

National Park Service
U.S. Department of the Interior



Natural Resource Stewardship and Science

Fire Effects Monitoring for Trees and Shrubs at George Washington Carver National Monument

Natural Resource Data Series NPS/GWCA/NRDS—2012/412

Sherry Leis and Christopher Kopek

Missouri State University
Biology Department
901 S National Ave
Springfield, MO 65897

December 2012

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from Heartland Inventory and Monitoring Network (<http://science.nature.nps.gov/im/units/htln/index.cfm>) and the Natural Resource Publications Management website (<http://www.nature.nps.gov/publications/nrpm/>).

Please cite this publication as:

Leis, S. L., C. Kopek. 2012. Fire effects monitoring for trees and shrubs at George Washington Carver National Monument. Natural Resource Data Series NPS/GWCA/NRDS—2012/412. National Park Service, Fort Collins, Colorado.

Abstract

Concern over the expansion of shrubs and trees in the prairie at George Washington Carver National Monument has prompted intense management efforts. These efforts include increased fire frequency from a previously highly variable frequency and expansion of herbicide treatments by the exotic plant management team. We initiated belt transect sampling in the northern prairie in 2011 to evaluate the effectiveness of these treatments. All live tree and shrub stems were counted in transects that were 100 m long by 6 m wide. In 2012, both the northern and southern prairies were sampled by this method. In the northern prairie, stem densities decreased from 2011 to 2012 for a small number of species post-fire, although stems increased by 2.9% overall. Fewer trees and shrubs were found in the southern prairie than the northern prairie (9 vs 12) in 2012. Additional treatments are needed to reduce these populations further.

Introduction

Concern over increases in woody plant encroachment at George Washington Carver National Monument (GWCA) led to additional monitoring and changes in management actions. In 2009, a baseline survey measured woody plant guild cover at 23.8% (± 18.0 sd) (James and Rowell 2009). In response to this high level of woody plants, the prescribed fire interval was decreased to two years from ≥ 3 yr with half the prairie being treated in a given year. The network exotic plant management team also increased chemical treatment of invasive woody and exotic plant species at the monument. While long-term monitoring provides an understanding of the status and trends, it is not designed to understand treatment effects, such as from burning. Monitoring timed around the burn treatments and spatially distributed across the areas being treated was needed to evaluate whether target species were being reduced.

In 2011, we implemented new monitoring of trees and shrubs in the north prairie units to assess the effectiveness of these management treatments. Pre- and post-burn monitoring was completed in the north prairie (2011, 2012) and a baseline post-burn data set was collected in the south prairie (2012). This report provides an analysis of the effect of fire on woody plants in the northern prairie and a baseline for the southern prairie.

Methods

Belt transect locations were randomly chosen from points on the breeding bird monitoring grid (Peitz et al. 2008). Five transect locations were established in the north prairie (burn units 1, 2, 7) in 2011 and five transects were added in the south prairie (burn units 3, 4, 5, 6) in 2012 (Figure 1). Points where any part of the transect was less than 5 m from a trail, road, or edge were not eligible and an alternative point was chosen. The azimuth of the transects (104°) was randomly chosen and applied to all transects. Because the belt transects are virtual rather than monumented on the ground, GPS error in placing the transects could result in slightly different area being monitored from year to year. All live trees and shrubs were counted in a belt 100-m long and 6-m wide (total area per belt, 600 m^2), centered on the transect line. A ranging pole and flags were used to demarcate the belt transects into 10-m segments to facilitate data collection. In 2012, pictures were taken at the start of each belt transect for visual comparison over time (not shown here).

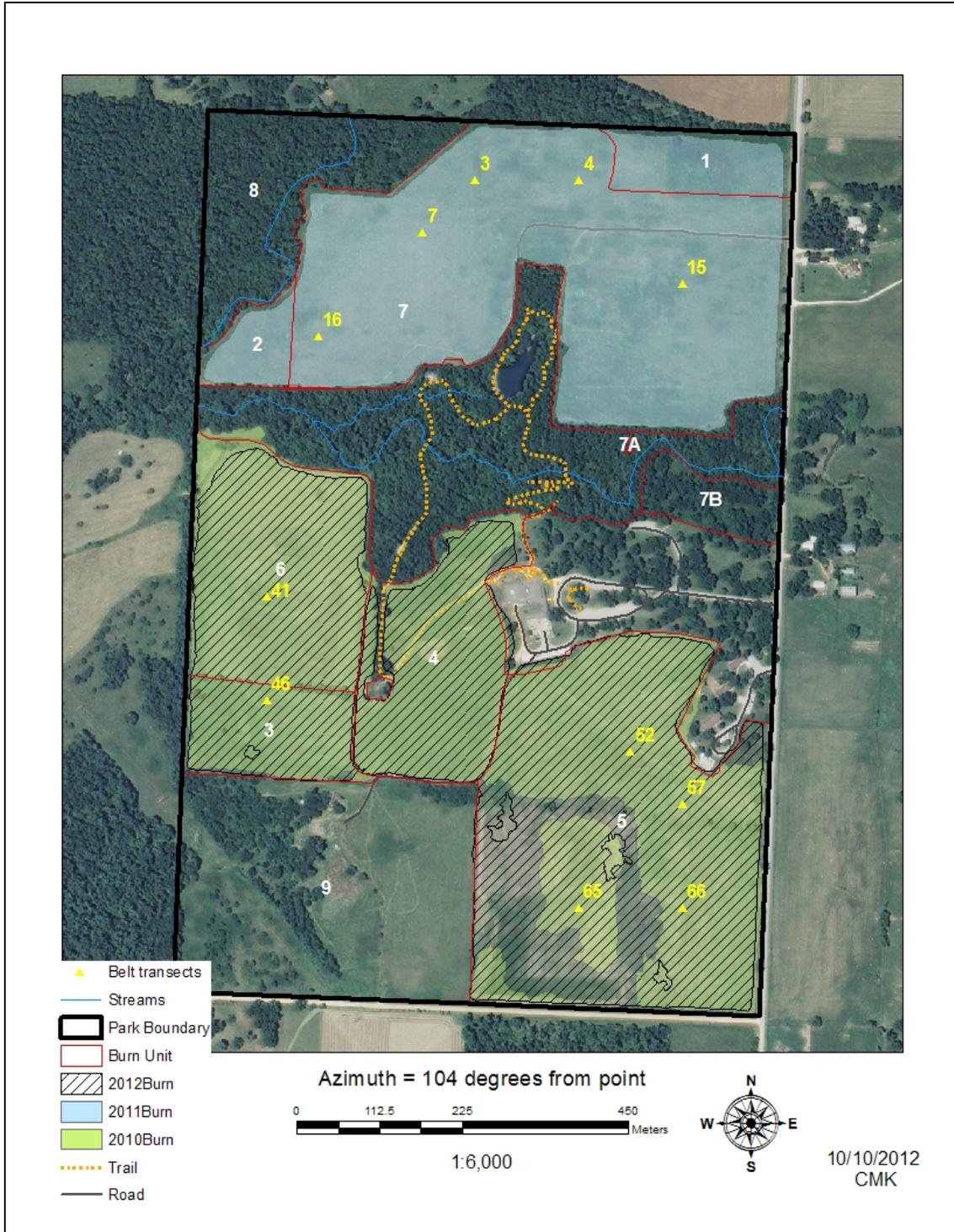


Figure 1. Belt transects and burn history since 2010 at George Washington Carver National Monument.

Target species included all live trees and shrubs as designated in the VegMon database. We identified each stem to species with the following exceptions: Blackberries (*Rubus*), Elm (*Ulmus*), Hackberry (*Celtis*), and Hawthorn (*Crataegus*) were lumped together by genus because identification at available life stages was unreliable. Stems were recorded by species and height

class (0.1-1 m, 1-2 m, 2-3 m, 3-4 m, >4 m). Height classes were designed to provide a profile of the target plants in the prairie because treatments could reduce the stature without reducing stem densities.

Although not a tree or shrub, blackberries (*Rubus* spp.) were included because their fidelity to fire could lead to increases. In 2011, we counted all blackberry stems within the first 60 m² of the belt transect. Recognizing the patchy nature of the distribution of these plants, we realized that populations would be better represented with a longitudinal sample. In 2012, we tested a new method that consisted of counting *Rubus* stems in a 2-m belt along the entire the 100-m transect (200 m²). In the northern units, we used both methods, and in the southern units we only used the 2-m wide belt. Analysis showed that the best crosswalk between the methods was to calculate the percent change at the 60-m² scale between 2011 and 2012. The conversion factor was then applied to the 2012 data taken at 200 m² to calculate a 2011 value for the same scale. Future analyses can use this derived value for 2011 as a baseline.

Two treatment types are being deployed. Herbicide treatments were conducted prior to the initial monitoring in both halves of the prairie (Figure 2). Stems that appeared to be dying as a result of herbicide treatment were not counted so as to focus only on the effects of the prescribed fire. A prescribed fire was conducted in the north prairie in August 2011 and another is scheduled for 2013. The south prairie was also burned prior to the initial monitoring and plans are to burn it again in 2014. Efficacy of the treatments was made through non-statistical comparison of stem densities. The park has not established bench marks for desired woody plant species.

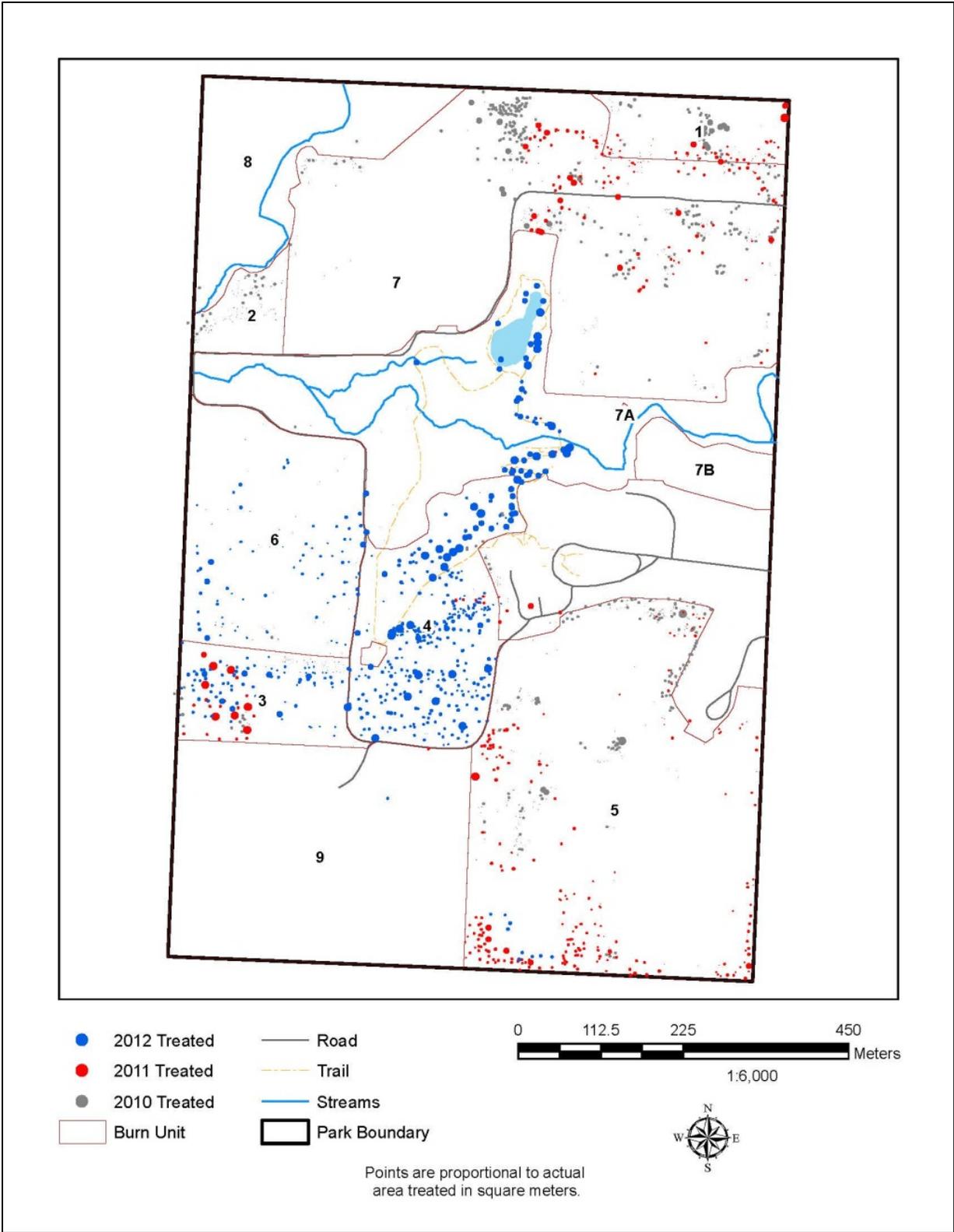


Figure 2. Exotic plant management treatment areas from 2010-2012 at George Washington Carver National Monument. Points are sized proportionally to number of square meters treated.

Results and Discussion

Thirteen species were recorded in 2012 with the northern prairie gaining two species (Table 1). Two additional species of note were recorded in 2012 but not included in the database. Five stems of *Rosa multiflora* (multiflora rose), a subshrub or vine, were recorded in the north prairie, but were not included in the analysis. Likewise, seven stems of the vine *Lonicera japonica* (Japanese honeysuckle) found in the south prairie were not included in the analysis.

Table 1. Species recorded in belt transects in 2011 and 2012 at George Washington Carver National Monument. N-north, S-South prairie.

Species	Common name	2011N	2012N	2012S
<i>Campsis radicans</i>	trumpet creeper	-	-	X
<i>Celtis spp</i>	hackberry	X	X	X
<i>Crataegus spp</i>	hawthorn	-	X	-
<i>Diosporos virginiana</i>	persimmon	X	X	X
<i>Fraxinus pennsylvanica</i>	green ash	X	X	X
<i>Gleditsia triacanthos</i>	honey locust	X	X	-
<i>Platanus occidentalis</i>	sycamore	X	X	-
<i>Prunus americana</i>	American plum	X	X	X
<i>Rhus copalina</i>	winged sumac	X	X	X
<i>Rubus spp</i>	blackberry	X	X	X
<i>Sassafras albidum</i>	sassafras	-	X	-
<i>Symporicarpos orbiculatus</i>	coral berry	X	X	X
<i>Ulmus spp</i>	elm	X	X	X
Richness		10	12	9

After one burn treatment, five species declined and seven increased in number of stems for a net increase of 2.9%. Herbicide treatments occurred prior to monitoring in 2011 so effects were the result of burning and environmental factors alone. To better understand the contribution of *Rubus* spp. (blackberry), we calculated the proportion of blackberry stems in the data. In the northern prairie units, blackberry encompassed 90.2 and 88.8% of the stems counted in 2011 and 2012, respectively. In the southern prairie units, blackberry was 60.2% of the 2012 counts.

The fire was successful at reducing the stature of the taller target plants. Overall stem height in the northern prairie was reduced between treatment years (Table 2). This is a result of fewer tall stems of *Prunus Americana* (American plum) and *Fraxinus pennsylvanica* (green ash). In the northern prairie, stems over 1-m tall reduced from 182 in 2011 to 132 in 2012. We only encountered 35 stems over 1-m tall in the southern prairie in 2012.

Table 2. Change in species stem counts between northern belts 2011-2012 at George Washington Carver NM. Negative values indicate a decline in number of stems.

Species	Total stems	% change in total stems	Stems by height class			
			Stems 0.1-1m	Stems 1-2m	Stems 2-3 m	Stems 3-4m
<i>Ulmus spp</i>	-213	57.6	-213	0	0	0
<i>Symporiocarpos orbiculatus</i>	-134	92.4	-134	0	0	0
<i>Celtis spp</i>	-11	100.0	-11	0	0	0
<i>Diosporos virginiana</i>	-7	21.9	-4	-3	0	0
<i>Gleditsia triacanthos</i>	-4	80.0	-4	0	0	0
<i>Prunus americana</i>	1	0.5	31	-30	0	0
<i>Crategeous spp</i>	3	100.0	3	0	0	0
<i>Platinus occidentalis</i>	18	51.4	19	1	-2	0
<i>Sassifrass albida</i>	145	100.0	145	0	0	0
<i>Rubus spp</i>	170	1.3	170	0	0	0
<i>Rhus copalina</i>	185	56.5	185	0	0	0
<i>Fraxinus pennsylvanica</i>	272	83.7	288	-7	-8	-1
Total gain/loss	425	2.9	475	-39	-10	-1

The burn treatment had positive effects by reducing the height of saplings in the prairie and some woody species stem counts declined. However, additional treatments to reduce invasive woody species will be needed to continue to improve the condition of the prairie.

Literature Cited

James, K.M. and G.A. Rowell. 2009. Plant community monitoring baseline report, George Washington Carver National Monument. Natural Resource Technical Report PS/HTLN/NRTR—2009/190. National Park Service, Fort Collins, Colorado.

Peitz, D.G., G.A. Rowell, J.L. Haack, K.M. James, L.W. Morrison, and M.D. DeBacker. 2008. Breeding Bird Monitoring Protocol for the Heartland Network Inventory and Monitoring Program. Natural Resource Report NPS/HTLN/NRR- 2008/044. National Park Service, Fort Collins, Colorado.