



## Upland Vegetation Monitoring at Bighorn Canyon NRA

Upland plant communities are important to resource managers because they contain key plant species that contribute to healthy rangelands, and in the last few decades the condition and areal extent of these communities have been declining throughout the inter-mountain west. Shrub steppe is both ecologically significant and heavily impacted, both within Bighorn Canyon National Recreation Area (NRA) and throughout the region. Biological invasions, altered fire regimes, and other stressors continue to cause major changes to these ecosystems. Because of this interest, sagebrush, juniper, and juniper-mountain mahogany plant communities were identified as a potential “vital sign” by the National Park Service’s Greater Yellowstone Network Inventory & Monitoring Network (GRYN) and later added as important indicator of ecological response to climate change as part of the National Park Service Climate Change Response Program.

### Objectives

Upland plant communities, which include sagebrush (*Artemisia tridentata*), juniper (*Juniperus osteosperma*), and juniper-mountain mahogany (*Cercocarpus ledifolius*) communities, are of interest to resource managers in Bighorn Canyon NRA, located in northeast Wyoming and south central Montana, for at least two reasons. First, these communities have been heavily impacted by both historical and modern human activity; and second, the quality and abundance of key plant species in these communities are considered indicators of overall rangeland health.

The objective of this pilot study was to test field methods that will be used during the development of the long-term vegetation monitoring protocol for Bighorn Canyon NRA. Specific long-term objectives include determining the status and trend in: (1) principal native plant species composition and abundance; (2) principal invasive plant species; (3) exposed soil (bare ground) cover, a fundamental indicator of soil stability; and (4) cryptobiotic soil crust cover.

### Methods

Field work was conducted during May-July 2011 and followed an approved NPS vegetation monitoring protocol that was developed by the Upper Columbia Basin Inventory & Monitoring Network (UCBN) to monitor sagebrush steppe communities. This protocol calls for collecting data from numerous sampling plots (1 m<sup>2</sup> and 10 m<sup>2</sup>) within a sampling frame (mapped polygon of distinct vegetation communities).



Field crew lays out a quadrat to measure vegetation at Bighorn Canyon National Recreation Area.

Sagebrush, juniper, and juniper-mountain mahogany communities were identified from a botanical survey conducted in Bighorn Canyon NRA in 1987, and sample frames were chosen for each vegetation community. The boundaries were adjusted such that: (1) no sample frames included areas of obvious human disturbance such as roads, ditches, trails, or developed areas; (2) areas with slopes greater than 30 degrees were excluded; and (3) areas with significant restrictions to access, such as impassable cliffs or bodies of water, were excluded. Vegetation patterns described in this report are preliminary and may be revised as additional data become available.



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NPS

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Three vegetation communities sampled (from left to right): sagebrush steppe, juniper woodlands, and juniper-mountain mahogany.

## Results

Mountain mahogany and sagebrush had both the highest average percent cover and highest frequency of occurrence in their sample frames; juniper was relatively common in all three sample frame types.

### Invasive Species

Three invasive plant species were detected during 2011: One occurrence of Japanese brome (*Bromus japonicus*) was recorded; cheatgrass (*Bromus Tectorum*) occurred in all but one of the sample frames visited, and in those frames where it occurred, it occupied 2%-8% of the plots; and halogeton (*Halogeton glomeratus*) was found only in the two juniper-mountain mahogany frames that were surveyed, where it occupied 1% and 13% of the plots (Figure 1). The identification of halogeton was based on immature plants and is therefore provisional until identification can be confirmed.

### Cheatgrass and Bare Ground

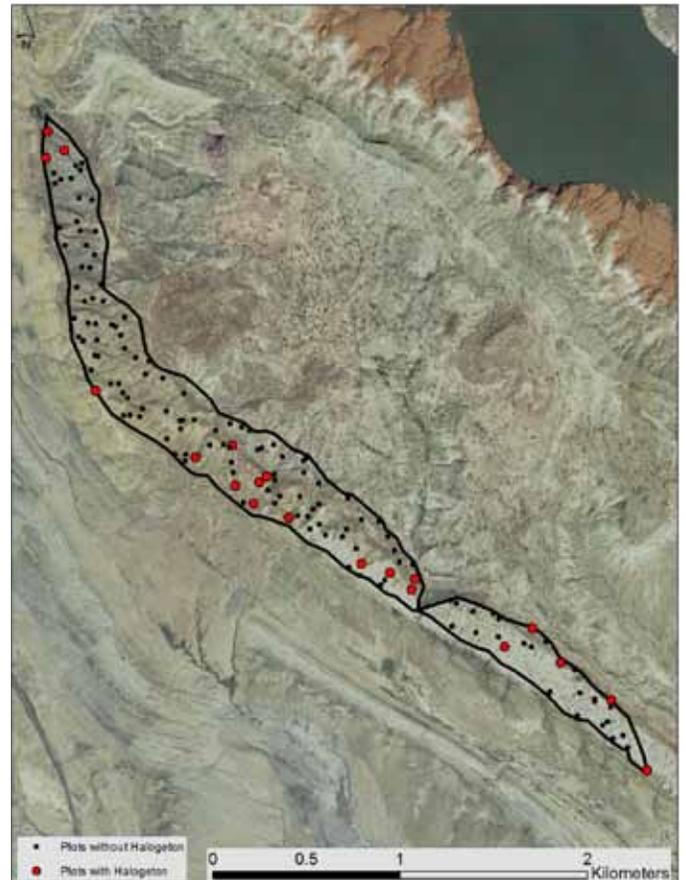
The occurrence of cheatgrass and the occurrence of plots with a large percentage cover of bare ground, which are both indicators of disturbance to the plant community, had somewhat similar patterns. For example, two sample frames had the largest proportion of plots occupied by cheatgrass (8% and 6%) and had the two highest scores for average percent cover of bare ground (11% and 8%, respectively).

### Cryptobiotic Crust, Fungi, and Lichen

Cryptobiotic crust, fungi, and lichen were present in a very high proportion of the sample plots within all of the frames (85%-99%), but they had relatively low average percent cover within each plot (2%-8%).

### Next Steps

The methods used in this pilot effort are efficient at detecting broad-scale conditions of vegetation, such



**Figure 1.** Map showing the location of plots within the juniper-mountain mahogany sample frame that contained halogeton.

as the presence of weed infestations and the abundance of key forage or indicator species, and the data collected are generally consistent with expectations based on previous work conducted in Bighorn Canyon NRA. Sampling will continue in 2012 with visits to new sampling frames as well as revisits to a subset of frames from last year to allow measurement of year-to-year variability. This information will be used to develop the monitoring protocol for upland vegetation at Bighorn Canyon NRA.