



Integrated Uplands



Establishing a plot in the sagebrush shrub steppe community at Great Basin National Park, 2021. NPS photo / Joseph Ladd.

Background

Mojave Desert Network (MOJN) parks encompass a wide range of habitats and upland plant communities, from saltbush and creosote bush communities at low elevations to bristlecone pine forests at the highest elevations. The presence and composition of plant species depends on many factors, including climate, water, nutrients, and soil microbes. This makes vegetation (and the soils associated with it) a good general indicator of environmental change.

What are the Threats and Why do We Care?

Upland vegetation communities provide essential “ecosystem services” such as soil conservation, carbon storage, and wildlife habitat. Many of the desert habitats found in MOJN parks are also characterized by “biological soil crusts,” living collections of blue-green-algae, lichens, and mosses, that live in the top few millimeters of soil. These biological soil crusts provide nutrients, help prevent soil erosion, and slow water loss.

Vegetation communities in MOJN parks are vulnerable to a variety of threats. Climate models predict increasing temperatures and decreasing precipitation in the southwestern U.S. Researchers expect many species in these areas to have range shifts, likely moving up in elevation to escape the warmer temperatures. This can lead to changes in species associations and community composition. Water availability will also become an increasing driver of plant community shifts, as timing and amount of precipitation is expected to change with increasing temperature. In desert environments, this can greatly affect annual plant species and may increase the spread of invasive plant species.

Air quality, human water use, and altered disturbance regimes (such as fire, grazing, and development) also threaten MOJN park vegetation communities, as does the introduction of invasive species. Non-native plants can displace native species, and non-native animals can overgraze or trample native vegetation. Some invasive plants, like red brome, pose significant threats to

ecosystems because they can lead to an increase in wildfire frequency.

Monitoring Upland Vegetation

Given the large size of most of the MOJN parks and financial and logistical constraints, we monitor one shrub community in each park. Park resource managers were also interested in addressing questions pertaining to and monitoring change within specific communities rather than park-wide vegetation. Since shrub communities collectively cover large areas in MOJN parks (and include several communities of interest such as Joshua tree, creosote bush, and sagebrush), we selected them as the vegetation community type to study.



Taking a repeat photograph of the creosote bush—white bursage shrub community at Lake Mead National Recreation Area, 2020. NPS photo / Kyle Smith.

Objectives

The goal of this monitoring protocol is to detect long-term environmental change, provide insights into the ecological consequences of change, and help park managers determine if observed changes indicate a need to adjust management practices. Our primary monitoring questions are:

- 1) How are structure and composition of vegetation changing over time?
- 2) How are soil surface properties changing over time?

- 3) How are the abundance, structure, and composition of biological soil crusts changing over time? and
- 4) What relationships are observed between soil properties, invasive species, and plant community characteristics?

Sample Design

One shrub community in each MOJN park was selected for monitoring, within which 35 sample sites were randomly distributed. Established sites are sampled on a three-year rotation. During a sampling visit, we collect data on shrub species and their life form, structure, and relative abundance; soil erosion and surface disturbance; biological soil crust composition and function; and targeted invasive plant species distribution and abundance.

Integrated Upland monitoring began in 2013 and is conducted in Grand Canyon-Parashant National Monument, Great Basin National Park, Joshua Tree National Park, Lake Mead National Recreation Area, Manzanar National Historic Site, and Mojave National Preserve and will soon be in Death Valley National Park.

Management Applications

Integrated Upland monitoring will provide park managers with information that:

- Helps them to make informed decisions and work more effectively with other agencies and individuals for the benefit of park resources.
- Provides early warning of degraded conditions in park resources and supports developing effective mitigation measures, thus reducing management costs.
- Provides better understanding of the dynamic nature of park ecosystems.
- Furnishes data to meet legal and congressional mandates related to natural resource protection and visitor enjoyment.
- Can be shared with the public to enhance visitor experience and contribute to protecting these communities.

More Information:

The protocol [narrative](#) and [standard operating procedures](#) (SOPs) for spring vegetation monitoring were published in 2018 (SOPs were updated in 2020).

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To learn more about the Mojave Desert Network Inventory and Monitoring Program, please visit our website at: <https://www.nps.gov/im/mojn/index.htm>

