



Natural Resource Monitoring at Cedar Breaks National Monument



Cedar Breaks Amphitheater

The Northern Colorado Plateau Network

The Northern Colorado Plateau Network (NCPN) covers a geologically and biologically diverse region comprising 16 national parks in four western states. These parks contain desert grasslands, shrublands, forests, caves, large rivers, perennial streams, seeps, springs, and striking geology. Invasive plants, trampling and grazing by livestock, and adjacent land-use activities are some of the most significant threats to NCPN parks. The NCPN is designing and implementing a long-term monitoring program to measure key indicators of ecological integrity, or “vital signs.” Multiple monitoring efforts will help inform managers of the health of park resources and provide early detection of potential problems. This brief describes recent NCPN activities at Cedar Breaks National Monument.

Vegetation Mapping



Bureau of Land Management, Hegwood

Woods' rose.

The NCPN recently completed a multi-year, multi-partner effort to map vegetation at Cedar Breaks NM. This project included gathering aerial photography, collecting initial vegetation-plot data, using the vegetation data to classify vegetation types and write descriptions, writing a vegetation-type key, performing photo interpretation, conducting an accuracy assessment, creating a geodatabase, and writing the final report. The team collected vegetation and environmental data from 172 vegetation classification plots and 110 observation points. A total of

1,195 map polygons representing 20 natural and semi-natural vegetation map classes were developed for the project, which achieved an overall mapping accuracy of 88.1%. The most common map class was Subalpine fir - Engelmann Spruce Forest Complex, with 240 polygons covering 25.6% of the mapping area. These maps will be a valuable resource for use in park management, resource monitoring, interpretive programs, planning, and prescribed fire, and as a baseline for designing ecological studies. All final products were delivered to park staff in summer 2011.

Uplands



Leopard lily (*Fritillaria atropurpurea*).

NCPN uplands monitoring is intended to strike a balance between increasing fundamental understanding of these systems and providing managers with early warning of undesirable change. This protocol measures plant community characteristics, including vegetation and surface cover, density of woody species, canopy closure, and fuels. Through discussions

with park staff, the dominant vegetation types that occur above the rim (subalpine meadows, spruce-fir forests, and aspen forests) were selected for integrated uplands monitoring at Cedar Breaks NM. In 2009, the NCPN completed the first year of data collection at the monument. Network staff returned for a third season of monitoring in 2011.

Climate

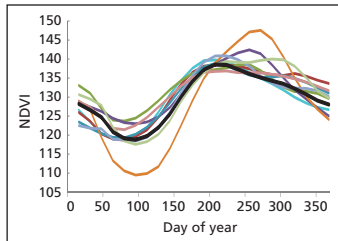


Temperature sensor.

The overarching goal of NCPN climate monitoring is to compile and present climate data in a form that helps us to understand the reasons for trends seen in other network vital signs. The NCPN compiles and analyzes climate data from one weather station near Cedar Breaks NM, at Midway Valley. In 2010, mean annual maximum temperature tended to be below average throughout much of the NCPN region, while mean annual minimum temperature, precipitation, and snowfall were above long-term

averages. Most stations with long observation periods show a general increase in average annual minimum temperature over the past 30–50 years. There is evidence for a declining trend in snowfall from the 1980s to the mid-2000s; however, snowfall in 2010 and during the previous couple of years was higher than the long-term average. A climate report was produced by the NCPN and posted on the network's web site in 2011.

Land Condition

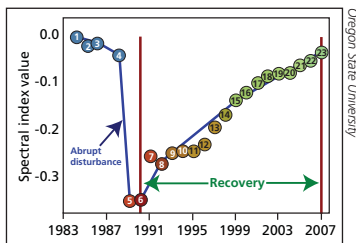


Annual NDVI curves stacked for inter-annual comparison, Cedar Breaks NM, 2000–2009.

The NCPN and U.S. Geological Survey have developed remote-sensing methods to improve understanding of how broad-scale vegetation condition responds to short-term weather events, long-term climate trends, land use, and geographic position. The satellite-derived Normalized Difference Vegetation Index (NDVI) and snow-cover imagery, available bi-weekly, are used to measure vegetation greenness and

snow-covered area through time. In 2011, the NCPN published its first status and trends report on remote sensing of vegetation phenology and snow-cover extent in NCPN parks, covering the years 2000–2009. The maximum NDVI greenness at Cedar Breaks NM in 2009 (black line in chart) was 4.4% below the nine-year average.

Land Cover and Land Use



Spectral index showing landscape disturbance and recovery over time.

The composition and connectivity of land-cover types determine habitat availability, energy and material flows, and the movement of organisms on a landscape. Disturbance-based changes in landscape structure can be detected by evaluating imagery representing conditions across many years. Using a time series of remotely sensed imagery collected annually from Landsat satellites, it is now possible to determine spatial extent, rate, direction, duration, and relative magnitude of vegetation-cover change for some ecosystems. Detectable changes include both rapid and gradual change

due to fire and drought stress, as well as growth and recovery processes. Cooperators at Oregon State University have analyzed 25 years of Landsat imagery and developed new analysis techniques for arid ecosystems. Pinyon-juniper dynamics at Dinosaur NM are currently being examined; after this work is complete, we will determine the utility of applying these techniques at other NCPN parks. We are also evaluating this technology for application to riparian ecosystems and grazed versus ungrazed environments.

Air Quality



Park airshed.

Understanding changes in air quality can aid in interpreting changes in other monitored vital signs and support evaluation of compliance with legislative and reporting requirements. The NCPN acquires and analyzes air quality data from existing stations in and near NCPN parks. The network's second air quality report

was produced in 2010. For Cedar Breaks NM, the report focused on visibility monitoring, as determined from data obtained at nearby Bryce Canyon NP. Visibility was estimated to be in moderate condition at the park, and has been improving on clear days. The park is currently meeting its 2009 GPRA goal for visibility.

For more information

Northern Colorado Plateau Inventory & Monitoring Program
National Park Service
P.O. Box 848
Moab, UT 84532
435-719-2346
<http://science.nature.nps.gov/im/units/ncpn/>

