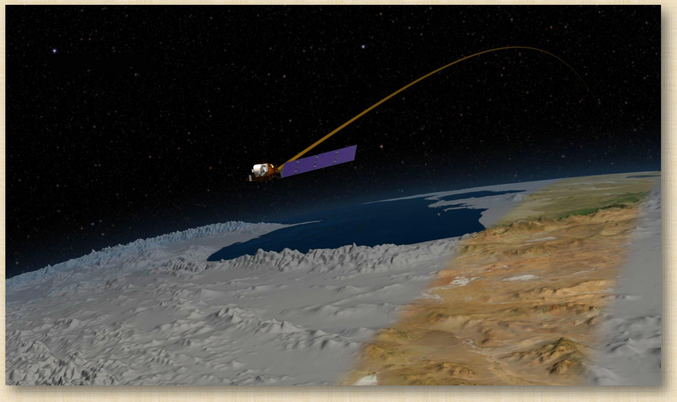
United States Department of Agriculture
Forest Service

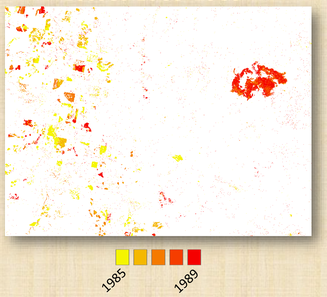
Landscape Change Monitoring System: A Time Machine for Mapping Landscape Change



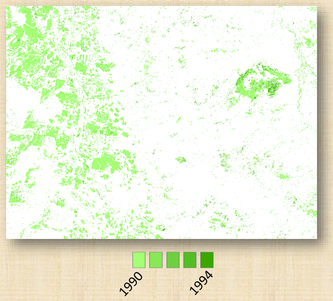
Building on a National Treasure

- Since 1984 the United States has consistently taken pictures of the Earth using a satellite system named Landsat.
- This record of what the Earth looks like is a treasure chest of information with nearly every location in the lower 48 states having 800 pictures taken.
- Using these images Forest Service researchers in collaboration with other federal and academic scientists have developed the Landscape Change Monitoring System (LCMS).
- LCMS is a consistent approach using the latest advancements in remote sensing science, “big data” statistical analyses, and cloud computing to produce maps of landscape change.
- LCMS produces annual maps of vegetation loss and gain over all federal, state, and private lands. The maps below are examples of LCMS vegetation loss and gain maps from adjacent 5-year time periods. Note gains mapped after the 1989 fire in the eastern portion of the sample area.

Losses 1985-1989

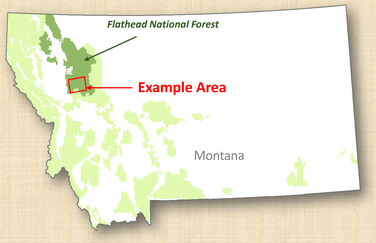


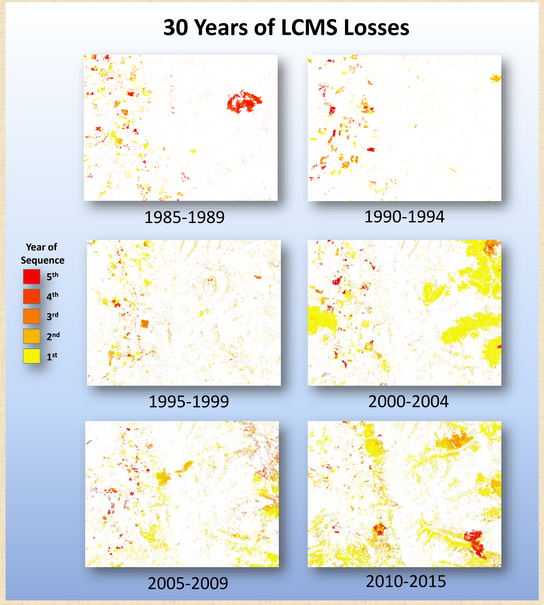
Gains 1990-1994



LCMS Map Products

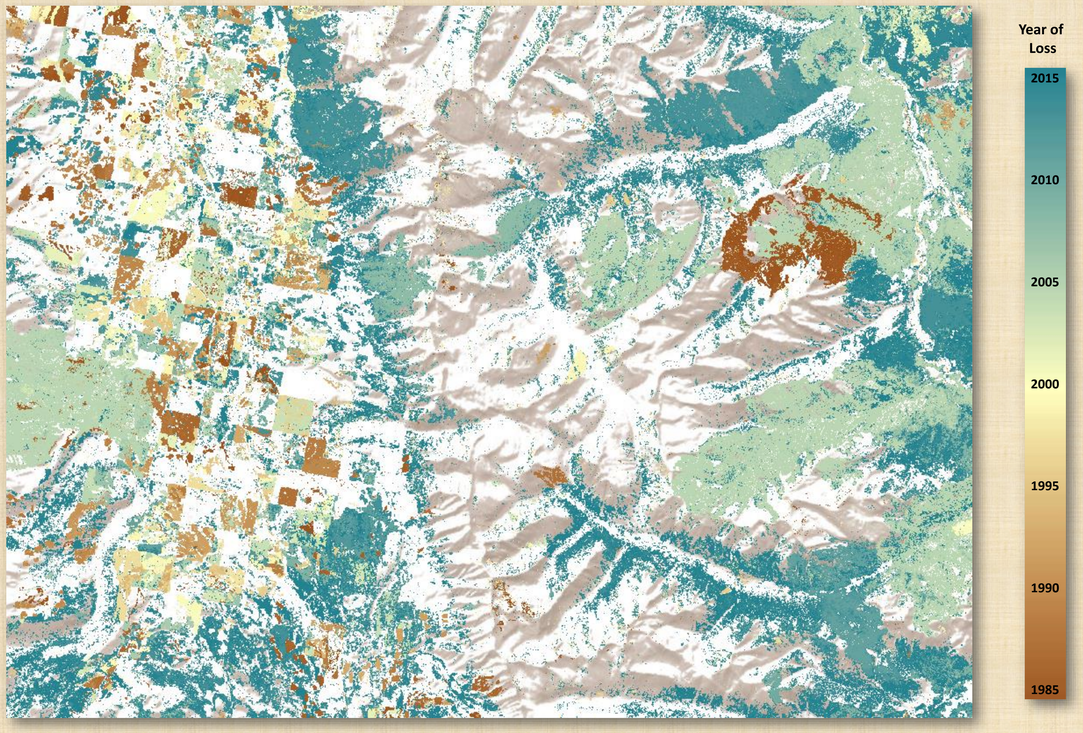
The LCMS data modernize intra- and inter-agency monitoring capabilities by creating annual change maps over all lands. These maps show where the satellites can detect either **loss or gain** of vegetation and can be viewed, analyzed, or summarized over any area of interest. The six maps to the right show 30 years of annual losses over 5-year increments for a portion of the Flathead National Forest in Montana (below). In each of the six maps the year of loss is symbolized by a color, yellow to red, with yellow being the first year and red the last year of the 5-year period.





30 Years of Landscape Change

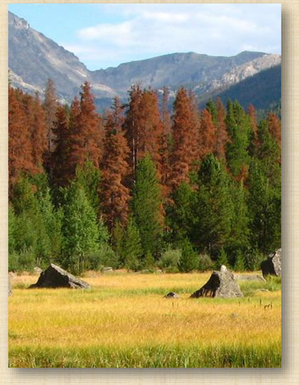
Using LCMS more than three decades of landscape changes can be mapped. The image below is one such result, showing losses from 1985-2015 over a part of the Flathead National Forest in Montana. For reference, the LCMS map is shown over greyscale shaded relief and year of loss symbolized in a color ramp from brown to light yellow to turquoise. Blocky forest harvest patterns from earlier in the time period can be seen in the western part of the image (brown to tan) and compact but irregularly shaped fires exist throughout the mapped period. Also evident are the widespread, less concentrated effects of mountain pine beetle damage later in the time series (turquoise).



Land Management Applications

Forest Management

Long term monitoring is required to understand how forest management and other factors are having an effect on the landscape. LCMS maps provide a consistent approach to account for the cumulative effects of forest management across all land ownerships.



National Forest Plans

Forest Service land management plans guide activities on all 174 National Forests and Grasslands. LCMS maps provide a consistent method to meet broader-scale monitoring needs over areas greater than a single National Forest or Grassland.

Wildfire

Wildland fire affects millions of acres of Federal, State, and private land each year. Projects such as the Monitoring Trends in Burn Severity (MTBS) characterize the extent and severity of large incidents, but do no map smaller fires or provide assessments of post-fire regeneration. Vegetation gain maps from LCMS provide an opportunity to consistently assess regrowth and identify areas that may require treatments.

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