



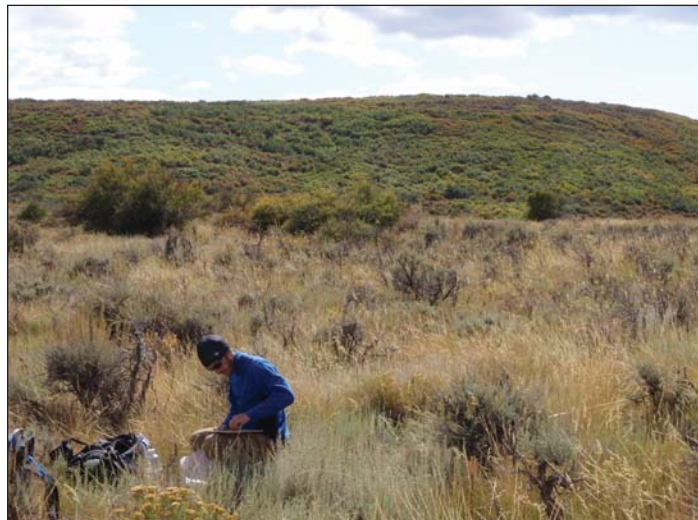
Integrated Uplands Monitoring

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 uplands monitoring includes measuring soil stability, hydrologic function, biological soil crusts, and plant community characteristics. 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 (3–6 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 uplands monitoring is intended to strike a balance between increasing fundamental understanding of these systems and providing managers with early warning of undesirable change.



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Uplands monitoring plot.

Status and Trends

The NCPN initiated uplands monitoring in 2006. By the end of the 2011 field season, the network will have established plots in all 10 park units where uplands are monitored. To optimize uplands monitoring and ensure that we are sampling the appropriate number of plots to detect trends, pilot sites are sampled for three consecutive years in most park units, to estimate variability of ecosystem measures. In 2011, a power analysis was conducted on this data from Black Canyon of the Gunnison NP and Curecanti NRA to identify an “affordable” sample size that optimizes tradeoffs between trend and status estimation and overall operational reality. A survey and revisit design has been created for the park units based on this analysis. In addition, data from the 2010 field season will be summarized in annual reports for Arches, Black Canyon of the Gunnison, Bryce Canyon, Canyonlands, and Capitol Reef national parks; Cedar Breaks, Dinosaur, and Timpanogos Cave national monuments; and Curecanti NRA. After at least five full years of monitoring at any park, the NCPN will perform more detailed analyses to identify trends.

Contact

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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

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The NCPN initiated uplands monitoring at Arches NP in 2010.

Monitoring Gambel Oak/Mixed Montane Shrublands

Gambel oak/mixed montane shrublands are one of the predominant vegetation types in the southwestern U.S. These communities are found on rocky soils at elevations of 6,200–8,700 feet, where rainfall averages between 12 and 25 inches per year. They usually occur just above pinyon-juniper woodlands and below ponderosa pine or aspen forests, although they may also exist at lower elevations on canyon walls. Mixed montane shrublands are dominated by Gambel oak (*Quercus gambelii*), serviceberry (*Amelanchier utahensis*), snowberry (*Symphoricarpos oreophilus*), and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*). They form dense stands of tall shrubs that tend to have high species richness and high cover of native perennial grasses and forbs. Gambel oak/mixed montane shrublands provide cover and nesting habitat for many forms of wildlife (e.g., birds, mammals, amphibians) and good winter habitat for deer. Gambel oak is highly adapted to living with fire, and resprouts from the roots after the shoots are burned.

NCPN resource managers are interested in the general health of mixed montane shrublands and, especially, in the health of Gambel oaks. In 2000, scientists discovered a new Phytophthora pathogen that began attacking tan oaks and coast live oaks in California five years earlier and causing Sudden Oak Death.

Although Sudden Oak Death is not known to affect Gambel oaks, resource managers would like to monitor this species so that any signs of new pathogens can be detected early.

Compared to the other dominant ecosystems in the region (e.g., semiarid grasslands, sagebrush shrublands, pinyon-juniper woodlands, mixed conifer forests, and aspen forests), Gambel oak/mixed montane shrublands are understudied and rarely monitored in a long-term manner. This may be in part due to the difficulty of sampling in tall, dense shrubs. Because we could not identify any examples of long-term monitoring methods for Gambel oak/mixed montane systems, standard methods developed for grasslands, woodlands, and forests will be adapted for this purpose. The NCPN has developed sampling methods that use a reduced plot size with three 20-m transects (less than half the length of transects for other vegetation types), with standard vegetation measurements concentrated within. Due to the clonal nature of Gambel oak and the difficulty distinguishing individuals, as well as the large size of other mixed montane shrubs, density counts are not performed. Gambel oak/mixed montane shrublands are monitored in Black Canyon of the Gunnison NP, Curecanti NRA, Timpanogos Cave NM, and Zion NP.



Clockwise from top left: Utah serviceberry (©Patrick J. Alexander), Gambel oak (©Patrick J. Alexander), mountain big sagebrush (Gary A. Monroe@USDA-NRCS PLANTS Database), Gambel oak/mixed montane shrubland at Black Canyon of the Gunnison NP (both; NPS).