



# Monitoring Upland Vegetation and Soils

### Importance

Vegetation and soils are the foundation upon which all terrestrial ecosystems are built. Soils provide the medium for the storage and delivery of water and nutrients to plants, which in turn provide animal populations with both habitat and food. Vegetation affects the spatial distribution of soil resources through processes such as nutrient uptake, litter deposition, and control of overland water flow. These interactions result in a tight linkage between the spatial patterning of vegetation and soils—especially in dryland ecosystems, where both water and nutrients are limiting. In addition, degradation of one of these resources can cause deterioration in the other; a drought might cause die-back of vegetation, resulting in increased erosion and further degradation of plant communities. In the semi-arid uplands of the Colorado Plateau, it is necessary to monitor soil stability as well as vegetation composition and structure in order to track changes in ecosystem condition.

Taking a soil core in a grassland plot, Wupatki National Monument.



Sampling vegetation in mixed-conifer forest at the North Rim, Grand Canyon National Park.

### Long-term Monitoring

In 2007, the Southern Colorado Plateau Network (SCPN) began long-term monitoring of vegetation and soils in five national parks, focusing on the predominant ecosystems of greatest concern to park managers. Permanent half-hectare plots were established in each of these parks to measure species frequency and abundance, forest structure, amount of exposed soil, and soil stability.

These plots will be monitored annually over the next three-to-five years in order to estimate spatial and temporal variability in the vegetation and soils attributes that we are tracking. At that time, we will determine how many plots are required to detect trends, and how frequently those plots will be revisited. Over the next few years, additional monitoring plots will be established in all 15 SCPN parks where upland vegetation and soils monitoring will occur.

### Management Applications

The legacy of past livestock grazing, altered fire regimes, adjacent land-use activities, and climate change are the major issues relating to the condition of upland ecosystems within SCPN parks. Other human stressors include visitor use, exotic plant invasions, and air pollution.

The first several years of monitoring data will be used to describe current conditions for upland vegetation and soil

resources. Over time, the data will be used to detect changes in the condition of upland ecosystems that could result from one or more of the stressors listed above. Understanding these trends will help park managers as they manage upland ecosystems and respond to emerging park issues.

### Contact

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#### Network park units where uplands are being monitored

Park	Monitored ecosystems
Aztec Ruins NM	Grassland/Shrubland
Bandelier NM	Mixed-Conifer Forest; Pinyon-Juniper Woodland
Chaco Culture NHP	Grassland/Shrubland
Grand Canyon NP	Mixed-Conifer Forest; Pinyon-Juniper Woodland
Mesa Verde NP	Pinyon-Juniper Woodland
Petrified Forest NP	Grassland/Shrubland
Petroglyph NM	Grassland/Shrubland
Wupatki NM	Grassland/Shrubland

Priority ecosystems for monitoring have yet to be determined for seven parks: Canyon de Chelly NM, El Malpais NM, El Morro NM, Glen Canyon NRA, Navajo NM, Sunset Crater NM, and Walnut Canyon NM.

NP = National Park; NM = National Monument; NHP = National Historical Park