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Landsat Helps Bolster Food Security

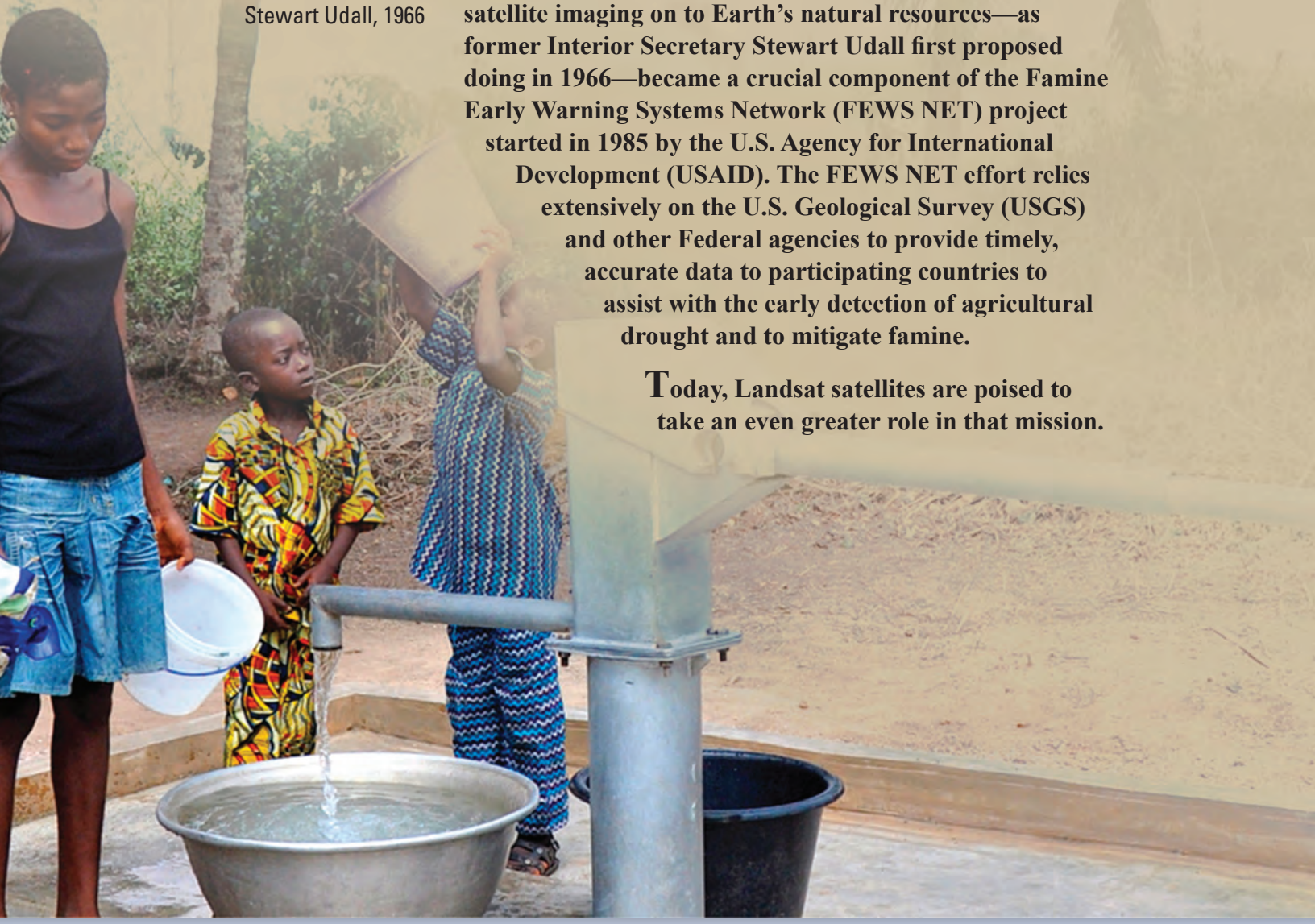
"A vision to observe Earth for the benefit of all..."

Interior Secretary
Stewart Udall, 1966

One of the cruelest, most complex narratives in the world today (2019) is written in the hunger of sub-Saharan Africa. When famine is the only yield from the scorched Earth, survival often depends on a heart-rending calculation—how far is the distant feeding center and how close is the nearest well?

In many ways, the ability of remote-sensing satellite imagery to capture the unforgiving side of Nature has become a valuable asset to decision makers facing troubling food insecurities in their homelands. Turning satellite imaging on to Earth's natural resources—as former Interior Secretary Stewart Udall first proposed doing in 1966—became a crucial component of the Famine Early Warning Systems Network (FEWS NET) project started in 1985 by the U.S. Agency for International Development (USAID). The FEWS NET effort relies extensively on the U.S. Geological Survey (USGS) and other Federal agencies to provide timely, accurate data to participating countries to assist with the early detection of agricultural drought and to mitigate famine.

Today, Landsat satellites are poised to take an even greater role in that mission.



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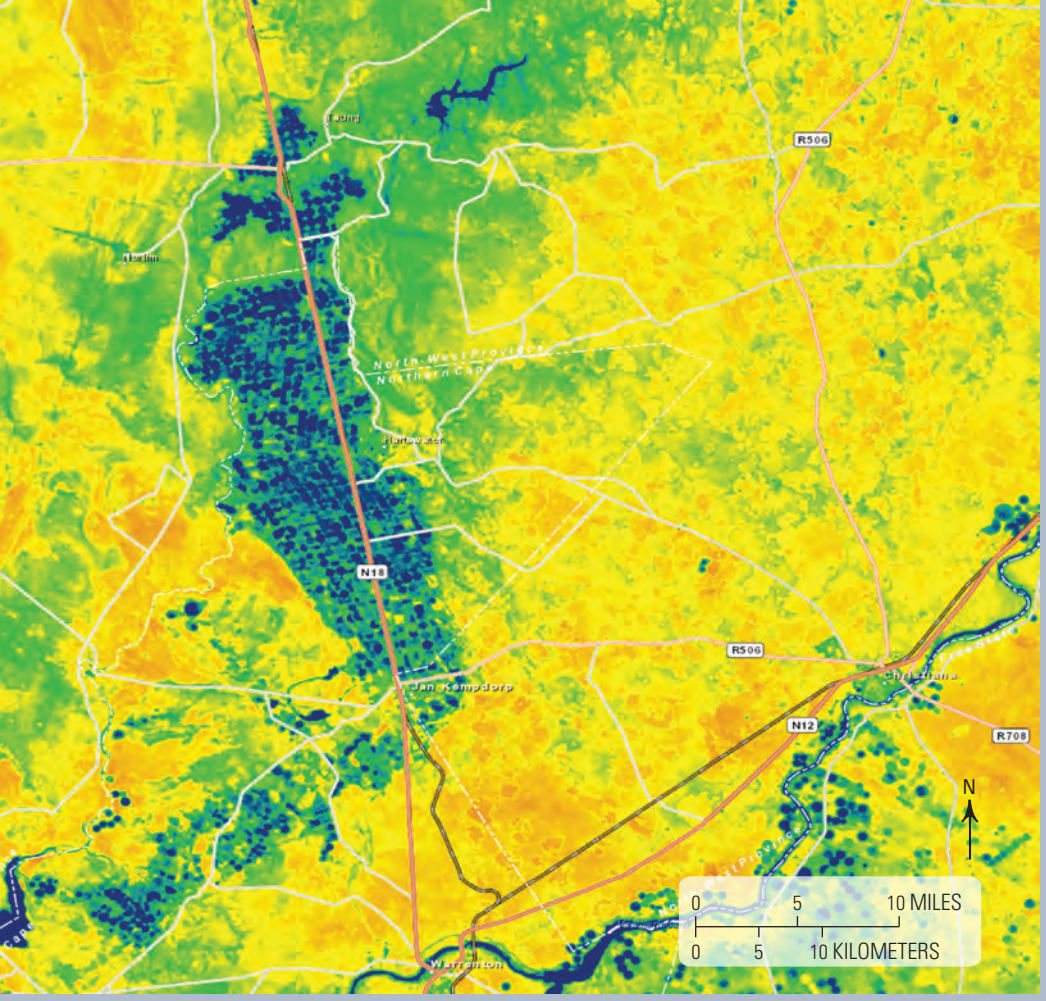

Figure 1. Landsat data are useful in creating evapotranspiration maps, which detail water usage and availability in a region. This map shows where water is transpiring from plants or evaporating from the ground in an irrigation district of South Africa from October 2013 to February 2014. The blue and green areas indicate greater water usage, whereas the yellow and orange areas indicate less water use. The circular blue areas denote center-pivot irrigation systems where water use is highest. Such maps are useful in providing early detection of agricultural drought to mitigate famine.

Although coarse-resolution remote sensing by weather satellites has been part of FEWS NET from virtually the beginning, Landsat's involvement has evolved in recent years, according to Michael Budde, a USGS geographer at the Earth Resources Observation and Science (EROS) Center in Sioux Falls, South Dakota. The evolution of large-scale data processing by Google Earth Engine and others now makes analyzing massive global datasets much easier, Budde noted. Extensive computing capabilities, made possible by the USGS decision in 2008 to make Landsat satellite data free to the public, opened the door to numerous products that could prove useful to FEWS NET projects in Africa, Central America, and Central Asia.

Combining Landsat data with precipitation and runoff data, USGS scientists have created computer models that accurately predict water availability and usage in a region. These models work well in the western United States, where researchers are producing maps of evapotranspiration (ET)—water that transpires from plants and evaporates from the ground. Landsat-derived ET indices are useful globally, at local scales, in identifying water shortages for crops, and the impact of such shortages on low food production.

Landsat also plays an important role in monitoring crop growth. Satellite sensors measure wavelengths of light absorbed and reflected by green plants. Raw data from the plants are then transformed into vegetation indices that describe the relative density and health of the vegetation. These vegetation indices give rough measures of vegetation quantities and condition. Using 30-meter resolution imagery from Landsat, vegetation evaluations are nearly 70 times more detailed than vegetation condition measurements from moderate-resolution satellites.

The compatibility of the European Space Agency's new Sentinel-2 satellite with Landsat satellites 7 and 8 means revisit times are more frequent. Greater satellite frequency over an area is useful in places where fields are large enough to study crop management practices, Budde noted. Increased revisit times also have proven valuable in validating coarser-resolution products that look at snowmelt, flooding concerns, and even the operational mapping of irrigation.

Landsat provides decision makers with crucial information needed on crop, natural vegetation, and water availability data. Accessibility to Landsat data can help agencies in prioritizing where to direct food assistance by identifying where one area may be in worse condition than another area because of flooding or drought. When they need information, USAID officials have indicated that data and evidence-based information provided by FEWS NET are important in the organization's decision-making process.

For the sake of those individuals living in places where famine is the Earth's only yield, the decisions made by organizations such as USAID are critical for their survival. As remote-sensing technology continues to evolve, Landsat and FEWS NET will help provide those much-needed answers.

For additional information, contact:

Michael Budde
Earth Resources Observation and Science (EROS) Center
U.S. Geological Survey
47914 252nd Street
Sioux Falls, SD 57198
605–594–6511
https://www.usgs.gov/centers/eros

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