will further worsen food security in Africa (13). However, questions remain over the precise impact on rainfall and temperature trends. The Intergovernmental Panel on Climate Change's (IPCC) 2007 assessment reports that 18 out of 21 models predict increased rainfall in East Africa, extending into the Horn of Africa (14). Actual rainfall records since the 1970s, however, indicate precipitation has declined, and a recent study predicts continued declines in the future (4, 10). The IPCC has acknowledged its models have difficulty representing regional processes affecting rainfall (27).

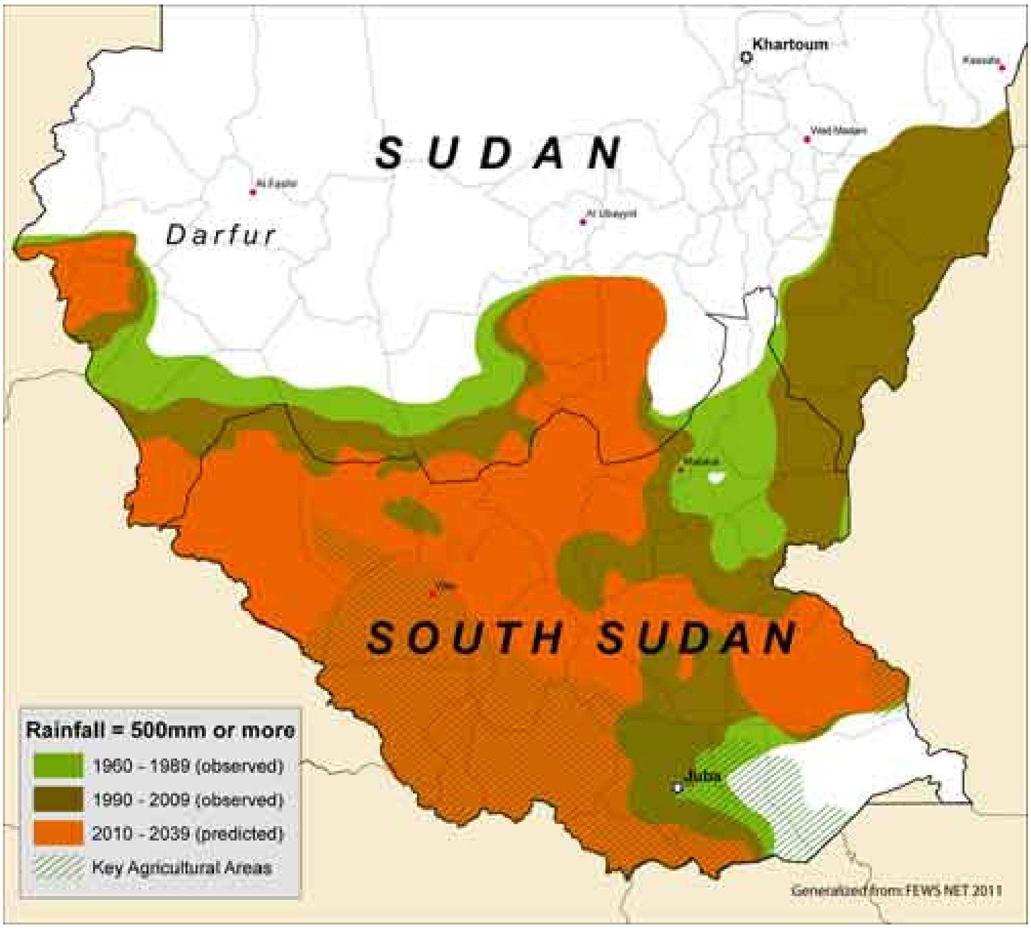

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Figure 8: Five-hundred millimeters of rain is a rough "rule-of-thumb" measure of agricultural viability. The area of South Sudan and Sudan currently meeting this threshold is expected to shrink by 30 per cent between 1960 and 2039.

While long-term precipitation predictions are uncertain, research by A. Williams and others (15, 17) has indentified a relationship between declining March-to-June precipitation in the Horn of Africa and a trend in rising sea-surface temperatures (SSTs) in the south-central Indian Ocean and western Pacific Ocean between 1960 and 2009 (Figure 6). This heat causes enhanced convection over the tropical Indian Ocean. They believe it is driving a pattern of descending dry air over eastern Africa, which has been suppressing convection over East Africa since 1980 and decreasing precipitation during the March-to-June rains. The authors assert that the rising Indian Ocean sea surface temperatures have been convincingly linked to anthropogenic greenhouse gas