Sonoran Desert Network
Monitoring Brief

National Park Service
U.S. Department of the Interior

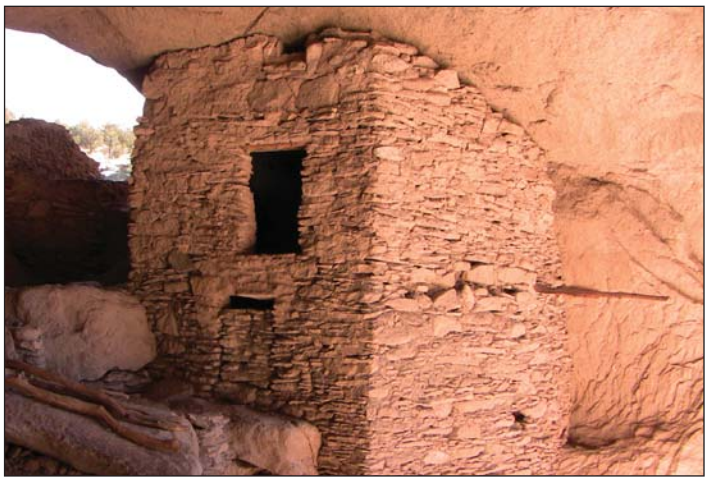
Intermountain Region
Inventory & Monitoring Program

2010

Uplands Monitoring at Gila Cliff Dwellings NM

Importance

Generating more than 99.9% of Earth's biomass, plants are the primary producers of life on our planet. Vegetation represents much of the biological foundation of terrestrial ecosystems, and it comprises or interacts with all primary structural and functional components of these systems. Vegetation dynamics can indicate the integrity of ecological processes, productivity trends, and ecosystem interactions that can otherwise be difficult to monitor. In the Sonoran Desert and Apache Highlands ecoregions, vegetation composition, distribution, and production are highly influenced by factors that include soil texture, mineralogy depth, and landform type. As such, a fundamental understanding of soils and landforms is essential for evaluating vegetation patterns and processes.



NATIONAL PARK SERVICE

Gila Cliff Dwellings National Monument.

Monitoring Effort

The overall goal of the Sonoran Desert Network (SODN) terrestrial vegetation and soils ("uplands") monitoring program is to detect broad-scale changes in vegetation and soils within the context of changes in other ecological drivers, stressors, processes, and resources of interest.

Specific, measurable objectives for uplands monitoring at Gila Cliff Dwellings National Monument (NM) are to determine the status of and detect trends, over five-year intervals, in:

1. Terrestrial *vegetation cover* for common (≥10% absolute canopy cover) perennial species, including non-native plants, and all plant lifeforms (for example, see figure, next page).
2. Terrestrial *vegetation frequency* of uncommon (<10% absolute canopy cover) perennial species, including non-native plants.
3. Terrestrial *soil cover* by substrate classes (e.g., bare soil, litter, vegetation, biological soil crust, rock fragments of several size classes) that influence resistance to erosion.
4. Terrestrial *soil stability* of surface aggregates by stability class (1–6).

Status and Management Concerns

In September 2010, SODN published a report summarizing the results of the first season of uplands monitoring at Gila Cliff Dwellings National Monument (NM), in southwestern New Mexico (Hubbard et al. 2010). The report focused on current status, with trend evaluations to commence after the next sampling period in 2014. Ten permanent monitoring sites in two elevation strata (4,500–6,000' and >6,000') were established and sampled in 2009. Results revealed a mesa-and-canyon landscape in which local topography, rather than elevation, is the primary mediator of plant water status.

Exotic species

Preventing the spread and dominance of exotic plants is an important goal at the park. Two exotic species, common mullein (*Verbascum thapsus*) and silversheath knotweed (*Polygonum agrycoleon*), were found at 40% and 10% of sites, respectively, but with very low cover. Although neither species is currently outcompeting native flora, continued vigilance toward potential invasions of exotic plant species is recommended.

Erosion

Uplands areas of the park appear to be free of substantial soil erosion, although a few sites had evidence of sheet flow and rill development. Soil surfaces are currently well-armored, with less than 3% of the soil surface consisting of unprotected, bare mineral soil. However, the majority of the resistant soil cover is composed of vegetation, leaf litter, and duff—materials that could be rapidly lost following wildfire or prolonged drought. Also, surface soil aggregates are relatively unstable, suggesting the potential for substantial soil loss if protective cover is lost. As soil erosion has important consequences for natural and cultural resources at the park, this is an important consideration.

Management Assessment Points

To achieve the National Park Service's core mission of resource protection, resource management and monitoring must be explicitly linked. Management assessment points, which are "preselected points along a continuum of resource-indicator values where scientists and managers have agreed to stop and assess the status or trend of a resource relative to program goals, natural variation, or potential concerns," can serve as a bridge between science and management (Bennetts et al. 2007). Management assessment points are intended to serve as a potential early warning system encouraging scientists and managers to pause, review available information, and consider options. They do not define strict management or ecological thresholds, inevitably result in management actions, or reflect any legal or regulatory standard.

In Hubbard et al. (2010), SODN proposed seven assessment points for uplands at Gila Cliff Dwellings NM, based on the ecological literature and network staff's knowledge of park ecosystems and management goals. Those proposed assessment points, intended as a starting point for discussion, are summarized in the table below.

Terrestrial vegetation and soils monitoring data in the context of proposed management assessment points, Gila Cliff Dwellings NM, 2009.

Issue	Management assessment point	
400 stratum (4,500–6,000')		
Erosion hazard	1	Bare ground (with no overhead vegetation) is >20%
	2	**Average surface soil aggregate stability is <Class 3**
	3	% grass & forb cover that are annuals is >33%
Site stability	4 a,b	Foliar cover of dead trees/shrubs is >10%
Fire hazard	5	Litter + duff cover is >80%
Exotic plant dispersal	**6**	**Extent of exotic plants is >50%**
Exotic plant invasion	7 a,b,c	% of total plant cover that is exotic is >10% (field, subcanopy, canopy)
500 stratum (>6,000')		
Erosion hazard	1	Bare ground (with no overhead vegetation) is >20%
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	3	% grass & forb cover that are annuals is >33%
Site stability	4 a,b	Foliar cover of dead trees/shrubs is >10%
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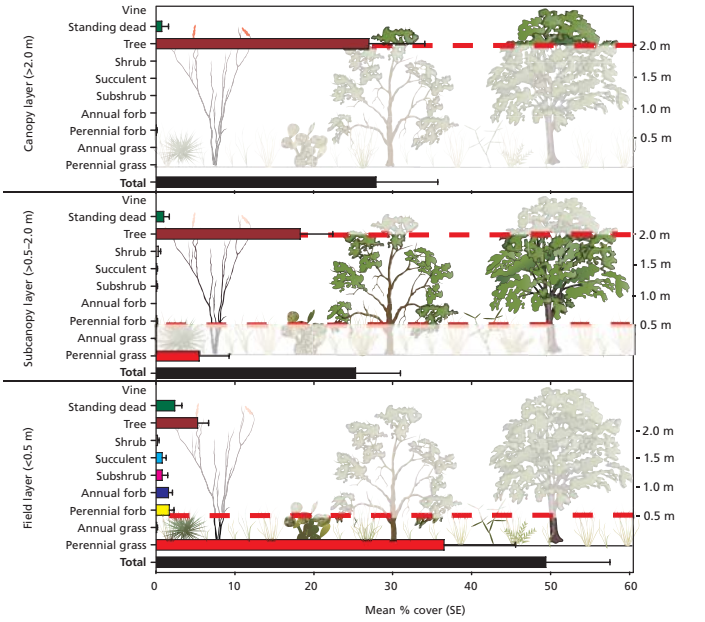

Lifeform cover in terrestrial vegetation monitoring plots, 400 stratum (4,500–6,000' elevation), Gila Cliff Dwellings NM, 2009. The greatest cover and frequency occurred in the "field" layer.

Most indicators did not approach the management assessment points, but some plots had values that suggested the potential for site-specific issues. The parkwide exception (across both elevation strata) was surface soil aggregate stability (#2), an indicator of erosion hazard. Also, in the 400 stratum, exotic plants (#6) were detected on more than 50% of the monitoring sites. It is recommended that park staff and network scientists meet about these issues and consider possible options for management.

Conclusions

Hubbard et al. (2010) concluded that the terrestrial vegetation and soils in uplands of Gila Cliff Dwellings NM are well within the historic range of natural variability. Current park conditions compare very favorably with those described in local and regional accounts. Gila Cliff Dwellings NM is relatively free of anthropogenic stressors, and is therefore an excellent reference site for evaluating other parks and protected areas with similar ecology and/or park settings. In addition, the park provides a unique opportunity to identify the signal of potential climate-change effects from the noise of other common stressors that are absent there.

Contact

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Bennetts, R. E., J. E. Gross, K. Cahill, C. L. McIntyre, B. B. Bingham, J. A. Hubbard, L. Cameron, and S. L. Carter. 2007. Linking monitoring to management and planning: Assessments points as a generalized approach. The George Wright Forum 24(2):59–77.

Hubbard, J. A., and S. E. Studd. 2010. Terrestrial vegetation and soils monitoring at Gila Cliff Dwellings National Monument: 2009 status report. Natural Resource Technical Report NPS/SODN/NRTR—2010/375. National Park Service, Fort Collins, Colorado.

For more information

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