Sonoran Desert Network
Monitoring Brief

National Park Service
U.S. Department of the Interior

Intermountain Region
Inventory & Monitoring Program

Vegetation and Soils at Tonto National Monument

2014

Background

The Sonoran Desert Network (SODN) monitors terrestrial vegetation and soils ("uplands") to detect broad-scale changes in vegetation and soils within the context of changes in other ecological drivers, stressors, processes, and resources of interest. During our first season (2009–2010) of monitoring at Tonto National Monument (NM), our objectives were to determine the status of vegetation cover, vegetation frequency, soil cover, biological soil crusts, and surface soil stability. We will assess trends over five-year intervals.

In 2009–2010, field crews sampled 19 plots across three elevation strata at Tonto NM:

(1) Valley: <2,501', characterized by jojoba (*Simmondsia chinensis*)-dominated shrublands with low paloverde (*Parkinsonia microphylla*) cover occupying the bajada, alluvial fans, and low hill slopes,

(2) Bajada: 2,501–3,700', characterized by semi-desert grassland/shrub savanna systems with mixed shrubs occurring on higher slopes, and

(3) Foothills: 3,701–4,500', characterized by mountain mahogany (*Cercocarpus montanus*) and crucifixion thorn (*Canotia holacantha*) shrublands on upper-elevation slopes in the southern part of the monument.

Status and Management Concerns

Vegetation cover

Vegetation cover was always greatest in the field height category (<0.5 m), and increased dramatically with elevation. Subcanopy (0.5–2 m) and canopy (>2 m) vegetation cover was similar across all elevation strata, consisting almost exclusively of sparse shrubs and small trees.

Exotic species

Five exotic plant species were detected in monitoring plots: red brome (*Bromus rubens*), wild oat (*Avena fatua*), Lehmann lovegrass (*Eragrostis lehmanniana*), marsh parsley (*Cyclospermum leptophyllum*), and redtop (*Agrostis gigantea*). Red brome was one of the most widespread plants found in the park (recorded on 14 of 19 plots). The potential for red brome to dominate monument vegetation in the future is cause for concern. The overall extent of invasive exotic plants is cause for concern, as well. In the valley, bajada, and foothills strata, exotic plants were found on 67%, 55%, and 100% of plots, respectively.

Biological soil crusts

The biological soil crust community of Tonto NM was dominated by bryophytes (mosses and liverworts), which is unusual for the Sonoran Desert. In addition, spikemoss (*Selaginella* sp.) provided substantial ground cover and may help stabilize the soil surface in a manner similar to biological soil

crusts. Bryophyte occurrence and cover was generally more associated with mid- and higher elevations, where lower temperatures and higher effective moisture favor these lifeforms. The prevalence of bryophytes suggested that the soil surface was relatively moist and well-protected from water and wind erosion.

Erosion

Upland areas of the park appeared to be well-protected from soil erosion, and surface soil aggregate stability was relatively high. Total soil cover was also high, with little exposed bare soil. Collectively, these results indicated high resistance to erosion from rain and surface flow. However, nearly one-third of soil cover was plant litter, suggesting that if fire or drought were to reduce litter cover, susceptibility to wind and water erosion could increase. Although six plots contained rills or gullies, they were generally small and limited.

Fire in a desert landscape

Although Tonto NM is often perceived as having only classic Sonoran Desert vegetation, the monument encompasses transitions between Sonoran Desert scrub, semi-desert grassland, and interior chaparral (Figure 1). These transitions, and the monument's connection with the Mogollon Rim, lead to a surprisingly active and pervasive role of fire in terrestrial ecosystems at Tonto NM.

From 1947 to 1980, five intense wildfires burned through portions of the monument. This equates to a 21-year fire return interval from park establishment to the present—an interval more characteristic of pre-settlement semi-desert grassland than of Sonoran Desert shrubland, which typically has intervals of approximately 300 years.

Its connections with the Mogollon Rim likely drive the active fire ecology of Tonto NM. There was a high degree of overlap between all five fires, all but one of which started from lightning strikes at higher elevations and burned into the park from the south. With one exception, the same middle and higher elevations of the park were burned repeatedly. These areas generally correspond with the semi-desert grassland areas of the park—albeit with fire frequencies far shorter than those of many other semi-desert grassland parks in the region.

Conclusions

We conclude that the terrestrial vegetation and soils in uplands of Tonto NM are within the historic range of natural variability. Our data reflect an intact and functioning terrestrial ecosystem with species abundances and diversity within expected ranges. Vegetation composition and abundance are consistent with published data from elsewhere in the Sonoran Desert ecoregion. The Sonoran Desert Network will continue to monitor terrestrial vegetation and soils at Tonto NM, and will revisit the 19 plots in 2014. Continued monitoring will permit us to detect any directional changes in the terrestrial vegetation and soils going forward.

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Report citation

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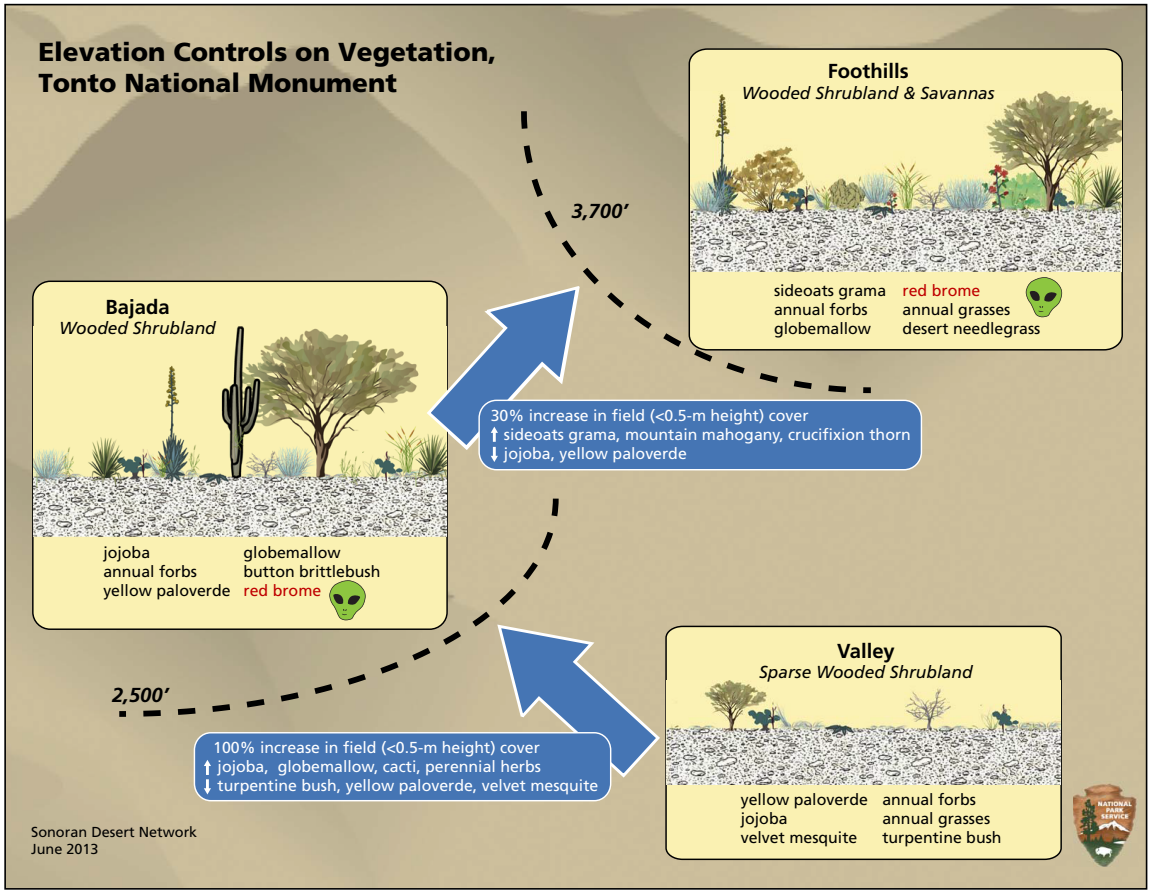

Read the full report at:
http://go.nps.gov/TONT2010

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

For more information

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