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# TRANSITION FROM EL NIÑO TO LA NIÑA AFFECTED VEGETATION

NASA scientists using satellite data have shown that shifts in rainfall patterns from one of the strongest El Niño events of the century in 1997 to a La Niña event in 2000 significantly changed vegetation patterns over Africa.

Assaf Anyamba and Compton Tucker of NASA's Goddard Space Flight Center, Greenbelt Md., and Robert Mahoney of Global Science and Technology Inc (GST) analyzed satellite derived images of vegetation from 1997 to 2000. They noticed regions of above normal "greenness" over East Africa associated with patterns of above normal rainfall during the 1997-1998 El Niño event. At the same time, they observed below normal "greenness" over southern Africa associated below normal rainfall conditions there.

During the transition to La Niña, rainfall patterns reversed. Southern Africa experienced above normal rainfall and East Africa received below normal rainfall, resulting in a corresponding reversal of vegetation greenness patterns.

"These changes vegetation patterns have implications for agriculture, livestock farming and vector borne disease outbreaks especially is semi-arid land of Africa," Anyamba said. "Above normal vegetation conditions are an indicator of improved pasture conditions which boosts livestock production in these areas."

In addition, it is also an indicator of the likelihood of bumper harvests. Agricultural production in these areas rises and wanes to the tune of the El Niño -Southern Oscillation (ENSO) patterns as revealed here by changes in vegetation patterns during years of above normal and below normal rainfall. During above normal rainfall, vegetation conditions provide habitats necessary for the breeding of vector borne diseases such as Malaria Rift Valley Fever as was the case in 1997/98 in East Africa.

Satellite monitoring and mapping the extent of such anomalies in vegetation conditions can provide useful early warning information for drought, agriculture and vector borne disease outbreaks to prevent disaster situations.

Anyamba and his colleagues analyzed 20 years of Normalized Difference Vegetation Index (NDVI) data to determine changes in vegetation greenness patterns. Tucker, a co-author of the report, developed the NDVI data to monitor vegetation using orbiting weather satellites.

The NDVI data is derived from the Advanced Very High Resolution Radiometer (AVHRR) instrument flown aboard the National Oceanic and Atmospheric Administration's (NOAA) polar orbiting satellites.

NDVI measures vegetation "greenness" or plant health based on the principle that plants prefer to use (absorb) visible red colors (wavelengths) of sunlight for photosynthesis during growth. For example, a healthy plant will absorb more visible red sunlight for photosynthesis and reflect less back to space. A plant stressed by drought will photosynthesize less and reflect more sunlight back to space. A satellite can measure the amount of sunlight reflected in the red and near infrared spectrum and the NDVI can be computed to provide a relative measure of greenness or plant health that can be displayed as an image.

El Niño and La Niña events are both part of a cycle of recurring warmings and coolings of the ocean surface in the central and eastern Pacific known as the El Niño Southern Oscillation (ENSO). El Niño refers to the warm phase of the oscillation and La Niña refers to the cool phase. Each of these phases affects weather patterns worldwide and changes in rainfall can impact vegetation patterns.

Above normal rainfall during the 1997-1998 El Niño in East Africa and during the 1999-2000 La Niña in southern Africa improved pasture conditions in those areas, but also caused widespread flooding and disease outbreaks. The drought that followed in East Africa during the 1999 to 2000 La Niña was devastating and caused widespread famine.

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The findings appear in the November 1 issue of the American Meteorological Society's Journal of Climate (Vol. 15, Issue 21: 3096-3103, 2002).

For more information and images:
**http://www.gsfc.nasa.gov/topstory/20021101elnino.html**
For information on how NDVI measures the health of vegetation:
**http://earthobservatory.nasa.gov/Library/MeasuringVegetation/measuring_vegetation_2.html**