



Natural Resource Monitoring at Bryce Canyon National Park

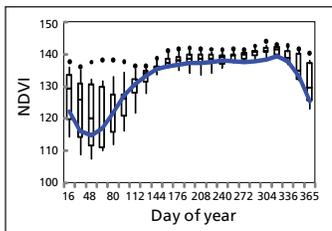


Bryce Canyon National Park (©A. Wondrak Biel)

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 Bryce Canyon National Park.

Land Condition



Normalized Difference Vegetation Index values for Bryce Canyon NP in 2009, plotted with historical ranges.

The NCPN and U.S. Geological Survey have developed remote-sensing methods to study how broad-scale vegetation condition responds to short-term weather patterns, long-term climate trends, land use, and geographic position. Understanding vegetation response enhances knowledge of the biological ecosystems and physical processes affected by vegetation productivity and distribution. The Normalized Difference Vegetation Index (NDVI) is a measure of vegetation greenness, or productivity, derived

from satellite imagery. Although the timing of green-up was approximately the same as the 9-year average, 2009 was one of the least productive of the last 10 years, based on sustained seasonal greenness. In mid-July, the Bridge Fire burned about 5.6% of the park area, which may in part explain why the NDVI values for the growing season were slightly below average. End of season brown-down occurred slightly sooner than in previous years.

Water Quality



Sheep Creek watershed (NPS)

The NCPN is conducting long-term water quality monitoring at selected sites in Bryce Canyon NP. Data are used to determine compliance with the Clean Water Act and monitor trends in water quality that may impact visitors as well as the ecological function of aquatic systems. Data available since 2006 indicate that both Sheep Creek and Yellow Creek have excellent water

quality. Infrequent *E. coli* contamination occurred at each site, but did not exceed the acute standards for drinking water or recreation. The park has repaired boundary fences to eliminate cattle trespass. After a 2009 wildfire burned a portion of the Sheep Creek watershed, monitoring at this site was reinitiated.

Landbirds



Black-throated sparrow (©Greg Lavaty)

The NCPN is partnering with the Rocky Mountain Bird Observatory to assess breeding bird species trends in three habitats: riparian, pinyon-juniper, and sagebrush-shrubland. In 2009, the fifth year of monitoring was completed, including one plot in pinyon-juniper woodland and two in sagebrush-shrubland at Bryce Canyon NP. We currently estimate that we will be able to detect a population change of at least 3% within 30 years for 55 species, representing

more than 90% of all individual birds observed thus far. To date, only one species is showing a consistent annual decline in NCPN parks: mourning dove, in low-elevation riparian areas. Three species have shown consistent annual increases: black phoebe and black-throated sparrow, both in low-elevation riparian habitat, and dusky flycatcher, in sage-shrubland. This trend information is preliminary.

Air Quality



Bryce Canyon NP airshed (IMPROVE)

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 NCPN parks. The network's first air quality report was produced in 2009. For Bryce Canyon NP, the report focused on wet deposition and visibility monitor-

ing. Based on five-year averages, the park has sulfur levels in good condition, while nitrogen levels are in moderate condition. Visibility, the most sensitive air quality-related value at Bryce Canyon NP, is estimated to be in moderate condition, and has been improving on clear days. The park is currently meeting its 2008 GPRA goals for deposition and visibility.

Climate

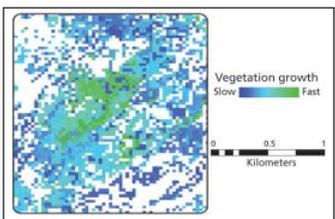


Climate station (NPS)

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 five weather stations in Bryce Canyon NP. In 2009, average annual maximum temperatures tended to be below average throughout much of the NCPN region. Precipitation in 2009 was noticeably below long-term averages for 20 of 23 stations with valid precipitation totals.

Snowfall was somewhat less than long-term averages at many stations. Most stations with long observation periods show a general increase in average annual minimum temperature over the past 29–49 years. Conversely, there is evidence for a declining trend in snowfall over the past 20–25 years. Bryce Canyon NP climate data for the years 1948–2009 are available in an interactive, graphical format on the NCPN web page. A climate report, produced by the NCPN in 2010, is also available on the network's web site.

Land Cover and Land Use



Vegetation growth rates, 1984–2002.
Oregon State University

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, with newly developed image analysis techniques, 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. In the near term, this project will focus on park-specific issues of management concern related to cheatgrass invasion and changes in pinyon-juniper cover.

Additional Efforts

The NCPN is continuing to expand ecological monitoring at Bryce Canyon NP. A protocol for monitoring uplands is underway and planned for implementation in 2010, focusing on high-

elevation mixed conifer forests and pinyon-juniper woodlands. The park's list of natural resource inventory needs was updated in 2009.

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/>

