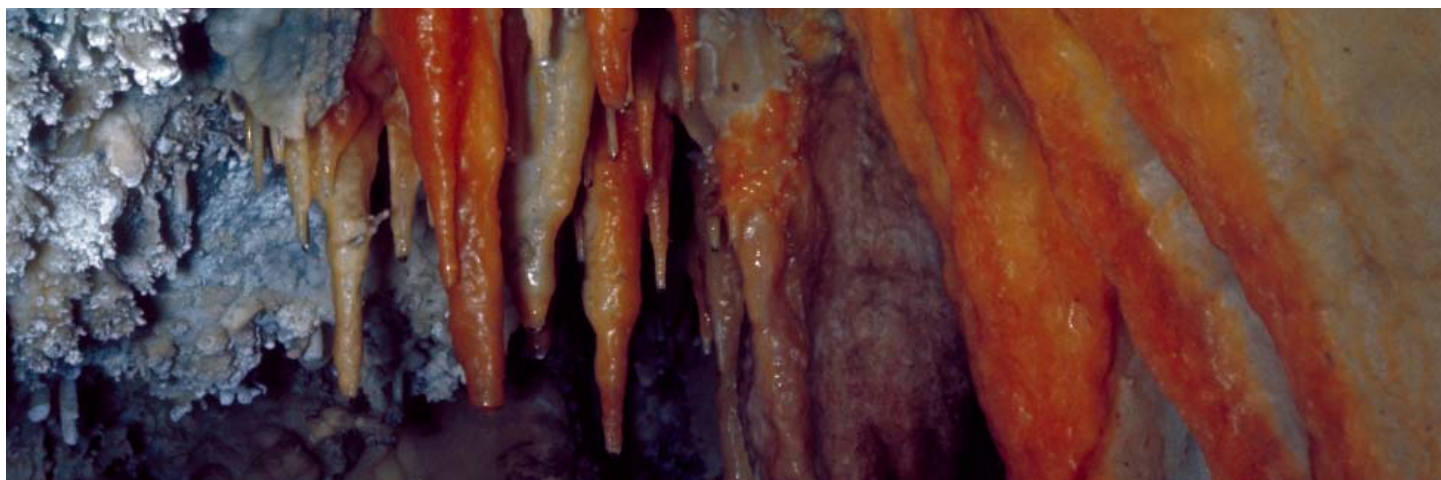




Natural Resource Monitoring at Timpanogos Cave National Monument



Timpanogos Cave/NPS

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 Timpanogos Cave National Monument.

Flora Checklist



Sego lily.
Sheri Hagwood@USDA-NRCS PLANTS Database

In 2008, a revised checklist of the vascular flora of Timpanogos Cave NM was completed. This entailed a thorough review of existing literature, re-examination of specimens from the Timpanogos Cave NM herbarium and other state and national museum collections, and additional field work to corroborate unverified species reports and locate new species. Based on this study, 235 vascular plant taxa have been confirmed or reliably reported as occurring

in the monument. Another 37 species formerly considered part of the monument flora have now been shown to be falsely reported. Although no plant taxa are federally listed as threatened or endangered, at least 8 are considered species of concern by the state’s natural heritage program. Introduced plants make up 27% of the monument flora (63 species), of which only three species are considered noxious weeds by the State of Utah.

Water Quality



Cave environment/NPS

At Timpanogos Cave NM, the NCPN cooperates with the State of Utah and park staff to collect water quality data used to assess condition and trends relative to the Clean Water Act, human health, and ecological function of cave environments as well as the American Fork River. Available data for the American

Fork River prior to 2005 indicate good water quality, and the first six months of monitoring at two cave sites indicated no signs of water quality impairment. The NCPN has built a robust flow-monitoring device that will be used to evaluate drip rates from a stalactite over time.

Uplands



Uplands/NPS

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 soil and site stability, hydrologic function, biotic integrity, and vegetation composition and structure. In cooperation with park staff,

discussions to determine which vegetation types to include in the monitoring effort took place in 2008. As a result, subalpine meadows, Gambel oak woodlands, and mixed conifer forests are being considered for integrated uplands monitoring at Timpanogos Cave NM. The NCPN will begin to implement uplands monitoring at Timpanogos Cave NM in 2009.

Climate

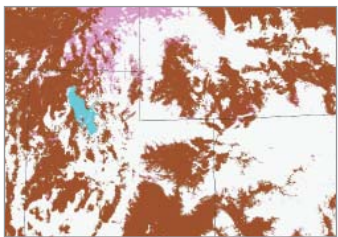


Rainy day (NPS/J. Jasper)

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 two weather stations in Timpanogos Cave NM, which is one of seven NCPN parks that have shown an increase in average maximum annual temperature, and a decrease in average annual snowfall, over the past 43 years or more. The average maximum high for 2007 was 65.6°, the fourth-highest average ever re-

corded for this station. Precipitation for 2007 was 10.2 inches, the sixth-lowest amount ever recorded for this station. In 2007, maximum and minimum temperatures were generally above average, and snowfall below average, at climate stations across the network. Timpanogos Cave NM climate data for the years 1946–2007 are available in an interactive, graphical format on the NCPN web page. A climate report, produced by the NCPN in 2008, is also available on the network's web page.

Land Condition

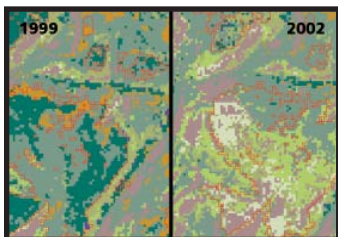


Northern Utah snowpack, 2/2007.
MODIS image

Information on landscape-scale plant vigor and productivity (land condition) is key to understanding natural and human-caused ecosystem changes. Land condition monitoring involves the use of the MODIS (MODerate Resolution Imaging Spectroradiometer) satellite imagery. A measure of vegetation productivity, Normalized Difference Vegetation Index (NDVI), is calculated over time to estimate the start and end of the growing season,

the time of peak production, and seasonal productivity. This coarse-scale assessment of land condition can reveal important trends in the overall health of a park and surrounding ecosystem. Draft protocols for land condition monitoring will be implemented as pilot projects at Fossil Butte NM and Bryce Canyon NP in 2009. Pending these results, the NCPN will move forward with implementation at all 16 network parks in future years.

Land Cover and Land Use



Example fire-effects map.
USDA Forest Service

The composition, configuration, and connectivity of land-cover types determine habitat availability, energy and material flows, and the movement of organisms on a landscape. Changes in landscape structure due to natural and human-caused disturbances can be detected by evaluating imagery representing conditions across many years. Custom algorithms are being refined to unambiguously separate long-term change from seasonal and

annual phenological changes due to variations in weather. These data will provide park managers with a baseline against which to assess future changes in landscape structure and composition; the ability to detect large-scale disturbances in remote areas; and information on land-use activities along park boundaries. A pilot report is expected in May 2009, with protocols and standard operating procedures to follow.

For more information

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