Impacts of Climate Change on Length of Growing Period

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WHAT ARE THESE MAPS TELLING US?

Projections show that climate changes between now and the 2050s may significantly affect the length of growing periods (LGP) in Africa. LGP, expressed as number of days per year, is a metric that integrates rainfall, temperature, and some soil conditions to determine when crops grow in certain areas (Map 1). It is a useful proxy for season type in the water-limited conditions that prevail in many parts of the tropics. LGP ignores intervening drought periods and so it is not always a good indicator of cropping success, but it is often highly correlated with yields. Map 2 shows the projected percentage change in LGP in the 2050s compared with current conditions, using a scenario of high greenhouse gas emissions and several global climate models. Most of the continent will see reductions in LGP, some of them severe. Parts of eastern Africa, particularly the Horn of Africa, may see some increases, but in these areas, current LGP is low (90 days or less, Map 1). The climate models used to project LGP do not all agree on how the climate may change by 2050. Map 3 shows the variability in projections for LGP estimated from several climate models. Since areas with lower values, such as much of central Africa, show more agreement between the various climate models, one can have more confidence in projected LGP changes in these areas. In areas with higher values, the climate models agree less, meaning the projections of LGP change are less reliable.

WHY IS THIS IMPORTANT?

To effectively adapt to climate change, farmers, governments, and other stakeholders must understand the potential effects on crop and livestock production. A contracted growing season can impact crop and livestock productivity, particularly in areas where growing seasons are already short. Temperature increases and rainfall changes could push some of these areas to a point where cropping may fail in most years. Some farmers may be able to adapt to shorter growing seasons by planting varieties that mature more quickly; other farmers may need to change to more drought- and heat-tolerant crops. Increase in LGP may present more growing opportunities, but it is uncertain how the change in growing time would impact soil moisture. As climate changes, the distribution of crop pests and diseases may change, too. Of course, LGP is only one metric; the information shown here can be combined with or compared to other aspects of projected climate change—such as temperature changes—to create a more detailed picture of how climatic shifts could affect crop growth and development.

TABLE 1 Atmosphere–Ocean General Circulation Models used to estimate LGP changes to the 2050s

Model Name (Vintage)	Institution	Resolution (degrees)
BCCR_BCM2.0 (2005)	Bjerknes Centre for Climate Research	1.9 × 1.9
CNRM-CM3 (2004)	Météo-France/Centre National de Recherches Météorologiques, France	1.9 × 1.9
CSIRO-Mk3_5 (2005)	Commonwealth Scientific and Industrial Research Organisation Atmospheric Research	1.9 × 1.9
ECHam5 (2005)	Max Planck Institute for Meteorology	1.9 × 1.9
INM-CM3_0 (2004)	Institute Numerical Mathematics	4.0 × 5.0
MIROC3.2 (medres) (2004)	Center for Climate System Research, National Institute for Environmental Studies, and Frontier Research Center for Global Change	2.8 × 2.8
Ensemble average	Average climatology of the above models	

Source: For model details, see Randall et al. 2007.

WHAT ABOUT THE UNDERLYING DATA?

The data are from downscaled climate projections. Because differences between climate models may be quite large, particularly for projected changes in rainfall patterns and quantities, the means of six climate models (Table 1) form the basis for generating daily weather data sequences plausible for future climatologies. Jones and Thornton (2013) provide details of the models used and the methods applied. LGP is calculated daily using a water balance model that calculates available soil water, runoff, water deficiency, and the ratio of actual to potential evapotranspiration (Ea/Et). The growing period begins with 5 consecutive growing days and ends with 12 consecutive nongrowing days; a growing day has an average air temperature greater than 6°C and Ea/Et exceeding 0.35.

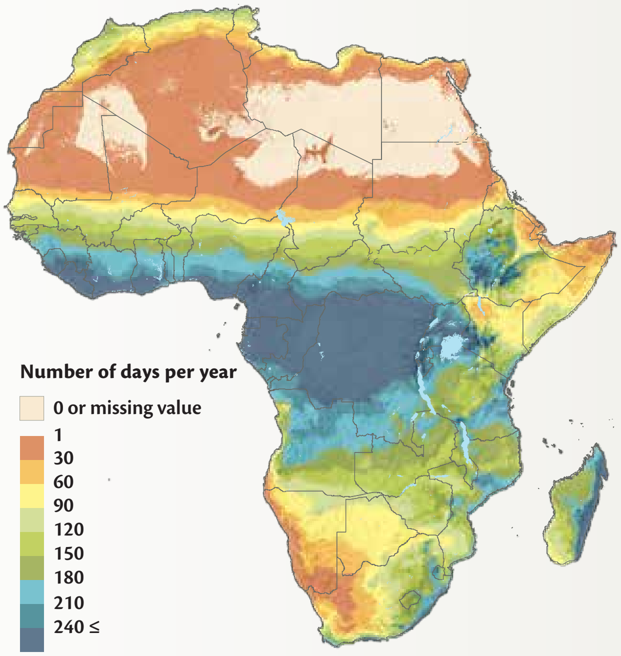
WHERE CAN I LEARN MORE?

Methods used to develop this data and create these maps: www.ccafs-climate.org/pattern_scaling/

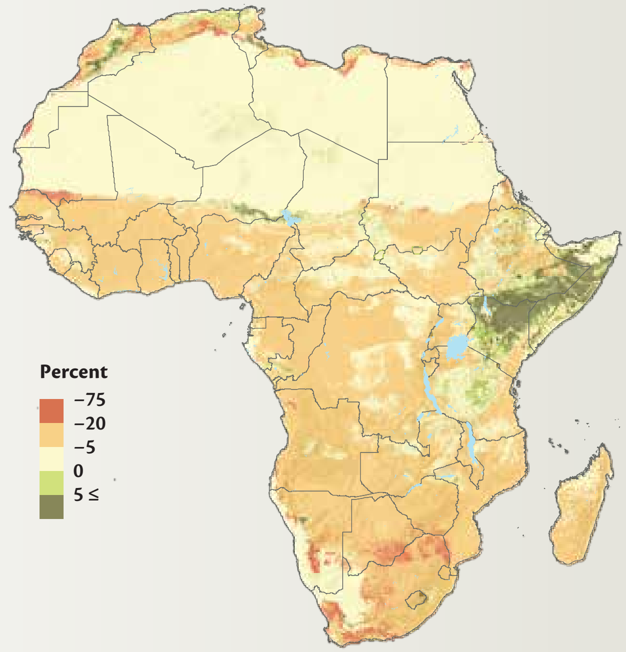
More information on the effects of climate change: Easterling et al. 2007.

Details on models used and methods applied: Jones and Thornton 2013; and Jones, Thornton, and Heinke 2009.

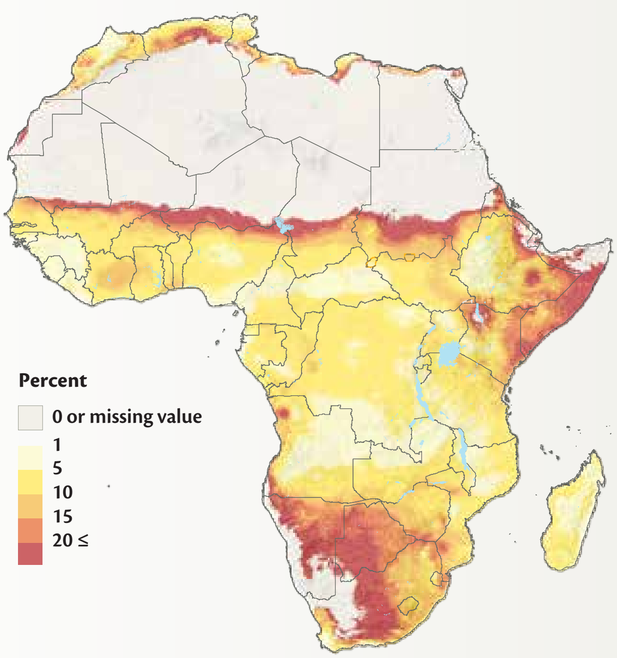
MAP 1 Average length of growing period (LGP) for current conditions, 2000s



MAP 2 Projected mean change in length of growing period (LGP) in 2050



MAP 3 Variability among length of growing period (LGP) projected values for 2050



Data source (all maps): Jones et al. 2009.

Note: LGP variability is represented by the coefficient of variation (CV), calculated as the standard deviation divided by the average LGP, expressed as a percentage.

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