

National Park Service
U.S. Department of the Interior



Natural Resource Program Center

Vegetation Community Monitoring at Homestead National Monument of America, Nebraska

1998-2009

Natural Resource Data Series NPS/HTLN/NRDS—2011/144

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March 2011

U.S. Department of the Interior
National Park Service
Natural Resource Program Center
Fort Collins, Colorado

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Please cite this publication as:

James, K. M.. 2011. Vegetation community monitoring at Homestead National Monument of America, Nebraska: 1998-2009. Natural Resource Data Series NPS/HTLN/NRDS—2011/144. National Park Service, Fort Collins, Colorado.

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Introduction

Restored tallgrass prairie

The importance of prairie as the historic landscape to early settlers lead the Park Service to restore 100 acres of former agricultural fields to native prairie at Homestead National Monument of America (HOME). The first seed and sod transfer efforts date back to 1939, making the Homestead prairie the second oldest prairie restoration in the United States. In subsequent years, park managers have been diligent towards their goal of prairie restoration, and have utilized increasingly sophisticated techniques to restore and maintain the tallgrass prairie. Monitoring is a continuation of this effort and aims to quantify the effects of management and guard against degradation.

Lowland forest

The hardwood forest occupies sixty acres along Cub Creek (NPS 1999) and comprises two distinct zones based on past land use. The species composition of the forest in the northern part of the park is consistent with the description of a mesic bur oak forest, a critically imperiled community in Nebraska (Steinauer & Rolfsmeier 2000). The southern portion is characterized as a successional forest and was heavily logged in the 1930's. Fire suppression, grazing cessation and changes in the hydrology of Cub Creek have produced significant changes in the woodlands since the establishment of the first homestead. For a complete description, inventory and evaluation of the lowland forest along Cub Creek, see Mlekush and DeBacker (2003) and Rolfsmeier (2007).

Methods

Data collection

The Heartland Inventory and Monitoring Network (HTLN) implemented monitoring at HOME in 1998 to provide analysis of baseline conditions and to assess future change in floral communities (see James et al, 2009 for detailed information on monitoring protocol). Monitoring of five prairie sites occurred in 1998, 1999, 2000, 2002, 2005, and 2006. In 2009, two new sites were established bringing the total number of sites monitored in the prairie to seven (Fig. 1).

Overstory trees in the successional forest (sites 6 and 7) were monitored in 2000, 2002, 2005 and 2009 while the bur oak woodland (site 8) was monitored in 2005 and 2009 (Fig. 1).

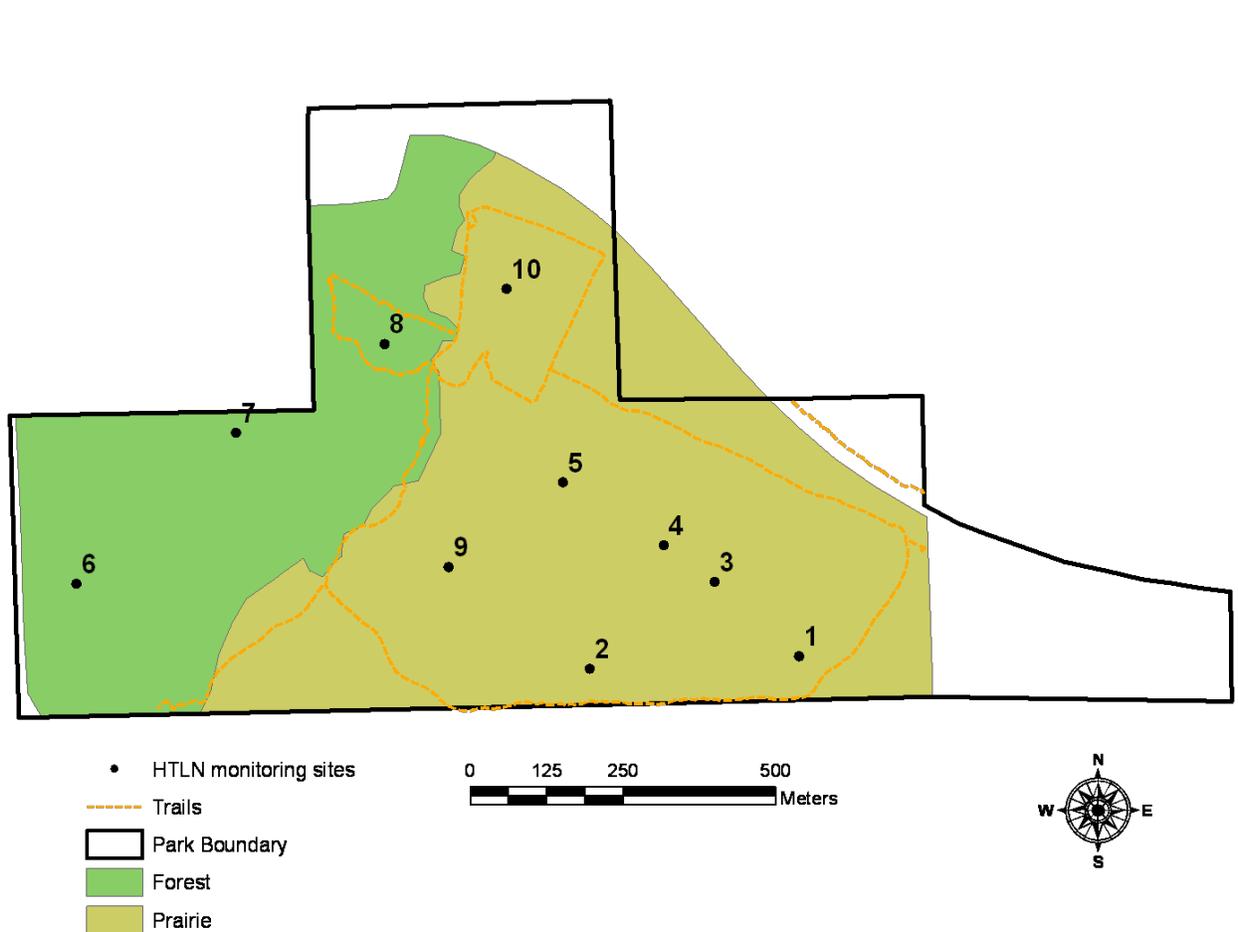


Figure 1. Location of Heartland Inventory and Monitoring Network vegetation monitoring sites (n=10) at Homestead National Monument of America, Nebraska.

Prairie sites are monitored according to the revised 2009 protocol and are comprised of two parallel transects each containing five nested sample plots (Fig. 2). Species composition and foliar cover estimates are collected from each plot and values are summarized to the individual site.

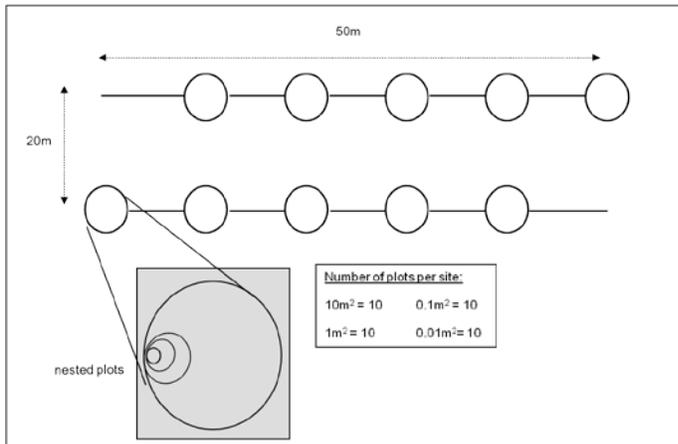


Figure 2. Heartland Inventory and Monitoring Network vegetation community sample design showing transects and plots including nested plots.

Individual species percent foliar cover was calculated for each site. Foliar cover serves as an estimate of abundance for herbaceous species. Cover class intervals are converted to median values to estimate percent cover for each herbaceous and shrub species. Mean percent cover is then calculated as the species percent cover for a site, averaged for all ten plots within the site.

Forest sites are based on the same monitoring protocol. In the 0.1ha space formed between the two parallel transects, overstory tree data are collected. Overstory trees greater than 5.0 cm diameter at breast height (dbh) are recorded along with their dbh and condition (live or dead). For all trees < 5.0cm dbh, including seedlings and saplings, a simple count of individuals by species are tallied at the 10m² plot level along both transects. These data are summed to the site level.

Data Summary and Analysis

Data collected from all plots within a site are summarized by species to the site level. Mean site values along with a measure of among site variability (± 1 standard error of the mean) are presented for the community. Foliar cover estimates collected for each species within a plot are the basis of field data used in all subsequent analysis.

Prairie community diversity

Three measures of diversity were calculated among all sites within the restored prairie. Alpha diversity (i.e., site level diversity) was calculated as the average species richness per site; gamma diversity (i.e., community level diversity) was estimated as the total number of species across all sites (McCune and Grace 2002). Each measure of diversity was summarized for the restored prairie. Beta diversity, as a measure of the heterogeneity in the data, was calculated as (Whittaker 1972):

$$\beta_w = (S_c / S) - 1$$

where:

β_w = beta diversity,

S_c = the number of species in the prairie,

S = the average species richness in the sample sites.

As a rule of thumb, values of $\beta_w < 1$ are rather low and $\beta_w > 5$ are considered high beta diversity (McCune and Grace 2002). If $\beta_w = 0$, then all species are found within each site. The one is subtracted to make zero beta diversity correspond to zero variation in species presence. While this measure does not have any formal units, the result could be thought of in approximate units as the “number of distinct communities” (McCune and Grace 2002).

Prairie species diversity

For each site within the community, species richness (S) along with the effective number of species derived from both Shannon diversity index (Shannon number or H_e) and Simpson’s diversity index (Simpson’s number or D_e) was calculated. Foliar cover estimates for each species in a site are used to determine each measure of species diversity in PC-ORD (McCune and Medford 1999).

Initial plant diversity for each site was calculated using the Shannon diversity index:

$$H' = - \sum_{i=1}^n p_i \ln p_i$$

where p_i is the relative cover of species i (Shannon 1948). Shannon diversity index value for 2009 is presented to address the specifics of Goal A of the 2006 Vegetation Management Action Plan (NPS 2006), which aims to keep native species diversity levels at or above the baseline period 1998-2002.

Simpson’s index of diversity for an infinite population (D) was calculated by site (McCune and Grace 2002). It is the likelihood that two randomly chosen individuals from a site will be different species and emphasizes common species (McCune and Grace 2002). It is calculated by site using the complement of Simpson’s original index of dominance:

$$\text{Simpson’s index} = 1 - \sum_{i=1}^n p_i^2$$

Shannon and Simpson’s index values were converted into effective number of species for each community (H_e and D_e , respectively). This allowed for both diversity measures to be compared directly to species richness of the sites (S) within and among sample years based on counts of distinct species in the community (Joust 2006). Shannon index was converted into effective number of species (H_e) using the following formula:

$$H_e = \exp^{(H)}$$

where H was the Shannon index value. The effective number of species based on Simpson’s index (D_e) was the inverse of the index value or:

$$D_e = 1/(1-D)$$

where D was the Simpson’s index value.

As S , H_e and D_e approach the same number, species begin to be equally abundant in the prairie while large differences in the number of species between each measure reflect an increasing number of less abundant species and decreasing number of more abundant species. See Jost (2006) and James and Rowell (2009) for a complete explanation and implementation of species diversity measures, respectively.

Prairie guild abundance

Species are grouped into functional guilds and foliar cover estimates are presented at the guild level for the prairie. For each guild, foliar cover is totaled for each plot and then a mean site value is calculated from all ten plots. Guilds are first divided among native and nonnative groups and then among grasses, forbs, sedges/rushes, ferns and woody species within each group. A complete species list along with guild assignment is provided in Appendix A.

Lowland forest

Overstory tree composition in the lowland forest is based on individual tree counts for each species and basal (m^2/ha). Understory trees and the regeneration layer (seedlings and saplings) are summarized by individual species counts. Taken together, all tree metrics are used to describe the lowland forest composition and structure for both the successional and bur oak communities. Overstory tree counts are grouped by size class (Table 1).

Table 1. Diameter at breast height (dbh) measurement range (cm) and size class used to group overstory trees.

dbh (cm)	size class
5.0 - 14.9	1
15.0 - 24.9	2
25.0 - 34.9	3
35.0 - 44.9	4
≥ 45	5

Results

Restored prairie

Goal A in the 2006 Vegetation Management Action Plan (NPS 2006) is to protect biodiversity in the vegetation with the specific objective to maintain the diversity of native plant species at levels measured over the baseline period 1998-2002. Baseline Shannon diversity index for the restored prairie was 2.70. In 2009, the total Shannon diversity index value was 2.31 (native species only). However the average index value for native species over the entire sample period (1998 -2009) was 2.76 in the prairie restoration.

Across all sample years all three community diversity measures varied within a relatively narrow range (Table 2). On average a site contained nearly half of the total diversity observed in the community. Beta values in all but a single year (2002) were slightly above 1.0. The low beta values were indicative of all sites being representative of a single community.

Table 2. Alpha, beta and gamma diversity for the restored prairie by sample year. N is the number of monitoring sites sampled that year.

N	Year	Alpha	Beta	Gamma
5	1998	41	1.32	95
5	1999	46.8	1.09	98
5	2000	46.6	1.15	100
3	2002	48.3	0.84	89
5	2005	44	1.20	97
5	2006	47.2	1.25	106
7	2009	37.4	1.70	101

The prairie sites were characterized by a larger number of species that were represented by a few individuals and/or low foliar cover (species richness, Fig. 3), and a small number of species that occurred frequently in large abundance (Shannon and Simpson number, Fig. 3). This is consistent with the distribution patterns of species within a native prairie (Collins and Glenn 1991).

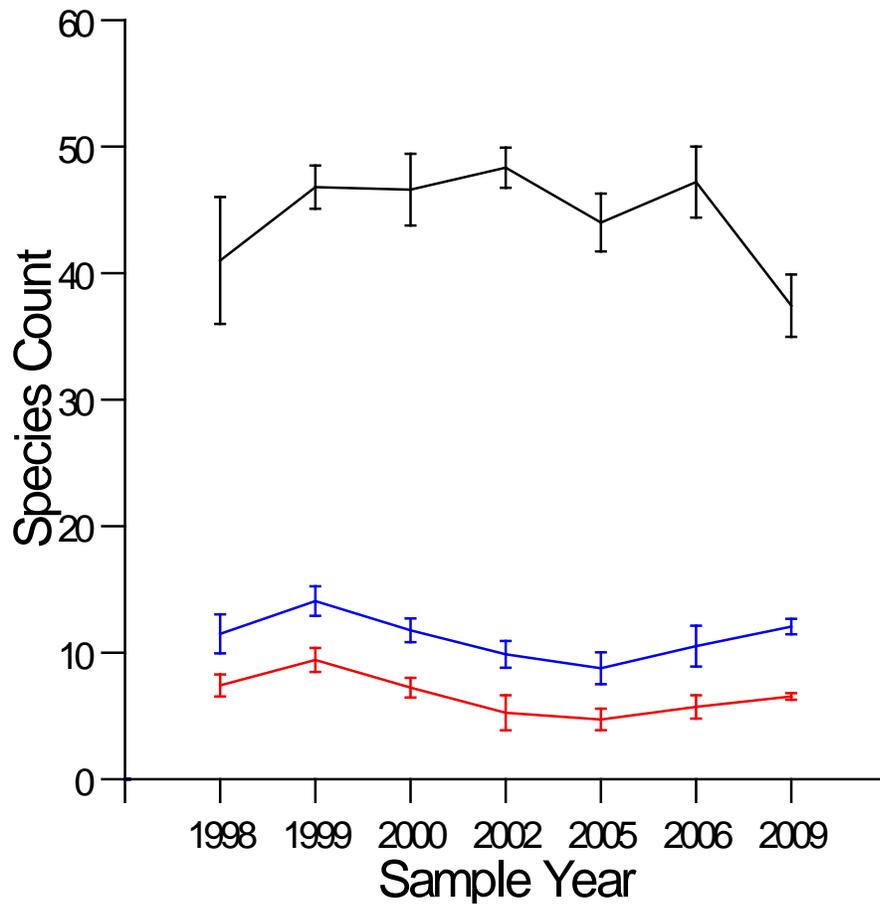


Figure 3. Mean number of species within a site as measured by species richness (black) and effective number of species for two diversity measures (Shannon number, blue; and Simpson's number, red) for prairie sites. Error bars are ± 1 standard error of the mean.

Although mean site foliar cover of native forbs and grasses declined during the sample period, both guilds dominated all prairie sites (Fig. 4). Native woody guild and nonnative grass guild did not exceed 10% mean foliar cover in any sample year, yet their presence was a noticeable component of the prairie sites (Fig. 4).

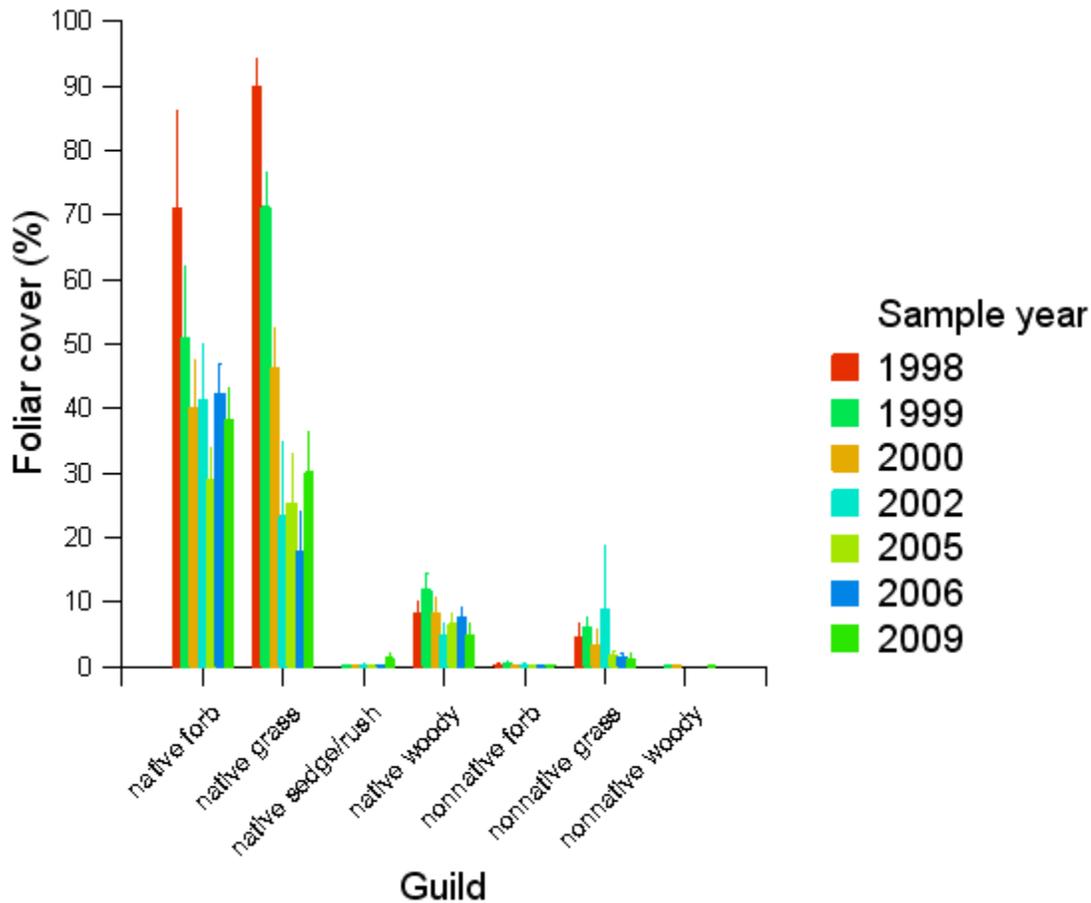


Figure 4. Mean foliar cover (± 1 standard error of the mean) for plant guilds in the prairie restoration.

Lowland forest community

The lowland forest at HOME is composed of two forested communities: successional forest and bur oak woodland. Goal H of the Vegetation Management Action Plan (NPS 2006) is to restore the lowland bur oak forest with the specific objective to restore the southern portion of the woodland to a species composition and structure similar to the northern portion of the lowland bur oak woodland.

The bur oak woodland is represented by site 8 and was dominated by an overstory of bur oak (*Quercus macrocarpa*) and sugar maple (*Acer saccharum*) (Fig. 5). The successional forest (sites 6 and 7) was characterized by an overstory dominated by hackberry (*Celtis occidentalis*) along with a few large remnant bur oak (Fig. 6). Figure 7 illustrates the difference in overstory composition between the forested communities.

Overstory composition and structure

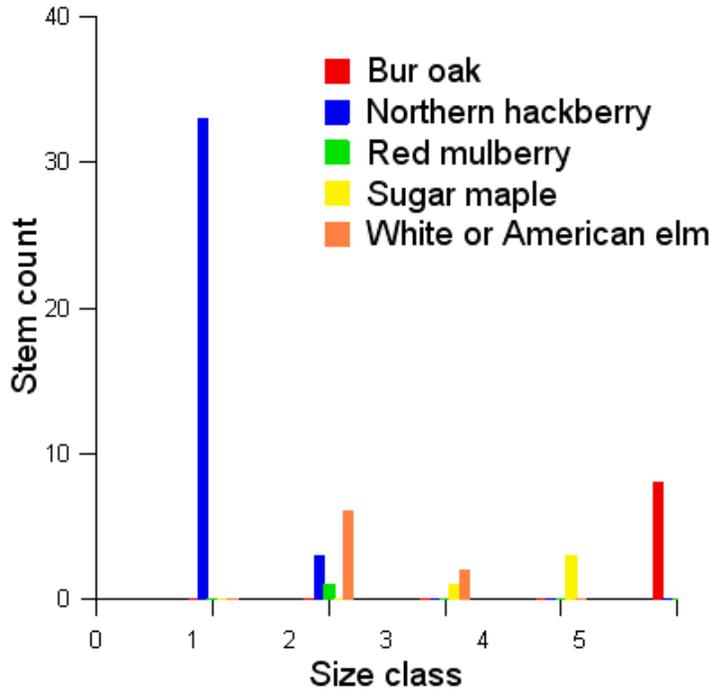


Figure 5. Bur oak woodland overstory species composition (site 8, 2009).

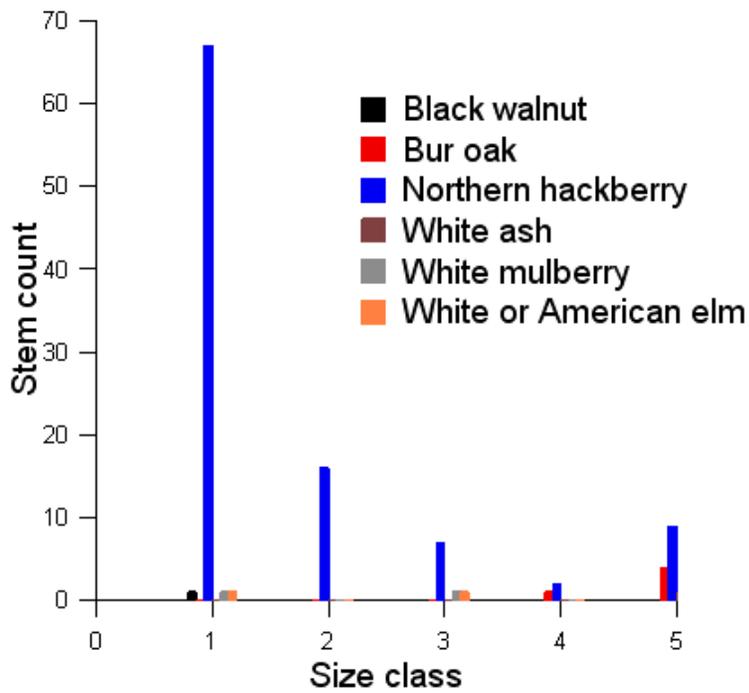


Figure 6. Successional forest overstory species composition (sites 6 and 7, 2009)

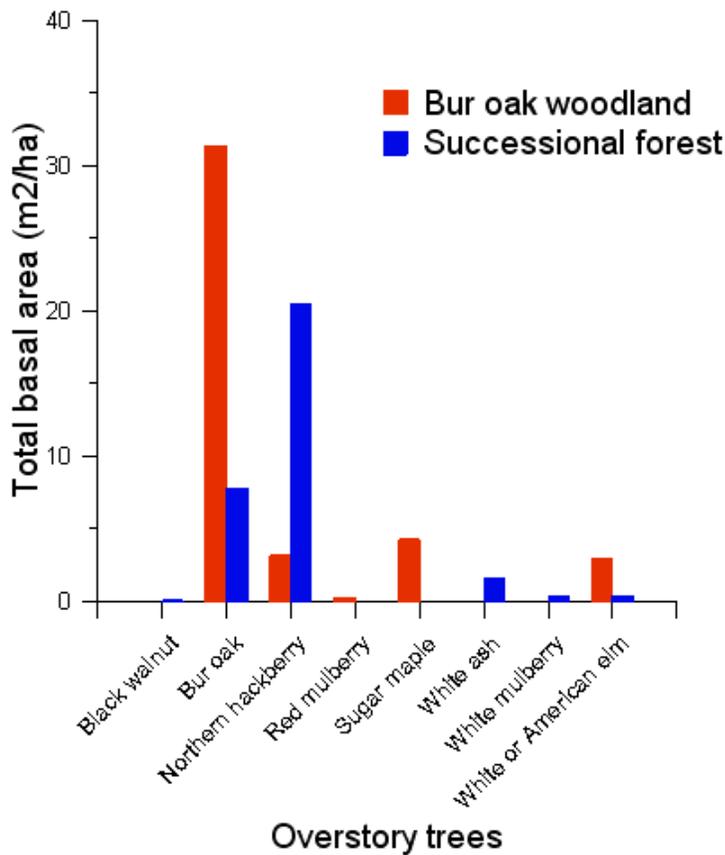


Figure 7. Comparison of overstory species basal area (m²/ha) between the bur oak woodland (site 8) and successional forest (sites 6 and 7) for 2009.

Regeneration and understory

Although bur oak seedlings have been detected in the understory during each of the last three sample years, hackberry seedlings were the prominent species in the regeneration layer for both the bur oak woodland and successional forest (Fig. 8 panel A and B, respectively). Nine saplings were observed among both communities during all three sample years. Hackberry accounted for all but two of the saplings, which were small elm saplings.

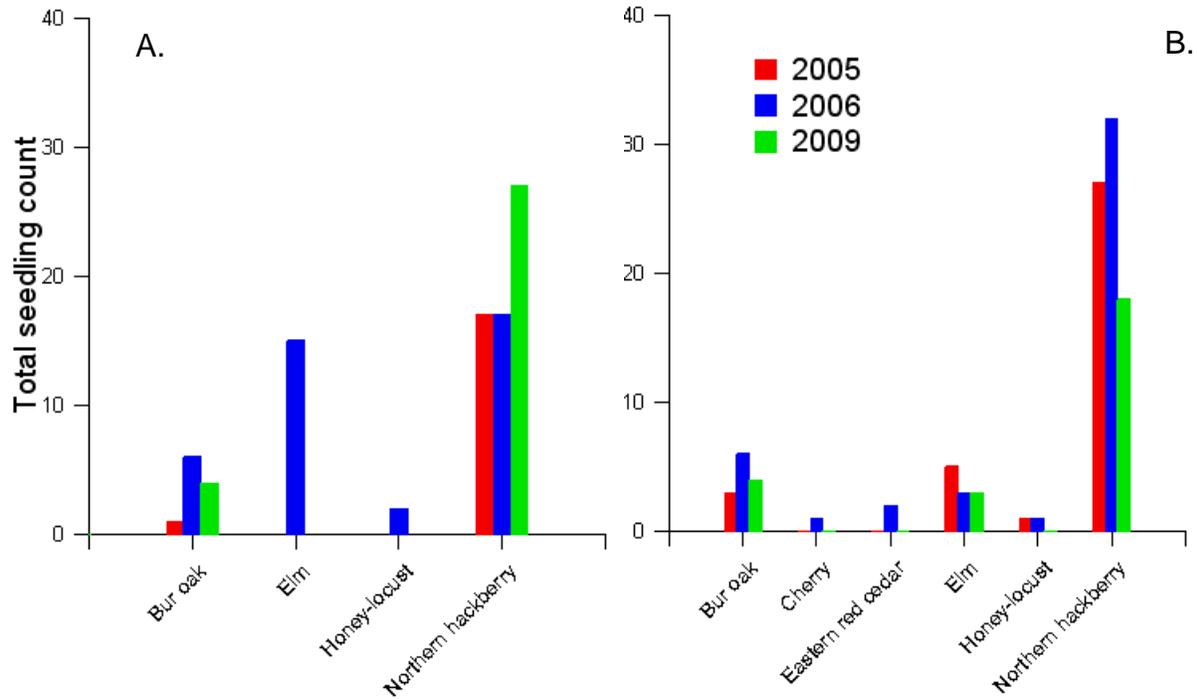


Figure 8. Total seedling count by species for three sample years in the bur oak woodland (A) and successional forest understory (B).

The understory of the bur oak site and successional forest sites were sparse with native forbs having the highest foliar cover during the last three sample years (Fig. 9 panel A and B, respectively). Nonnative guilds were not detected in any of the three sites between 2005 and 2009.

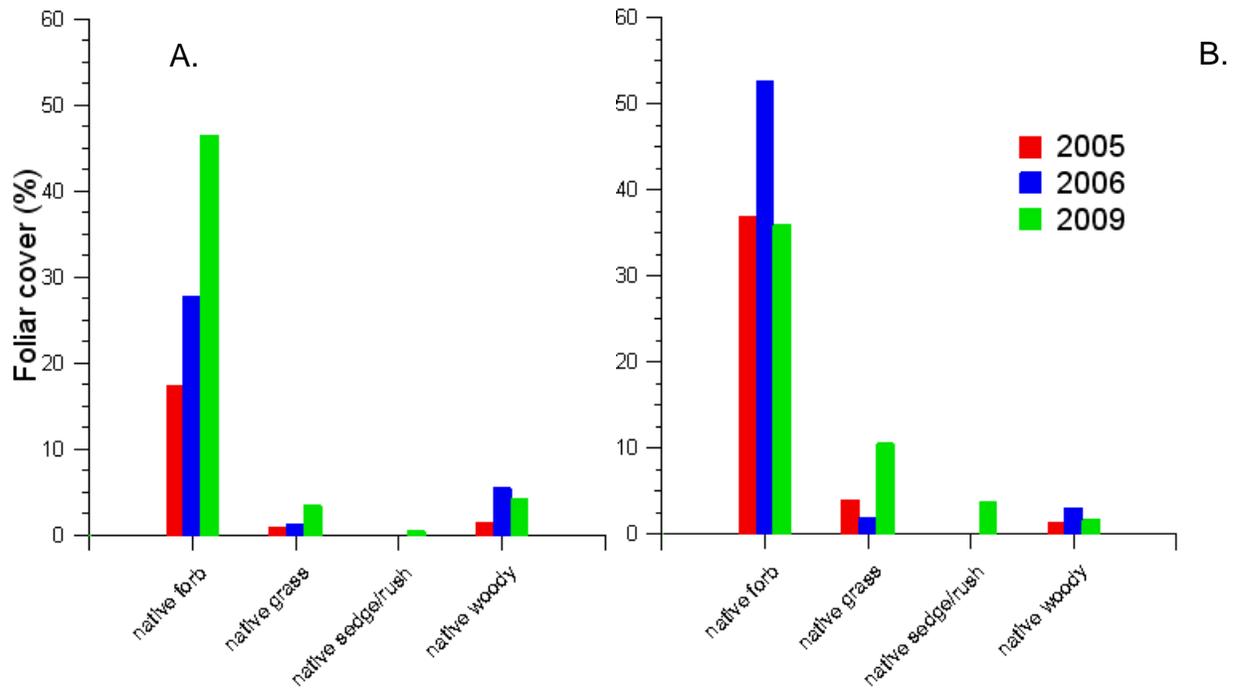


Figure 9. Understory guild foliar cover in the bur oak woodland (A) and successional forest (B).

Discussion

Across all sample years the monitored communities at HOME continue to remain stable. Abundance of native forbs declined during the first two sample years then remained relatively stable since 2000. Native grass abundance in the restored prairie has been relatively stable since 2002 after experiencing four years of decline. Invasive species remain a concern in the prairie. Woody encroachment, although not documented here, is increasing throughout the prairie. Establishment and recruitment of bur oak is required to maintain the existing bur oak woodland as well as transition the successional forest into a bur oak woodland type. Management steps have been taken by the park to address a number of these issues and continue without negative impact to the communities under management.

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Appendix

Appendix A. Species list compiled from all HTLN vegetation monitoring sites sampled between 1998 and 2009. Community type abbreviation corresponds to restored tallgrass prairie (P), successional forest (S) and bur oak woodland (B).

Scientific Name	Common Name	Guild	Type
<i>Acalypha</i> spp	copperleaf	native forb	P
<i>Acer saccharum</i>	sugar maple	native woody	B
<i>Achillea millefolium</i>	common yarrow	native forb	P
<i>Agalinis tenuifolia</i>	common agalinis	native forb	P
<i>Ageratina altissima</i>	tall ageratina	native forb	P, S, B
<i>Agrostis hyemalis</i>	ticklegass	native grass	P
<i>Ambrosia artemisiifolia</i>	common ragweed	native forb	P
<i>Ambrosia psilostachya</i>	western ragweed	native forb	P
<i>Ambrosia trifida</i>	giant ragweed	native forb	P, S
<i>Amorpha canescens</i>	lead-plant	native forb	P
<i>Andropogon gerardii</i>	big bluestem	native grass	P
<i>Antennaria neglecta</i>	field pussytoes	native forb	P
<i>Apocynum cannabinum</i>	hemp dogbane	native forb	P
<i>Artemisia ludoviciana</i>	white sage	native forb	P
<i>Asclepias stenophylla</i>	narrow-leaved milkweed	native forb	P
<i>Asclepias sullivantii</i>	smooth milkweed	native forb	P
<i>Asclepias syriaca</i>	common milkweed	native forb	P
<i>Asclepias verticillata</i>	whorled milkweed	native forb	P
<i>Asclepias viridiflora</i>	green milkweed	native forb	P
<i>Asclepias viridis</i>	ozark milkweed	native forb	P
<i>Aster ericoides</i>	squarrose white wild aster	native forb	P
<i>Aster lanceolatus</i>	white panicle aster	native forb	P
<i>Astragalus canadensis</i>	canada milk-vetch	native forb	P
<i>Baptisia alba</i>	largeleaf wild indigo	native forb	P
<i>Baptisia bracteata</i>	plains wild indigo	native forb	P
<i>Boehmeria cylindrica</i>	false nettle	native forb	P, S, B
<i>Bouteloua curtipendula</i>	side-oats grama-grass	native grass	P
<i>Brickellia eupatorioides</i>	aster	native forb	P
<i>Bromus inermis</i>	smooth brome	nonnative grass	P
<i>Buchloe dactyloides</i>	buffalograss	native grass	P
<i>Callirhoe involucrata</i>	purple poppymallow	native forb	P
<i>Calylophus serrulatus</i>	evening-primrose	native forb	P
<i>Calystegia sepium</i>	hedge-bindweed	native forb	P
<i>Campanulastrum americanum</i>	tall bellflower	native forb	P, S
<i>Carex</i> spp	sedge	native sedge/rush	P, S, B
<i>Celtis occidentalis</i>	common hackberry	native woody	S, B
<i>Chamaecrista fasciculata</i>	partridge-pea; locust-weed	native forb	P
<i>Chamaecrista nictitans</i>	partridge pea	native forb	P
<i>Chenopodium album</i>	lamb's quarters, pigweed	native forb	P, S, B
<i>Chenopodium berlandieri</i>	pitseed goosefoot	native forb	P, S
<i>Chenopodium pratericola</i>	narrow-leaf goosefoot	native forb	P
<i>Chenopodium simplex</i>	mapleleaf goosefoot	native forb	P, S
<i>Cirsium altissimum</i>	tall thistle	native forb	P

<i>Cirsium canescens</i>	thistle	native forb	P
<i>Cirsium</i> spp	thistle	nonnative forb	P
<i>Cirsium undulatum</i>	wavy-leaved thistle	native forb	P
<i>Convolvulus arvensis</i>	field-bindweed	nonnative forb	P
<i>Conyza canadensis</i>	horseweed	native forb	P
<i>Cornus drummondii</i>	rough-leaved dogwood	native woody	P
<i>Cornus foemina</i>	northern swamp dogwood	native woody	P
<i>Cryptotaenia canadensis</i>	canadian honewort	native forb	P, B
<i>Cuscuta megalocarpa</i>	bigfruit dodder	native forb	P, S, B
<i>Cyperus</i> spp	flatsedge	native sedge/rush	P
<i>Dalea candida</i>	white prairie clover	native forb	P
<i>Dalea purpurea</i>	purple prairie clover	native forb	P
<i>Delphinium carolinianum</i>	carolina larkspur	native forb	P
<i>Descurainia pinnata</i>	tansy-mustard	native forb	P
<i>Desmodium canadense</i>	canadian tick-trefoil	native forb	P
<i>Desmodium illinoense</i>	prairie tick-trefoil	native forb	P
<i>Desmodium</i> spp	tick-trefoil	native forb	P
<i>Diarrhena obovata</i>	obovate beakgrass	native grass	P, S, B
<i>Dichanthelium</i> spp	rosette grass	native grass	P
<i>Digitaria cognate</i>	carolina crab grass	native grass	P
<i>Ellisia nyctelea</i>	water-pod	native forb	P, S, B
<i>Elymus canadensis</i>	canada wild rye	native grass	P
<i>Elymus elymoides</i>	wild rye	native grass	P
<i>Elymus hystrix</i>	bottlebrush-grass	native grass	P, B
<i>Elymus virginicus</i>	virginia wild rye	native grass	P, S, B
<i>Eragrostis spectabilis</i>	purple lovegrass	native grass	P
<i>Erechtites hieraciifolia</i>	fireweed	native forb	P
<i>Erigeron strigosus</i>	rough fleabane	native forb	P
<i>Eupatorium altissimum</i>	tall joe-pye weed	native forb	P
<i>Euphorbia corollata</i>	flowering spurge	native forb	P
<i>Fagopyrum vulgare</i>	buckwheat	nonnative forb	P
<i>Festuca subverticillata</i>	nodding fescue	native grass	P, S, B
<i>Fragaria virginiana</i>	thick-leaved wild strawberry	native forb	P
<i>Fraxinus pennsylvanica</i>	green ash	native woody	S
<i>Galium aparine</i>	cleavers	native forb	P, S, B
<i>Gaura coccinea</i>	scarlet gaura	native forb	P
<i>Gentiana puberulenta</i>	prairie gentian	native forb	P
<i>Geum canadense</i>	white avens	native forb	P, S, B
<i>Gleditsia triacanthos</i>	honey-locust	native woody	P
<i>Gleditsia triacanthos</i>	honey-locust	native woody	S
<i>Glycyrrhiza lepidota</i>	wild licorice	native forb	P
<i>Hackelia virginiana</i>	stickseed, beggar's lice	native forb	P, S, B
<i>Helianthus annuus</i>	common sunflower	native forb	P
<i>Helianthus laetiflorus</i>	aster	native forb	P
<i>Helianthus mollis</i>	ashy sunflower	native forb	P
<i>Helianthus pauciflorus</i>	stiff sunflower	native forb	P
<i>Helianthus petiolaris</i>	plains sunflower	native forb	P
<i>Hieracium longipilum</i>	long-haired hawkweed	native forb	P
<i>Juglans nigra</i>	black walnut	native woody	S
<i>Juncus</i> spp	rush	native sedge/rush	P

<i>Juniperus virginiana</i>	eastern red cedar	native woody	S
<i>Kochia scoparia</i>	summer-cypress	nonnative forb	P
<i>Koeleria macrantha</i>	junegrass	native grass	P
<i>Lactuca canadensis</i>	tall lettuce	native forb	P
<i>Lactuca floridana</i>	woodland lettuce	native forb	P, S
<i>Lactuca serriola</i>	prickly lettuce	nonnative forb	P
<i>Laportea canadensis</i>	nettle	native forb	P, S, B
<i>Leersia virginica</i>	whitegrass	native grass	P, S, B
<i>Lepidium densiflorum</i>	prairie-pepperweed	native forb	P
<i>Lespedeza capitata</i>	bush-clover	native forb	P
<i>Liatris pycnostachya</i>	thick-spike blazing star	native forb	P
<i>Liatris</i> spp	blazing star	native forb	P
<i>Linum sulcatum</i>	grooved yellow flax	native forb	P
<i>Lithospermum incisum</i>	narrow-leaved puccoon	native forb	P
<i>Lotus unifoliolatus</i>	bird's foot trefoil	native forb	P
<i>Lycopus americanus</i>	american water-horehound	native forb	P
<i>Lysimachia ciliate</i>	fringed loosestrife	native forb	P
<i>Maianthemum stellatum</i>	starry false lily of the valley	native forb	P, S, B
<i>Mirabilis albida</i>	pale umbrella-wort	native forb	P
<i>Mirabilis linearis</i>	narrow-leaved umbrella-wort	native forb	P
<i>Mirabilis nyctaginea</i>	heart-leaved umbrella-wort	native forb	P
<i>Monarda fistulosa</i>	wild bergamot	native forb	P
<i>Morus alba</i>	white mulberry	nonnative woody	P, S, B
<i>Muhlenbergia frondosa</i>	muhly	native grass	P
<i>Muhlenbergia racemosa</i>	muhly	native grass	P
<i>Muhlenbergia</i> spp	muhly	native grass	P
<i>Oenothera biennis</i>	common evening-primrose	native forb	P
<i>Oxalis</i> spp	wood-sorrel	native forb	P
<i>Oxalis violacea</i>	violet wood-sorrel	native forb	P
<i>Panicum capillare</i>	witch-grass	native grass	P
<i>Panicum virgatum</i>	switchgrass	native grass	P
<i>Parietaria pensylvanica</i>	pennsylvania pellitory	native forb	P, S
<i>Parthenocissus quinquefolia</i>	virginia-creeper, woodbine	native woody	P, S, B
<i>Phryma leptostachya</i>	lopseed	native forb	P, S
<i>Physalis heterophylla</i>	clammy ground cherry	native forb	P
<i>Physalis pubescens</i>	downy ground cherry	native forb	P
<i>Physalis virginiana</i>	virginia ground cherry	native forb	P
<i>Phytolacca americana</i>	pokeweed, pokeberry	native forb	P, S
<i>Pilea pumila</i>	clearweed	native forb	P, S, B
<i>Plantago patagonica</i>	wooly plantain	native forb	P
<i>Poa pratensis</i>	kentucky bluegrass	nonnative grass	P
<i>Polygonum pensylvanicum</i>	pennsylvania smartweed	native forb	P
<i>Polygonum ramosissimum</i>	smartweed	native forb	P
<i>Polygonum scandens</i>	false buckwheat	native forb	P
<i>Polygonum virginianum</i>	jumpseed	native forb	P, S, B
<i>Prunus Americana</i>	wild plum	native woody	P
<i>Prunus</i> spp	Plum	native woody	S
<i>Psoralea argophylla</i>	silvery scurf-pea	native forb	P
<i>Psoralea esculenta</i>	breadroot scurf-pea	native forb	P
<i>Psoralidium tenuiflorum</i>	gray scurf-pea	native forb	P

<i>Quercus macrocarpa</i>	bur oak	native woody	S, B
<i>Rhus glabra</i>	smooth sumac	native woody	P
<i>Ribes missouriense</i>	missouri gooseberry	native woody	P, S, B
<i>Rosa arkansana</i>	dwarf prairie rose	native woody	P
<i>Rubus occidentalis</i>	black raspberry	native woody	P
<i>Rudbeckia hirta</i>	black-eyed susan	native forb	P
<i>Rumex crispus</i>	curly dock	nonnative forb	P
<i>Salvia azurea</i>	sage	native forb	P
<i>Sanicula odorata</i>	clustered blacksnakeroot	native forb	P, S, B
<i>Schizachyrium scoparium</i>	little bluestem	native grass	P
<i>Scutellaria parvula</i>	little skullcap	native forb	P
<i>Senecio plattensis</i>	platte groundsel	native forb	P
<i>Setaria faberi</i>	nodding foxtail-grass	nonnative grass	P
<i>Setaria pumila</i>	yellow foxtail	nonnative grass	P
<i>Setaria spp</i>	bristlegrass	nonnative grass	P
<i>Setaria viridis</i>	green foxtail-grass	nonnative forb	P
<i>Silene antirrhina</i>	catchfly, campion	native forb	P
<i>Silphium laciniatum</i>	compass-plant	native forb	P
<i>Silphium perfoliatum</i>	cup-plant	native forb	P
<i>Sisyrinchium campestre</i>	blue-eyed grass	native forb	P
<i>Smilax tamnoides</i>	catbrier	native woody	P, S, B
<i>Solanum spp</i>	nightshade	native forb	P, S
<i>Solidago canadensis</i>	common goldenrod	native forb	P
<i>Solidago gigantea</i>	smooth goldenrod	native forb	P
<i>Solidago missouriensis</i>	missouri goldenrod	native forb	P
<i>Solidago rigida</i>	stiff goldenrod	native forb	P
<i>Sorghastrum nutans</i>	indian grass	native grass	P
<i>Spermolepis inermis</i>	western spermolepis	native forb	P
<i>Sphenopholis obtusata</i>	wedge-grass	native grass	P
<i>Sporobolus asper</i>	tall dropseed	native grass	P
<i>Sporobolus clandestinus</i>	rough dropseed	native grass	P
<i>Sporobolus cryptandrus</i>	sand dropseed	native grass	P
<i>Sporobolus heterolepis</i>	prairie dropseed	native grass	P
<i>Stachys tenuifolia</i>	smooth hedgenettle	native forb	P, B
<i>Stipa spartea</i>	porcupine-grass	native grass	P
<i>Symphoricarpos occidentalis</i>	wolfberry	native woody	P
<i>Symphoricarpos orbiculatus</i>	coralberry	native woody	P, S, B
<i>Taraxacum officinale</i>	common dandelion	nonnative forb	P
<i>Teucrium canadense</i>	american germander	native forb	P
<i>Thlaspi arvense</i>	field penny-cress	nonnative forb	P
<i>Toxicodendron radicans</i>	common poison-ivy	native woody	P, S, B
<i>Triodanis perfoliata</i>	round-leaved triodanis	native forb	P
<i>Tripsacum dactyloides</i>	gama-grass	native grass	P
<i>Ulmus Americana</i>	american elm	native woody	S, B
<i>Ulmus pumila</i>	elm	nonnative woody	P
<i>Ulmus rubra</i>	red elm	native woody	P
<i>Ulmus spp</i>	elm	nonnative woody	P
<i>Urtica dioica</i>	nettle, stinging nettle	native forb	P, S, B
<i>Verbena bracteata</i>	prostrate vervain	native forb	P
<i>Verbena hastata</i>	common vervain	native forb	P

<i>Verbena simplex</i>	narrow-leaved vervain	native forb	P
<i>Verbena stricta</i>	hoary vervain	native forb	P
<i>Verbena urticifolia</i>	white vervain	native forb	P
<i>Verbesina alternifolia</i>	wingstem	native forb	P, S, B
<i>Vernonia baldwinii</i>	western ironweed	native forb	P
<i>Veronica arvensis</i>	corn speedwell	nonnative forb	P
<i>Viola bicolor</i>	violet	native forb	P
<i>Viola missouriensis</i>	missouri violet	native forb	P, S
<i>Viola pedatifida</i>	wood violet	native forb	P
<i>Viola pratincola</i>	violet	native forb	P
<i>Viola pubescens</i>	downy yellow violet	native forb	P, B
<i>Viola sororia</i>	violet	native forb	P, S, B
<i>Viola</i> spp	violet	native forb	P, B
<i>Vitis</i> spp	grapevine	native woody	P, B

