



LANDSCAPE DYNAMICS MONITORING

IMPORTANCE – Landscape dynamics include patterns and processes that occur at various spatial and temporal scales across Sierra Nevada Network (SIEN) parks and surrounding lands. The SIEN parks are primarily designated Wilderness, thus large areas of the parks are remote and costly to access for collection of ground-based monitoring data. The use of remote-sensing through satellite imagery offers an opportunity to monitor change at multiple spatial scales, and improve our understanding of how large-scale stressors are affecting park resources. Fire and climate are major drivers in the Sierra Nevada, and they have a strong influence on plant community composition and vegetation distribution. Global climate change, air pollution, and altered fire regimes may cause large-scale change in vegetation pattern by affecting the condition, abundance, and distribution of plants. Changes in land use at the regional scale also may affect the condition of park resources by increasing air pollution and reducing undeveloped corridors for wildlife travel.



Figure 1. Tehipite Fire in Kings Canyon National Park. Fire is an important process of change in Sierra Nevada Network parks. Photo by Karen Folger.

LONG-TERM MONITORING – Oregon State University scientists worked with SIEN and Park staff to develop a protocol to monitor:

1. Landscape mosaics (vegetation and other land cover types such as wetlands, bare ground, and developed areas)
2. Fire regime characteristics (fire size, severity, frequency, and season)
3. Vegetation response to fire (over variable time frames and fire regime characteristics)
4. Vegetation condition (explore relationship to drought, insects, air pollution, disease)

The protocol uses Landsat Thematic Mapper imagery. Steps for applying this satellite imagery to address our monitoring objectives include: preprocessing and correcting raw imagery across different time periods, extracting information on landscape change from that imagery, dividing the results into time periods of consistent change, and identifying points when vegetation metrics first begin to trend upward or downward. The next step involves linking the change maps to existing vegetation maps or other ground-based data for interpretation.

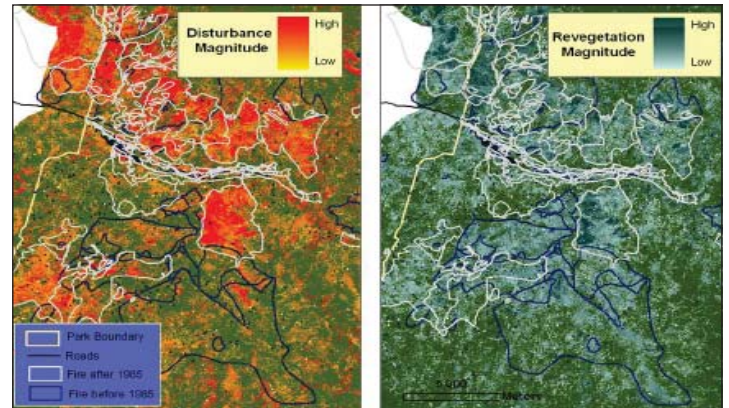


Figure 2. Landsat imagery showing fire disturbance magnitude for fires in Kings Canyon National Park (left) and revegetation (or regrowth of vegetation) magnitude post-burn (right) -- from Kennedy et al. (2010).

The results provide information on the start year, duration, and magnitude of change, as well as on starting values and relative change. The methods applied in this protocol allow detection of slow change over time, such as that occurring from climate change, disease, and gradual shifts in vegetation type; they also demonstrate abrupt changes like those caused by fire (see Figures 1 and 2) and the range of seasonal change driven by short-term variations in weather (Kennedy et al. 2010).

DISCUSSION – Monitoring landscape-scale change can provide park managers with a baseline against which to assess future changes in landscape structure and composition, and the ability to detect disturbances in remote Wilderness areas. Managers can also gain information on land-use activities near park boundaries and their potential impacts to park resources, which could provide useful information for working with other agencies and communities in formulating mitigation strategies.

WHERE MONITORED – Yosemite, Sequoia, and Kings Canyon National Parks, and Devils Postpile National Monument.

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