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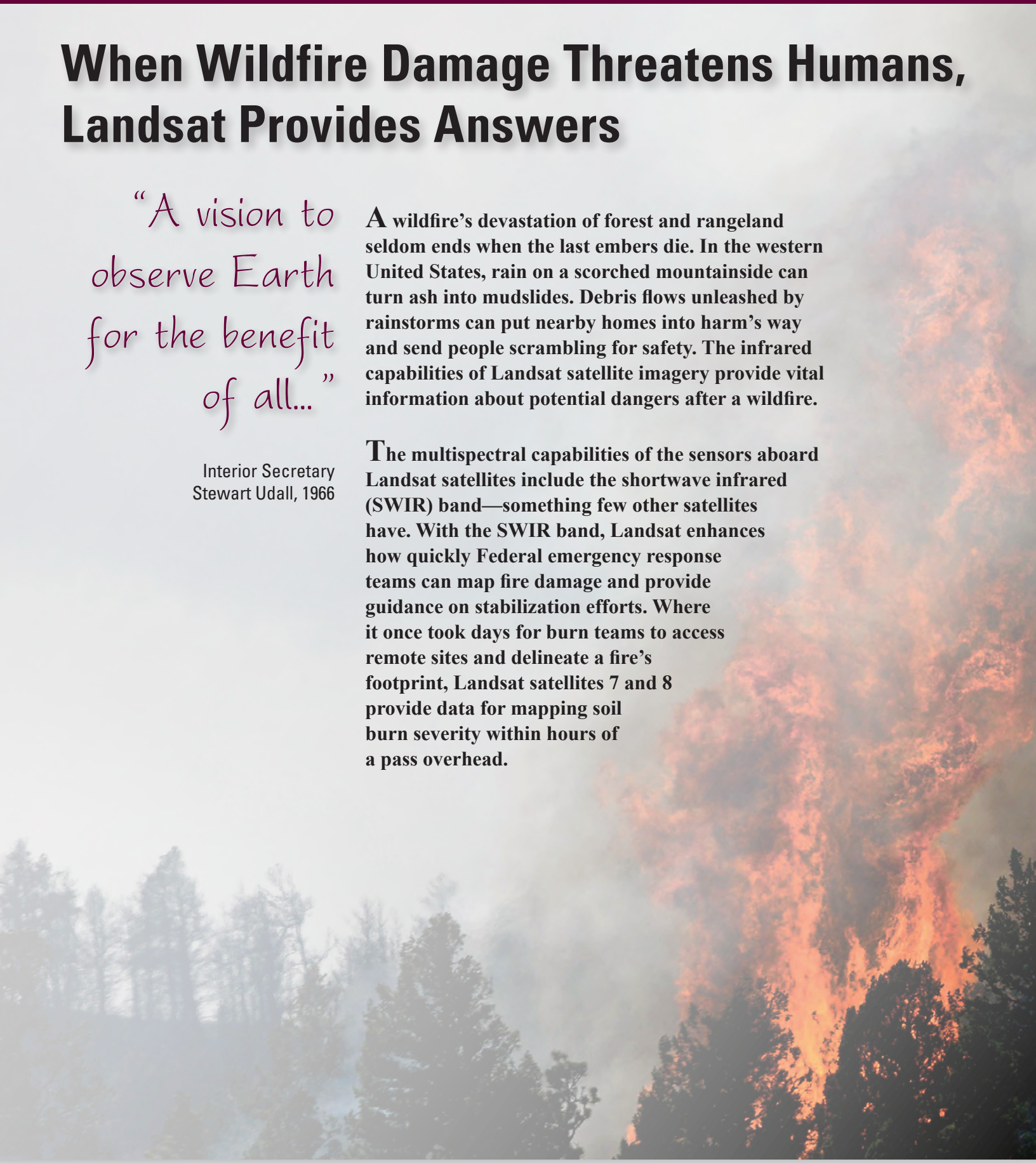
When Wildfire Damage Threatens Humans, Landsat Provides Answers

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

Interior Secretary
Stewart Udall, 1966

A wildfire's devastation of forest and rangeland seldom ends when the last embers die. In the western United States, rain on a scorched mountainside can turn ash into mudslides. Debris flows unleashed by rainstorms can put nearby homes into harm's way and send people scrambling for safety. The infrared capabilities of Landsat satellite imagery provide vital information about potential dangers after a wildfire.

The multispectral capabilities of the sensors aboard Landsat satellites include the shortwave infrared (SWIR) band—something few other satellites have. With the SWIR band, Landsat enhances how quickly Federal emergency response teams can map fire damage and provide guidance on stabilization efforts. Where it once took days for burn teams to access remote sites and delineate a fire's footprint, Landsat satellites 7 and 8 provide data for mapping soil burn severity within hours of a pass overhead.



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Fifty years ago, when he first pushed to turn space technology back toward Earth and issues involving Earth's natural resources, Interior Secretary Stewart Udall likely never imagined something called a SWIR band. Now it is one more valuable tool on a multiband Landsat system that offers broad-scale, synoptic imaging of the Earth at 30-meter resolution and nearly a half century of continuous observations.

The SWIR band provides information related to moisture content in soil and vegetation. Paired with Landsat's near-infrared (NIR) band, which is highly sensitive to growing vegetation, the two produce accurate images of burn scars.

The real value of SWIR lies in post-fire triage. Landsats 7 and 8 produce infrared data at least every 8 days, allowing fire science staff at the U.S. Geological Survey (USGS) to process and deliver burn-mapping products less than 24 hours after image acquisition, according to Randy McKinley, a geographer with the USGS who routinely maps fires on Department of Interior (DOI)-managed lands for the Bureau of Land Management, National Park Service, Bureau of Indian Affairs, and the U.S. Fish and Wildlife Service.

Burn severity maps also provide answers to rehabilitation managers on questions of where to focus post-fire mitigation activities. The contour felling of dead trees, mulching, and placement of sand bags or concrete barriers—all can slow and divert flash flood waters on a mountainside. The burn severity maps also offer an overall view of watersheds, which may help to identify where to place larger culverts for handling debris that begins to slide down burned hillsides.

In 2015, USGS staff mapped 2.5 million acres of burn area on DOI-managed lands. From 2001 through 2015, Federal agencies jointly mapped 1,594 wildfires representing almost 50 million burned acres. The USGS has also supported U.S. fire response teams deployed to wildfires in Australia, and mapped other global wildfires in Chile, Greece, and the Democratic Republic of Georgia.

While other satellites may provide finer, higher-resolution spatial imagery on everything from urban development to cars motoring down a highway, only Landsat and its SWIR sensor can efficiently image on a broad scale the scorched soil and vegetation associated with large wildfires. For that reason, when the last embers are dying, it is Landsat that quickly reveals the scars left behind. And, it is Landsat images that are used by scientists and resource managers, guiding their efforts to restore and rehabilitate the landscape following a wildfire. In that critical time between the last wisps of smoke and the first drops of the coming rain, it is the SWIR-imaging capabilities of Landsat that may ultimately save a home or more importantly, a life.

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Figure 1. Landsat satellite images of the Cougar Creek fire northeast of Portland, Oregon, in mid-August 2015 were produced from Landsat 8. At left is a pre-fire image of Mount Adams in Washington. Snow appears cyan on its peak. The middle image is post-fire; the previous green vegetation south and east of the mountain is charred and appears in shades of red. The burn severity map at the right was produced with infrared imaging from Landsat, including the shortwave infrared (SWIR) band. Dark green within the burn perimeter is vegetation that did not burn. Light blue is low burn severity, yellow is moderate burn severity, and red is high burn severity.