



Integrated Upland Monitoring

Importance

Uplands represent the vast majority of land area in the Northern Colorado Plateau Network (NCPN), and include rock outcrops, badlands, shrublands, grasslands, woodlands, and forests. Upland vegetation provides energy to other trophic levels, habitat structure for various organisms, and is a significant component of species diversity. The ability of uplands to retain soil and nutrients, absorb and release water, and buffer high-runoff precipitation events is a major influence on riparian condition. Upland ecosystems are easily disturbed and slow to recover, yet several NCPN units contain relatively undisturbed examples of grasslands and shrublands. Historic land uses include livestock and timber production; more recently, recreational use has increased. To effectively manage uplands, the National Park Service needs to know the impacts of these uses.

Long-term Monitoring

Integrated upland monitoring includes measuring soil stability, hydrologic function, biological soil crusts, and vegetation composition and cover. The NCPN uses a complex survey design to select randomized sampling plots that are visited in two consecutive years, followed by a relatively long interval between revisits (5–10 years). This design minimizes the chances that sensitive, arid-ecosystem plots will be damaged by repeated visits in successive years and is a cost-effective way to estimate the health of upland ecosystems across a large area. NCPN upland monitoring is intended to strike a balance between increasing fundamental understanding of these systems and providing managers with early warning of undesirable change.



Highly pinnated biological soil crust at Canyonlands National Park.



An NCPN ecologist enters data into a field laptop.

Status and Trends

The NCPN initiated upland monitoring in 2006. By the end of the 2009 field season, the network will have plots established in Black Canyon of the Gunnison, Canyonlands, and Capitol Reef national parks; Curecanti National Recreation Area; and Cedar Breaks, Dinosaur, and Timpanogos Cave national monuments. In order to optimize upland monitoring and ensure that we are sampling the appropriate number of plots to detect trends, field crews perform pilot monitoring in most park units. Pilot sites are sampled for three consecutive years to estimate variability of ecosystem measures. Canyonlands NP is the first unit with three years of data available for this type of analysis. In spring 2009, pilot data were analyzed and, based on the results, a long-term monitoring design was selected for that park. In addition, data from the 2008 field season were summarized in annual reports for Canyonlands and Capitol Reef national parks. After five years of monitoring at any park, the NCPN will perform more detailed analyses to identify trends.

Contact

Dana Witwicky, Dana_Witwicky@nps.gov

Network park units where uplands are monitored

Arches NP	Cedar Breaks NM
Black Canyon of the Gunnison NP	Curecanti NRA
Bryce Canyon NP	Dinosaur NM
Canyonlands NP	Timpanogos Cave NM
Capitol Reef NP	Zion NP

NP = National Park; NM = National Monument; NRA = National Recreation Area

A Closer Look at Management Questions Driving Upland Monitoring

Before initiating monitoring in a park unit, NCPN staff meets with park managers to determine how the network's monitoring design can address the park's most critical issues. While many NCPN park managers have identified the possible effects of climate change and the effects of human social trails as high on the list of questions to be answered, others are most interested in (1) how current grazing affects upland ecosystems and (2) how plants and soil respond when livestock grazing ceases. Much of the NCPN's upland monitoring effort is dedicated to investigating these issues.

Nearly all NCPN park units were historically grazed by livestock. Most grazing ceased shortly after the NPS acquired park lands, but four units (Black Canyon of the Gunnison and Capitol Reef national parks, Curecanti National Recreation Area, and Dinosaur National Monument) still have active grazing allotments within their boundaries. The survey designs for these parks are intended to allow comparisons between grazed and ungrazed areas. The primary ecosystems used for livestock grazing in NCPN park units are grasslands and sagebrush shrublands.

Although it is too early to detect trends, we expect elevation and precipitation to be important variables affecting vegetation response to livestock grazing. Higher-elevation sagebrush sites receive more precipitation and appear to be more resilient to grazing than lower-elevation sagebrush sites, which receive



NPS

Capitol Reef National Park is one of four NCPN units with active grazing allotments.

less precipitation and are more susceptible to invasion by exotic species. Several years of sampling will be necessary before we can determine the veracity of these and other hypotheses and provide scientific data that resource managers can use to make well-informed decisions on how to best manage their parks.

Recovery from Fire and Grazing Disturbances: A Site Comparison



NPS PHOTOS

One question that NCPN upland monitoring seeks to answer is whether some types of sites are more resilient to disturbances than others. These two photos, both taken in Dinosaur National Monument, demonstrate differences between the range of sites that the NCPN is monitoring. Both photos contain sagebrush stumps, illustrating the regular cycle of fires that naturally occur in this system. The photo on the left is a high-elevation, ungrazed sagebrush ecosystem. Here, native bunchgrasses thrive less than 10 years after the most recent fire and the system has a diversity of native plants. The photo on the right shows a low-elevation sagebrush ecosystem that is also currently ungrazed. Here, however, cheatgrass has invaded, and sagebrush has not returned even 22 years after the last fire. Few native bunchgrasses remain, and overall plant diversity is substantially less than at the high-elevation site shown on the left. By incorporating a wide range of grasslands and shrublands at different elevations, the NCPN hopes to learn how these systems respond to natural and anthropogenic disturbances over time.