Sonoran Desert Network
Monitoring Brief

National Park Service
U.S. Department of the Interior

Inventory & Monitoring Program

Vegetation and Soils at Montezuma Castle National Monument

2014

Background

The Sonoran Desert Network (SODN) monitors terrestrial vegetation and soils ("uplands") to detect broad-scale changes and place them within the context of other changes in Sonoran Desert park ecosystems. During our first season (2010–2011) of monitoring at Montezuma Castle National Monument (NM), our objectives were to determine the status of vegetation cover and frequency, soil cover, biological soil crust cover and frequency, and surface soil stability. We will assess trends over five-year intervals.

In 2010–2011, field crews sampled 12 plots at Montezuma Castle NM. For a number of reasons, data were analyzed and reported for just 8 of those 12 plots.

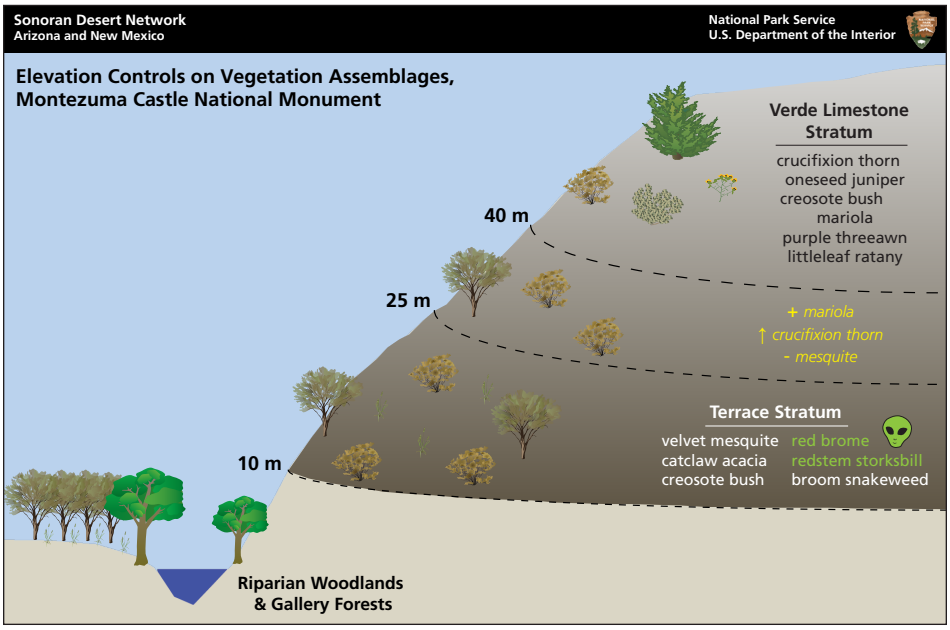

Figure 1. Effects of elevation on terrestrial vegetation communities at Montezuma Castle National Monument. This figure shows the characteristic species of each biome and the species most responsible for dissimilarities between biomes (italicized), as determined by data analysis.

Status and Management Concerns

Vegetation communities

There are two broad types of vegetation at the monument: (1) riparian woodlands and gallery forests, and (2) thornscrub communities in rocky uplands. Because riparian vegetation is tracked as part of SODN's streams monitoring, this brief addresses only the upland communities, found at an elevation of 2,501–3,700'.

Our data for those upland communities showed a secondary division into two groups (or strata), generally correlating to distance from and elevation above Beaver Creek, whose ecological influence appears to extend well beyond the 100-year floodplain (Figure 1).

The *terrace* group occupies the transitional spaces between the active floodplain terraces and the steep, scrubby uplands, and includes species common to both—including an abundance of large, shrubby mesquite and acacia, and patches of creosote bush.

The *Verde limestone* group is characterized by the shrub-scrub communities that are typical of the region, where crucifixion thorn and creosote bush co-mingle, and perennial bunchgrasses and thorny shrubs are occasional. For both strata, vegetation cover was greatest in the field layer (<0.5 m).

Exotic species

Field crews detected five exotic plant species during monitoring: red brome, redstem storksbill, horehound, Lehmann lovegrass, and cockspur grass. In fact, red brome was one of the most widespread plants found in the park, found on 7 of 8 monitoring plots. The percentage of ground it covered in the plots was low, indicating that native species in upland areas are effectively competing with this invasive under current conditions. Changing conditions, however, could bring a different scenario.

Red brome and fire

Because red brome can promote fires and subsequently outcompete native species that are less fire-tolerant, there is concern that these incipient red brome populations may come to dominate monument vegetation in the future. Like its close relative, cheatgrass, red brome tends to be more resilient to disturbance (particularly wildfire) than many native species.

In other words, if the park's red brome infestations continue to spread, the likelihood of wildfire at the monument may increase, leading to feedback loops in which increased fire occurrence promotes growth of red brome at the expense of natives that are less fire-tolerant. This, in turn, produces more fine fuels and, therefore, additional and, often, more intense wildfires. Current climate-change predictions are expected to reinforce and even accelerate this feedback loop.

Erosion

Although upland areas of the park appeared to be moderately protected from soil erosion, 20% of soil cover was composed of leaf litter, which could be rapidly lost following wildfire or prolonged drought. In addition, the stability of surface soil aggregates (an indicator of overall soil stability) was relatively low for the terrace stratum and several individual plots, indicating the potential for soil erosion.

Although biological soil crust cover (an erosion deterrent) was fairly low, the occurrence of biological soil crusts was fairly high across our monitoring plots.

Conclusions

We conclude that the terrestrial vegetation and soils in uplands of Montezuma Castle NM are currently within the historic range of natural variability. The Sonoran Desert Network will continue to monitor terrestrial vegetation and soils at Montezuma Castle NM, and will revisit the eight plots in 2015. We will add one plot to each stratum to try to increase our ability to detect species and our power to detect change in the percent cover of some plants and in soil aggregate stability. Continued monitoring will allow us to detect any directional changes in the park's terrestrial vegetation and soils going forward.

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Read the full report at:
http://go.nps.gov/MOCAup11

For more information

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