ACTIONABLE SCIENCE

Remote Sensing to Improve Detection and Treatment of Invasive Buffelgrass

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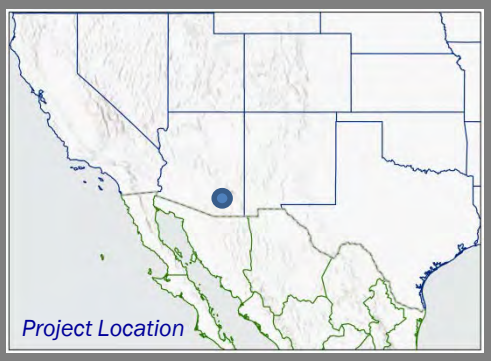
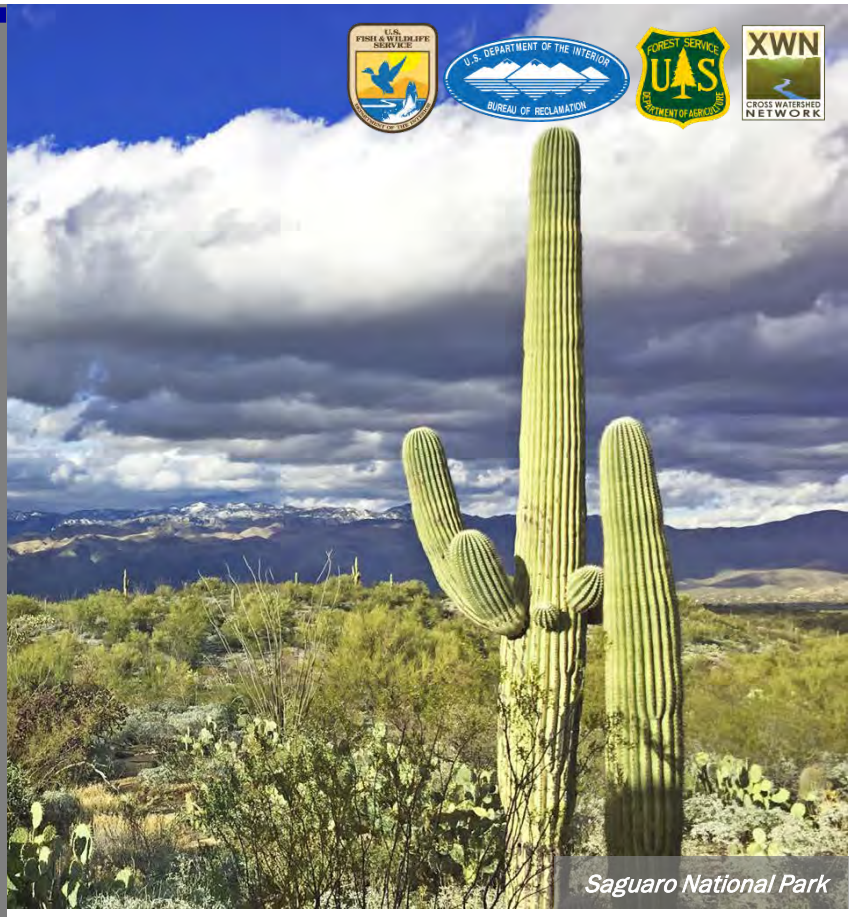
At Saguaro National Park (SNP) in Arizona, buffelgrass (*Pennisetum ciliare*) invasion is threatening biodiversity and iconic landscapes. Buffelgrass, a warm-season perennial species from Africa and Eurasia, is outcompeting native plants and increasing fire frequency, severity, and extent in the Sonoran desert. Herbicide is needed to effectively control buffelgrass, but it works best when applied to plants that are photosynthetically active (at least 50% green). In this project, researchers developed remote sensing methods that can help inform treatment of buffelgrass through landscape-scale monitoring and detection.





Saguaro National Park

KEY ISSUES ADDRESSED

In SNP, buffelgrass has spread to cover approximately 2,000 acres. Park managers work aggressively to constrain its spread because of its potential to destroy cacti and the habitat of other native organisms. Native Sonoran desert vegetation cover consists primarily of cacti and shrubs with intervals of bare ground between them. Buffelgrass fills in the spaces between native plants, preventing other species from establishing. This change in vegetation results in a different fire regime, which turns desert scrub into grassland.

Buffelgrass greenness changes quickly and varies across the landscape. The widespread nature of the invasion coupled with rugged and remote terrain makes monitoring and treating buffelgrass throughout the park very difficult. Herbicide treatments must be applied by ground crews or helicopter. Knowing where buffelgrass is and when it is treatable can save time, money, and reduce ineffectual use of herbicide and collateral damage to the ecosystem.

PROJECT GOALS

- Develop remote sensing tools to determine where buffelgrass is and to predict when buffelgrass will be green to help schedule effective herbicide treatments

Buffelgrass

THE POWER OF CITIZEN SCIENCE

From mid-June 2013 through 2014, volunteers conducted 896 sited visits documenting buffelgrass greenness, with 6,913 observations entered into the USA-NPN database.

PROJECT HIGHLIGHTS

Integrating Data from Multiple Sources: USGS researchers used precipitation data from PRISM (a source of spatial data compiled from multiple climate monitoring networks) and weather stations, satellite imagery (MODIS), aerial imagery, and observations of buffelgrass greenness from citizen scientists to develop phenological metrics (Climate Landscape Response or CLaRe) that capture the strength of the greenup response of the landscape, or phenological status, based on recent precipitation patterns. In these landscapes, areas with buffelgrass have higher CLaRe values because they greenup faster than areas with only native vegetation.

Partnerships: USGS researchers partnered with USA National Phenology Network (USA-NPN) and the Southern Arizona Buffelgrass Coordination Center (SABCC) to train volunteers to collect field data.

Data and Community Engagement: Citizen scientists were trained in protocols for visually estimating buffelgrass greenness and other phenological observations. The training, put on by USA-NPN and SABCC, also served the purpose of engaging the public in phenological monitoring. Observations from citizen scientists were crucial for linking greenness observed on-the-ground with satellite data, and for developing the metrics that make it possible to predict when buffelgrass will be at least 50% green.

Collaborators

- National Park Service
- US Geological Survey
- USA National Phenology Network

Case study support provided by US Fish and Wildlife Service, US Bureau of Reclamation, US Forest Service, and Cross Watershed Network. Updated November 2018.
Photos courtesy of National Park Service

LESSONS LEARNED

Even a small amount (less than 5%) of buffelgrass in the landscape significantly increases CLaRe values. Models show that 8-16 days following a 24-day period of significant rainfall (1-1.8 inches), buffelgrass will be 50% green. The amount of rainfall needed to reach 50% green varied by location, possibly due to differing soils, slope, aspect, and geology. Using models, the team accurately predicted the location of 49-55% of buffelgrass patches.

Managers can plan treatments using precipitation data to predict future buffelgrass green-up, and can later confirm that the buffelgrass patches have greened up using MODIS imagery—allowing them to fine-tune where crews and aircraft should be positioned for herbicide treatment.

These tools leverage the observation that buffelgrass greens up more quickly following rainfall than native vegetation. Although developed for buffelgrass, these tools may be useful for other invasive plants that similarly have a rapid response to environmental cues compared to native species.

NEXT STEPS

- Continue developing metrics and methods to improve detection of buffelgrass, especially newly established populations
- Partner with USA-NPN to develop a web-based app that can be used by managers to prioritize and optimize herbicide treatment of buffelgrass

PROJECT RESOURCES

For more information on this project, contact Cynthia Wallace: cwallace@usgs.gov

For additional project resources and case studies, visit the Collaborative Conservation and Adaptation Strategy Toolbox: WWW.DESERTLCC.ORG/RESOURCE/CCAST

Buffelgrass Experimental Burn