National Aeronautics and Space Administration

Landsat's Critical Role in Responding to Natural Disasters

In 2011, natural disasters affected 206 million people worldwide, costing a record-setting 355 billion dollars. Fire, floods, hurricanes, tornadoes, and other natural disasters can be particularly tragic and costly when critical facilities such as power plants, airports, roads, and hospitals are threatened. When a disaster strikes, remote sensing is often the only way to get a big-picture view of what is happening on the ground.

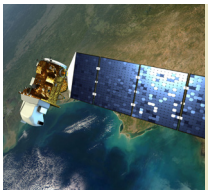
With its consistent, reliable, repeated observations of Earth's changing surface, Landsat keeps a record of Earth's land surfaces before and after disasters, serving as an essential tool for assessing risk, mapping the extent of damage, and planning post-disaster recovery. Landsat produces 185-kilometer-wide images with 30-meter resolution in visible and infrared wavelengths of light, making it possible to map impacts on the landscape in ways otherwise not visible to human sight. For example, Landsat sensors enable us to see the heat from fires both during and after the burns, and the lava flows from volcanic eruptions even when gaseous substances obscure the view to human eyes.

Designed, built, and launched by NASA, Landsat satellites have recorded global ecosystem conditions every year since the 1970s.The U.S. Geological Survey provides this valuable data to the public at no cost. Landsat observations continue into the future with the Landsat Data Continuity Mission, the eighth in the series of Landsat missions.

Image courtesy of Dennis Drenner/American Red Cross

Landsat Data for Decision-making

- Mitigating Damage from Fire
- Quantifying the Extent of Floods
- Assessing the Impacts of Hurricanes and Tornadoes
- Observing Severe Drought
- Mapping the Impacts of Volcanic Eruptions



ABOUT LANDSAT

Landsat satellites provide an unparalleled record of Earth's varying landscapes. Landsat's 30-meter resolution is ideal for measuring human impacts on the land. The consistency of Landsat's digital image data from sensor to sensor and year to year makes it possible to trace land cover changes from 1972 to the present.

USGS science for a changing world

Landsat and Natural Disasters

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Mitigating Damage from Fire

Landsat data enable natural resources managers to assess the severity and extent of large fires for planning recovery efforts. For example, the USDA Forest Service's Remote Sensing Applications Center uses Landsat data to map vegetation, water and soil changes after a fire. With these maps the staff can identify the areas that have been burned most severely, and so find and treat them to mitigate increased runoff and erosion.

Quantifying the Reach of Floods

In the spring of 2011, historic water levels led to extensive flooding from Mississippi County, Missouri, to southern Louisiana. Landsat 5 imaged the Mississippi shortly after the Army Corps of Engineers began blasting holes in earthen levees near Cairo, Illinois, to protect populations and farmlands downstream. Landsat imagery was crucial in helping to monitor the flood rate and effects of the flooding in the region. Landsat images also helped decision makers monitor and prepare for the flood wave as it made its way slowly down the river to the Gulf of Mexico.

Assessing the Impacts of Hurricanes and Tornadoes

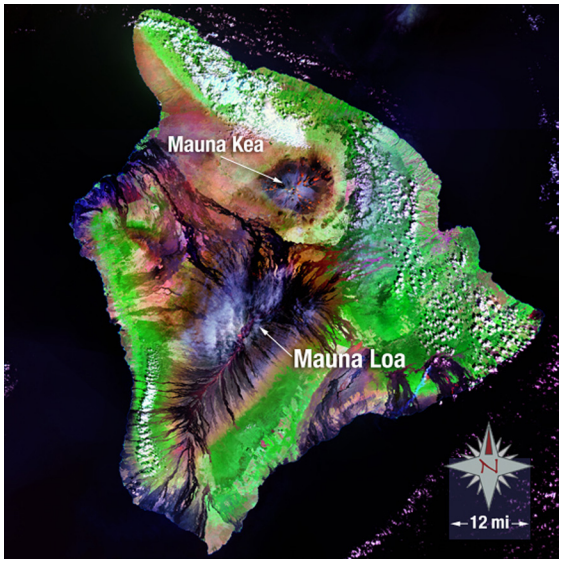
Large-scale paths of destruction by tornadoes and lands transformed by hurricanes often appear clearly in Landsat imagery. Such landscape-scale images allow decision makers to reliably map the damage after a storm and monitor the long-term ecological recovery. In 2005 after Hurricanes Katrina and Rita, the U.S. Geological Survey's Wetlands Research Center used Landsat imagery to determine that 217 square miles of Louisiana's coastal lands had been transformed to water. USGS has continually used Landsat data imagery in the following years to determine if this transformation from land to water is permanent.

Observing Severe Drought

By August 1, 2012, the United States Department of Agriculture had announced that more than 1,300 counties in 31 states qualified as natural disaster areas—the largest total area ever declared a disaster zone by the agency. Drought-stressed vegetation reflects less radiation in infrared wavelengths than healthy vegetation does. With Landsat's ability to detect infrared light, researchers can discern the effects of drought on crops and identify where drought is the most severe. The U.S. Department of Agriculture uses Landsat data to help monitor crop yields during growing seasons throughout the world.

Mapping the Results of Volcanic Eruptions

Landsat excels at monitoring changes in the land over time, and its observations of volcanoes provide an excellent example. Luke Flynn of the University of Hawaii has been studying the Kilauea volcano, which has been continually erupting since 1983. Flynn uses time series of Landsat images to map active lava flows with pinpoint accuracy and to provide advance warning to public safety officials. With Landsat observations of the heat emitted during eruptions, Flynn can distinguish active lava flows from older flows that have already begun to cool.



This Landsat image of volcanoes on the big island of Hawaii was created using combined infrared and green light. That combination helps to distinguish between the volcano and surrounding vegetation. Mauna Loa appears in dark grey and purplish-black in the middle of the island. Vegetation appears green and clouds are white.

Further Reading

Burned Area Emergency Response
http://www.fs.fed.us/eng/rsac/baer/

National Agricultural Statistics Service CropScape
http://nassgeodata.gmu.edu/CropScape/

National Wetlands Research Center
http://www.nwrc.usgs.gov

Federal Emergency Management Agency (FEMA)
http://www.ready.gov/natural-disasters

NASA Landsat http://www.nasa.gov/landsat

Landsat Science http://landsat.gsfc.nasa.gov

USGS Landsat http://landsat.usgs.gov/

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