Status Report

Vegetation Community Monitoring

George Washington Carver National Monument

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1.0 Introduction

The tallgrass prairie ecosystem once spread across more than 60 million hectares and extended from southern Texas to southern Manitoba (Collins and Glenn 1998). Now, however, it is estimated that as little as 1-4% (0.6-2.4 million ha) of the original tallgrass prairie remains (Weaver 1954). George Washington Carver National Monument (GWCA) contains 130 acres of restored tallgrass prairie, including a unique wet prairie component. Management of the prairie has been minimal for the last five to six years, with no prescribed fire since 2000.

During the week of May 25, 2004, seven long-term vegetation monitoring sites were established in the tallgrass areas of GWCA by the Heartland I&M Network and Prairie Cluster Prototype Monitoring Program (HTLN). These sites were sampled twice in the following growing season. Portions of the prairie were burned in April 2005, including four of the HTLN sites. All seven HTLN sample sites were resampled in May and August of 2005.

Long-term ecological monitoring, while contributing to our empirical understanding of prairie communities, is integral to the proper management and protection of the lands entrusted to the National Park Service. Resource managers of the parks require effective plant community monitoring to assess their management strategies in maintaining and/or restoring prairie plant community composition, structure, and diversity.

2.0 Methods

Site Selection

Initial sample site selection included determining a reference frame for statistical inference. Exclusions to the reference frame included the visitor center and future expansion area, as well as additional buildings, the woodland units with soil unit 92A, the Secech-Cedargap silt loams, and the future crop demonstration area in management unit seven. Total acreage of the reference frame is 127 acres. A 50m x 50m grid was then overlaid on the reference frame and sample sites were selected using geographic stratification by soils: 1) poorly drained silt loam, Carytown, or 2) well drained silt loams, Wanda, Keeno and Hoberg (Figure 1).

The number of sample sites were deployed to reflect the proportions of soils and larger-scale burn units (i.e. north half of park vs. south half of park) (Figure 2). Approximately 25% of the acreage (29.021 acres) is in poorly drained soils, so 25% of the sample sites (2) are located in the poorly drained soil areas. Therefore, the remaining 75% of the acreage (97.954 acres) is in the well drained soils, so 75% of sites (5) are located in the well drained soil areas. Of the reference frame, 60% of the acreage is in the southern part of the park, consisting of management units 3, 4 (southern part), 5 and 6 slated to burn together. Forty percent of the reference frame is located in the northern part of the park, consisting of management units 1, 2 and 7 also slated to burn the same year. Sixty percent of the plots (4) are located in the southern half of the park, while 40% (3) are located in the northern half of the park.

Sampling

The HTLN vegetation community monitoring sample design is based on the National Science Foundation's Konza Prairie Long-Term Ecological Research Program. For the HTLN, the

primary sample unit consists of two permanent, parallel 50m transects with five sets of nested plots systematically spaced along each transect. Additional information on the HTLN vegetation monitoring protocol is available at: http://www1.nature.nps.gov/im/units/htln/monitoring/projects/plant_communities.htm. During spring 2004, seven sample sites were established and sampled at GWCA. Establishment included installation and GPSing of rebar at each transect end. Permanent marking of sample sites aids in relocation for long-term monitoring. Each rebar is capped with a plastic yellow cap for safety and is marked with tags for the HTLN program. Vegetation was sampled initially during the May installation and again in late August. Double sampling in spring and late summer aids in identification of warm season grasses and late flowering forbs such as asters and goldenrods. Sites were resampled in the summer of 2005 after an April burn, which affected four of the HTLN sample sites.

3.0 Results

2004 Sampling Event

On the seven HTLN sample sites, 135 ground flora species were found. Seventy-five percent of the species are native in origin and account for 90% of the foliar cover. Warm season grasses such as indian grass (*Sorgastrum nutans*), big bluestem (*Andropogon gerardii*) and little bluestem (*Schizachyrium scoparium*) are the community dominants comprising over 70% relative foliar cover per site. Johnson grass (*Sorghum halepense*), annual brome species (*Bromus tectorum* and *Bromus japonicus*) and Kentucky bluegrass are the dominant exotic grass species. Exotic forbs include bedstraw (*Galium pedemontanum*), which occurred in 80% of the sample sites. Mean Shannon diversity is relatively low (1.87$\pm$ 0.6), but total Shannon diversity (i.e. diversity across all seven sampling sites) is higher at 2.43, indicating a range of species across the park.

2005 Sampling Event

Unburned sites

The plots that were not burned had a 5-15% increase in all vegetation types, including grass and grass-like species, herbaceous species, and shrubs and woody vines. Additionally, five new exotic species and two new native species were found in the 2005 sample. New exotic species included problematic species such as bull thistle (*Cirsium vulgare*) and sweet clover (*Melilotus* spp), as well as less invasive species such the common dandelion (*Taraxacum officinale*) and timothy (*Phleum pratense*). Additionally, mean cover of johnsongrass increased from 27% to 46%.

Woody tree species regeneration increased only slightly on the unburned sites, from 24 total in 2004 to 30 total in 2005. Two species of trees increased regeneration in the seedling layer from 2004 to 2005, ash (*Fraxinus* spp.) and slippery elm (*Ulmus rubra*). Wild plum seedlings were seen for the first time in 2005, but were not present in other layers. Slippery elm increased not only in the seedling layer, but also the small (>0.5m tall and <2.54in dbh) and large (>0.5m tall and >2.54in dbh) sapling layers.

Burned sites

The four burned sites had slightly different results in 2005 from the unburned sites. Herbaceous species were the only vegetation type to increase and only a slight increase of 8% mean cover. Shrubs and woody vines were unchanged from 2004, while grasses and grass-like species mean cover was reduced by 14%. Six new exotic species were found in 2005, but seven fewer native species than the year before. New exotic species included common chickweed (*Stellaria media*), Deptford pink (*Dianthus armeria*), northern crabgrass (*Digitaria sanguinalis*) and fistulous goat's beard (*Tragopogon dubius*). Johnsongrass did not occur either before or after the burn.

Woody tree species regeneration increased from 31 seedlings and saplings for the four sites to a total of 53 in 2005. Persimmon (*Diospyros virginiana*) was the only species found after the fire that was not found pre-burn. Tree species that had increased regeneration in the seedling layer (<0.5m tall) include ash, honey locust (*Gleditsia triacanthos*), cottonwood (*Platanus occidentalis*), sassafras (*Sassafras albidum*) and slippery elm. The only species to have decreased regeneration was the wild plum (*Prunus* spp). All wild plum was eradicated in both the seedling and small sapling (>0.5m tall and <2.54in dbh) layers. While increases were seen in the seedling layer for sassafras and slippery elm, small saplings were removed with the fire. There were no large saplings (>0.5m tall and >2.54in dbh) either before or after the fire.

4.0 DISCUSSION

Taken together the 2004-2005 sample seasons provide information on naturally occurring variation in the vegetation community in response to factors such as climate. This is especially important to assess naturally occurring change in warm season grass cover. The two years of sampling will also serve as baseline period for comparison of any future management efforts such as prescribed fire.

While initial response to the burning was measured the summer of 2005, it is still too early to determine the long-term effects of the April 2005 burn. Perhaps due to the reduction in fire fuels resulting in significant amounts of bare ground, there was increased regeneration of several tree species in the burned areas. This could also explain the increase in exotic species. Both of these trends would be expected to be reversed with additional fires. Additional years of monitoring will provide information on the long-term effect of burning on tallgrass prairie plant species composition and structure.

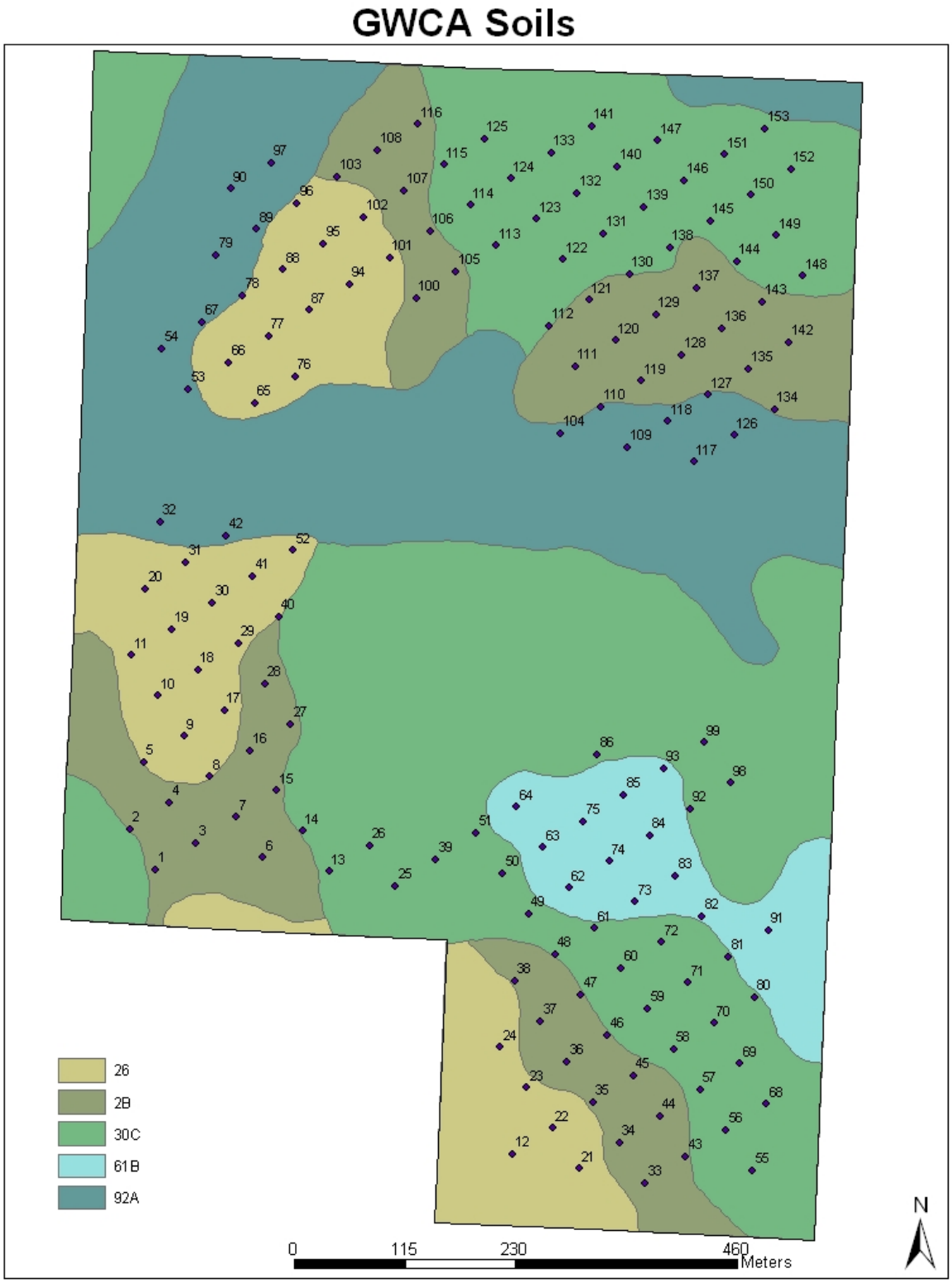

Figure 1 George Washington Carver National Monument with 50 meter grid points overlaid on the soils map (Carytown silt loam 26, Wanda silt loam 2B, Keeno very cherty silt loam 30C, Hoberg silt loam 61B, and Secesh-Cedargap silt loam 92A).

Figure 2 George Washington Carver National Monument with the seven permanent HTLN vegetation monitoring sites.

Appendix A. Summary statistics for GWCA 2005 vegetation monitoring.

Sites Not Burned (1,2,4)

Table 1a. Plant Community Composition: Species Richness and Shannon Diversity.

All Species:

Species Richness:	**109**		
Total Shannon Diversity:	**2.75**	Total Shannon Evenness:	**0.59**
Mean Diversity (st dev):	**2.22 (0.47)**	Mean Evenness (st dev):	**0.52 (0.10)**

Native Species Only:

Native Species Richness:	**82**		
Total Shannon Diversity:	**2.31**	Total Shannon Evenness:	**0.53**
Mean Diversity (st dev):	**1.87 (0.65)**	Mean Eveness (st dev):	**0.48 (0.14)**

Table 1b. Plant Community Summary: Relative Frequency and Cover of Exotic Species.

Number of Exotic Species: **26**
Number of Native Species: **82**
Exotic Ratio: **0.241**

	Mean Relative Frequency	Mean Relative Cover
I	**29.92%**	**22.84%**
N	**70.08%**	**77.16%**

Table 1c. Plant Community Composition: Relative Frequency and Cover of Plant Guilds.

Plant Guild	Mean Relative Cover (st dev)	Mean Relative Frequency (st dev)
Annuals and Biennials	**17.33% (0.211)**	**29.70% (0.126)**
Cool-Season Grasses	**2.10% (0.010)**	**12.86% (0.054)**
Grass-Like	**1.66% (0.012)**	**6.81% (0.046)**
Legumes	**0.78% (0.006)**	**5.06% (0.022)**
Spring Forbs	**3.08% (0.001)**	**13.44% (0.007)**
Summer/Fall Forbs	**0.97% (0.009)**	**5.37% (0.026)**
Warm-Season Grasses	**61.87% (0.215)**	**23.07% (0.045)**
Woody Species	**12.20% (0.176)**	**3.70% (0.027)**

Table 2a. Plant Community Structure: Ground Cover.

Structural Component	Mean Percent Cover
BARE SOIL	**12.42**
BARE ROCK	**0.07**
GRASS LITTER	**59.08**
WOODY DEBRIS	**0.35**
LEAF LITTER	**0.52**
UNVEGETATED SURFACE	**64.50**

Table 2b. Plant Community Structure: Vegetation Type Cover.

Vegetation Type	Mean Percent Cover
Grasses/Grass-Like	**73.47**
Herbs	**18.27**
Shrubs	**8.98**
Woody Vines	**0.18**

Table 3a. Plant Community Composition: Herbaceous and Shrub Species.

Species	Common Name	Frequency Cover	Mean	Importance Value
SORGHASTRUM NUTANS	Indian grass	96.67%	29.78	0.1644
ANDROPOGON GERARDII	Big bluestem	90.00%	14.70	0.0822
SORGHUM HALEPENSE	Johnsongrass	30.00%	46.22	0.0621
RUBUS SPP	Blackberry	46.67%	13.29	0.0461
GALIUM APARINE	Cleavers	63.33%	10.08	0.0379
POA PRATENSIS	Kentucky bluegrass	66.67%	5.03	0.0268
VALERIANELLA RADIATA	Corn salad	100.00%	1.33	0.0257
SOLANUM CAROLINENSE	Horse-nettle	100.00%	1.42	0.0254
ANNUAL BROMUS SPP	B. tectorum, B. japonicus	66.67%	4.20	0.0247
SCHIZACHYRIUM SCOPARIUM	Little bluestem	50.00%	4.40	0.0226
ANDROPOGON VIRGINICUS	Broom-sedge	73.33%	2.39	0.0223
LOLIUM ARUNDINACEUM	Tall Fescue	50.00%	5.03	0.0212
CAREX SPP	Sedge	76.67%	1.37	0.0191
RHUS COPALLINUM	Shining sumac	10.00%	26.83	0.0187
BOUTELOUA CURTIPENDULA	Side-oats grama-grass	53.33%	2.34	0.0172
STROPHOSTYLES LEIOSPERMA	Small-flowered woolly bean	73.33%	0.50	0.0154
AGROSTIS HYEMALIS	Ticklegrass	73.33%	0.50	0.0153
OXALIS SPP	Wood-sorrel	73.33%	0.50	0.0152
CRUCIATA PEDEMONTANA	Piedmont bedstraw	70.00%	0.50	0.0145
MYOSOTIS VERNA	Early scorpion grass	63.33%	0.50	0.0131
VERONICA ARVENSIS	Corn speedwell	60.00%	0.50	0.0125
TRIFOLIUM CAMPESTRE	Pinnate hop-clover	56.67%	0.79	0.0124
AMBROSIA ARTEMISIIFOLIA	Common ragweed	56.67%	0.50	0.0118
PLANTAGO LANCEOLATA	Narrowleaf plantain	56.67%	0.50	0.0117
VICIA SATIVA	Garden vetch	53.33%	0.81	0.0117
RUMEX CRISPUS	Curly dock	50.00%	0.67	0.0107
GERANIUM CAROLINIANUM	Carolina crane's-bill	50.00%	0.50	0.0104
CHAEROPHYLLUM TAINTURIERI	Southern chervil	30.00%	3.50	0.0097
RUMEX ACETOSELLA	Common sheep sorrel	33.33%	2.20	0.0094
TRIFOLIUM PRATENSE	Red clover	43.33%	0.50	0.0090
KOELERIA MACRANTHA	Junegrass	33.33%	1.25	0.0084
HORDEUM PUSILLUM	Little barley	40.00%	0.50	0.0083
ACALYPHA VIRGINICA	Virginia copperleaf	40.00%	0.50	0.0083
VULPIA OCTOFLORA	Six-weeks fescue	36.67%	0.50	0.0078
SETARIA VIRIDIS	Green foxtail-grass	36.67%	0.50	0.0076
TRIDENS FLAVUS	Purpletop	36.67%	0.50	0.0076
DICHANTHELIUM SPP	Panic grass	33.33%	0.75	0.0074
CIRSIUM ALTISSIMUM	Tall thistle	23.33%	1.93	0.0069
TRAGIA BETONICIFOLIA	Tragia	26.67%	0.81	0.0060
PANICUM VIRGATUM	Switchgrass	26.67%	0.50	0.0055
BARBAREA VULGARIS	Yellow rocket	26.67%	0.50	0.0055
STELLARIA MEDIA	Common chickweed	26.67%	0.50	0.0054
JUNCUS INTERIOR	Rush	23.33%	0.50	0.0050
ERAGROSTIS SPECTABILIS	Purple lovegrass	23.33%	0.50	0.0049
POTENTILLA RECTA	Sulphur five-fingers	23.33%	0.50	0.0048
ERIGERON STRIGOSUS	Rough fleabane	23.33%	0.50	0.0048
CAREX SHORTIANA	Short's sedge	20.00%	0.50	0.0043

Species	Common Name	Frequency	Mean Cover	Importance Value
PHYSALIS HETEROPHYLLA	Clammy ground cherry	20.00%	0.50	0.0041
VERBENA SIMPLEX	Narrow-leaved vervain	16.67%	0.50	0.0036
PANICUM ANCEPS	Beaked panicgrass	16.67%	0.50	0.0034
LACTUCA SPP	Wild lettuce	16.67%	0.50	0.0034
DAUCUS CAROTA	Wild carrot, Queen Anne's	13.33%	0.50	0.0028
ASTER PILOSUS	Awl wild aster	13.33%	0.50	0.0028
ALLIUM SPP	Wild onion	13.33%	0.50	0.0028
TRIODANIS PERFOLIATA	Round-leaved triodanis	13.33%	0.50	0.0028
ERECHTITES HIERACIIFOLIA	Fireweed	13.33%	0.50	0.0027
CONYZA CANADENSIS	Horseweed	13.33%	0.50	0.0027
TEUCRIUM CANADENSE	American germander	10.00%	0.50	0.0021
KRIGIA CESPITOSA	Sunflower	10.00%	0.50	0.0021
SOLIDAGO SPP	Goldenrod	10.00%	0.50	0.0021
OXALIS VIOLACEA	Violet wood-sorrel	10.00%	0.50	0.0021
CHAMAECRISTA FASCICULATA	Partridge-pea; locust-weed	10.00%	0.50	0.0021
CROTON GLANDULOSUS	Tooth-leaved croton	10.00%	0.50	0.0020
PHYSALIS VIRGINIANA	Virginia ground cherry	10.00%	0.50	0.0020
LACTUCA SERRIOLA	Prickly lettuce	10.00%	0.50	0.0020
BIDENS SPP	Beggarticks	10.00%	0.50	0.0020
CAMPSIS RADICANS	Trumpet creeper	6.67%	1.75	0.0019
DIGITARIA COGNATA	Carolina crab grass	6.67%	1.75	0.0019
POA COMPRESSA	Canada bluegrass	6.67%	1.75	0.0017
KUMMEROWIA STIPULACEA	Korean clover	6.67%	0.50	0.0014
CALYSTEGIA SEPIUM	Hedge-bindweed	6.67%	0.50	0.0014
PENSTEMON DIGITALIS	Talus slope penstemon	6.67%	0.50	0.0014
RUELLIA HUMILIS	Fringeleaf ruellia	6.67%	0.50	0.0014
VITIS SPP	Grape	6.67%	0.50	0.0014
PARTHENOCISSUS QUINQUEFOLIA	Virginia-creeper, woodbine	6.67%	0.50	0.0014
DESMODIUM SPP	Tick tre-foil	6.67%	0.50	0.0014
DESMODIUM ILLINOENSE	Prairie tick-trefoil	6.67%	0.50	0.0014
SPOROBOLUS ASPER	Tall dropseed	6.67%	0.50	0.0014
ASCLEPIAS VIRIDIS	Ozark milkweed	6.67%	0.50	0.0014
TARAXACUM OFFICINALE	Common dandelion	6.67%	0.50	0.0013
SCHRANKIA NUTTALLII	Sensitive brier	3.33%	3.00	0.0012
SALVIA AZUREA	Sage	3.33%	3.00	0.0012
APOCYNUM CANNABINUM	Hemp dogbane	3.33%	3.00	0.0011
SYMPHORICARPOS ORBICULATUS	Coralberry	3.33%	3.00	0.0010
SAPONARIA OFFICINALIS	Bouncingbet	3.33%	0.50	0.0007
CYPERUS SPP	Flatsedge	3.33%	0.50	0.0007
PASCOPYRUM SMITHII	Western wheatgrass	3.33%	0.50	0.0007
VERBENA STRICTA	Hoary vervain	3.33%	0.50	0.0007
ASCLEPIAS SPP	Milkweed	3.33%	0.50	0.0007
ASCLEPIAS VERTICILLATA	Whorled milkweed	3.33%	0.50	0.0007
NUTTALLANTHUS TEXANUS	Texas toadflax	3.33%	0.50	0.0007
CROTON CAPITATUS	Woolly croton	3.33%	0.50	0.0007
CROTON MONANTHOGYNUS	Prairie-tea, one-seed croton	3.33%	0.50	0.0007

Species	Common Name	Frequency	Mean Cover	Importance Value
EUPHORBIA COROLLATA	Flowering spurge	3.33%	0.50	0.0007
LACTUCA CANADENSIS	Tall lettuce	3.33%	0.50	0.0007
LESPEDEZA CAPITATA	Bush-clover	3.33%	0.50	0.0007
VERNONIA BALDWINII	Western ironweed	3.33%	0.50	0.0007
RUDBECKIA HIRTA	Black-eyed Susan	3.33%	0.50	0.0007
AGERATINA ALTISSIMA	Tall ageratina	3.33%	0.50	0.0007
VIOLA BICOLOR	Violet	3.33%	0.50	0.0007
SIDA SPINOSA	Prickly spinosa	3.33%	0.50	0.0007
POLYGALA SANGUINEA	Purple milkwort	3.33%	0.50	0.0007
POLYGONUM SPP	Knotweed	3.33%	0.50	0.0007
MELILOTUS SPP	M. albus , M. officinalis	3.33%	0.50	0.0007
PHLEUM PRATENSE	Timothy	3.33%	0.50	0.0007
CIRSIUM VULGARE	Bull thistle	3.33%	0.50	0.0007
GNAPHALIUM OBTUSIFOLIUM	Fragrant cudweed	3.33%	0.50	0.0007
CONVOLVULUS ARVENSIS	Field-bindweed	3.33%	0.50	0.0007
POA ARIDA	Plains bluegrass	3.33%	0.50	0.0007

Table 3b. Plant Community Composition: Exotic Species.

Species	Common Name	Frequency	Mean Cover	Importance Value
SORGHUM HALEPENSE	Johnsongrass	30.00%	46.22%	0.0621
POA PRATENSIS	Kentucky bluegrass	66.67%	5.03%	0.0268
ANNUAL BROMUS SPP	B. tectorum, B. japonicus	66.67%	4.20%	0.0247
LOLIUM ARUNDINACEUM	Tall Fescue	50.00%	5.03%	0.0212
CRUCIATA PEDEMONTANA	Piedmont bedstraw	70.00%	0.50%	0.0145
VERONICA ARVENSIS	Corn speedwell	60.00%	0.50%	0.0125
TRIFOLIUM CAMPESTRE	Pinnate hop-clover	56.67%	0.79%	0.0124
PLANTAGO LANCEOLATA	Narrowleaf plantain	56.67%	0.50%	0.0117
VICIA SATIVA	Garden vetch	53.33%	0.81%	0.0117
RUMEX CRISPUS	Curly dock	50.00%	0.67%	0.0107
RUMEX ACETOSELLA	Common sheep sorrel	33.33%	2.20%	0.0094
TRIFOLIUM PRATENSE	Red clover	43.33%	0.50%	0.0090
SETARIA VIRIDIS	Green foxtail-grass	36.67%	0.50%	0.0076
BARBAREA VULGARIS	Yellow rocket	26.67%	0.50%	0.0055
STELLARIA MEDIA	Common chickweed	26.67%	0.50%	0.0054
POTENTILLA RECTA	Sulphur five-fingers	23.33%	0.50%	0.0048
DAUCUS CAROTA	Wild carrot, Queen Anne's	13.33%	0.50%	0.0028
LACTUCA SERRIOLA	Prickly lettuce	10.00%	0.50%	0.0020
POA COMPRESSA	Canada bluegrass	6.67%	1.75%	0.0017
KUMMEROWIA STIPULACEA	Korean clover	6.67%	0.50%	0.0014
TARAXACUM OFFICINALE	Common dandelion	6.67%	0.50%	0.0013
SAPONARIA OFFICINALIS	Bouncingbet	3.33%	0.50%	0.0007
CONVOLVULUS ARVENSIS	Field-bindweed	3.33%	0.50%	0.0007
CIRSIUM VULGARE	Bull thistle	3.33%	0.50%	0.0007
PHLEUM PRATENSE	Timothy	3.33%	0.50%	0.0007
MELILOTUS SPP	M. albus , M. officinalis	3.33%	0.50%	0.0007

Burned Sites (3,5,6,7)

Table 1a. Plant Community Composition: Species Richness and Shannon Diversity.

All Species:

Species Richness:	**111**		
Total Shannon Diversity:	**2.73**	Total Shannon Evenness:	**0.58**
Mean Diversity (st dev):	**2.26 (0.42)**	Mean Evenness (st dev):	**0.56 (0.08)**

Native Species Only:

Native Species Richness:	**84**		
Total Shannon Diversity:	**2.53**	Total Shannon Evenness:	**0.57**
Mean Diversity (st dev):	**2.08 (0.35)**	Mean Eveness (st dev):	**0.55 (0.07)**

Table 1b. Plant Community Summary: Relative Frequency and Cover of Exotic Species.

Number of Exotic Species: **26**
Number of Native Species: **84**
Exotic Ratio: **0.236**

	Mean Relative Frequency	Mean Relative Cover
I	**15.17%**	**4.94%**
N	**84.83%**	**95.06%**

Table 1c. Plant Community Composition: Relative Frequency and Cover of Plant Guilds.

Plant Guild	Mean Relative Cover (st dev)	Mean Relative Frequency (st dev)
Annuals and Biennials	**18.99% (0.203)**	**22.97% (0.082)**
Cool-Season Grasses	**3.56% (0.054)**	**7.89% (0.032)**
Ephemeral Spring Forbs	**0.09% (0.000)**	**0.63% (0.003)**
Grass-Like	**0.83% (0.007)**	**4.83% (0.028)**
Legumes	**2.47% (0.029)**	**7.30% (0.041)**
Spring Forbs	**1.83% (0.007)**	**11.63% (0.028)**
Summer/Fall Forbs	**1.88% (0.029)**	**5.18% (0.057)**
Warm-Season Grasses	**55.44% (0.276)**	**33.75% (0.090)**
Woody Species	**14.92% (0.038)**	**5.82% (0.013)**

Table 2a. Plant Community Structure: Ground Cover.

Structural Component	Mean Percent Cover
BARE SOIL	**62.13**
BARE ROCK	**1.09**
GRASS LITTER	**12.88**
WOODY DEBRIS	**0.34**
LEAF LITTER	**0.71**
UNVEGETATED SURFACE	**72.63**

Table 2b. Plant Community Structure: Vegetation Type Cover.

Vegetation Type	Mean Percent Cover
Grasses/Grass-Like	**42.40**
Herbs	**21.30**
Shrubs	**11.25**
Woody Vines	**0.10**

Table 3a. Plant Community Composition: Herbaceous and Shrub Species.

Species	Common Name	Frequency	Mean Cover	Importance Value
ANDROPOGON GERARDII	Big bluestem	97.50%	24.42	0.1863
SORGHASTRUM NUTANS	Indian grass	92.50%	9.76	0.0874
ACALYPHA VIRGINICA	Virginia copperleaf	95.00%	8.54	0.0746
RHUS COPALLINUM	Shining sumac	42.50%	14.12	0.0449
RUBUS SPP	Blackberry	60.00%	8.08	0.0431
SCHIZACHYRIUM SCOPARIUM	Little bluestem	90.00%	2.54	0.0377
AMBROSIA ARTEMISIIFOLIA	Common ragweed	77.50%	2.16	0.0294
PANICUM VIRGATUM	Switchgrass	85.00%	1.15	0.0258
OXALIS SPP	Wood-sorrel	90.00%	0.50	0.0239
TRIDENS FLAVUS	Purpletop	70.00%	1.04	0.0211
PANICUM ANCEPS	Beaked panicgrass	32.50%	7.04	0.0198
CROTON MONANTHOGYNUS	Prairie-tea, one-seed croton	30.00%	6.00	0.0187
SOLANUM CAROLINENSE	Horse-nettle	67.50%	0.78	0.0179
CAREX SPP	Sedge	60.00%	0.71	0.0172
STROPHOSTYLES LEIOSPERMA	Small-flowered woolly bean	60.00%	0.50	0.0153
PANICUM CAPILLARE	Witch-grass	50.00%	0.75	0.0150
PLANTAGO LANCEOLATA	Narrowleaf plantain	52.50%	0.50	0.0133
GERANIUM CAROLINIANUM	Carolina crane's-bill	50.00%	0.50	0.0129
CIRSIUM ALTISSIMUM	Tall thistle	32.50%	3.12	0.0127
ANDROPOGON VIRGINICUS	Broom-sedge	45.00%	0.78	0.0119
DICHANTHELIUM SPP	Panic grass	47.50%	0.50	0.0111
ERAGROSTIS SPECTABILIS	Purple lovegrass	40.00%	0.50	0.0106
AGROSTIS HYEMALIS	Ticklegrass	37.50%	0.50	0.0101
RUELLIA HUMILIS	Fringeleaf ruellia	30.00%	2.13	0.0101
POA PRATENSIS	Kentucky bluegrass	37.50%	1.00	0.0098
TRIFOLIUM CAMPESTRE	Pinnate hop-clover	12.50%	8.40	0.0096
LESPEDEZA CAPITATA	Bush-clover	32.50%	0.69	0.0087
RUMEX ACETOSELLA	Common sheep sorrel	32.50%	0.69	0.0080
TRAGIA BETONICIFOLIA	Tragia	32.50%	0.50	0.0076
RUMEX CRISPUS	Curly dock	27.50%	0.50	0.0076
JUNCUS INTERIOR	Rush	22.50%	0.50	0.0072
ANNUAL BROMUS SPP	B. tectorum, B. japonicus	27.50%	0.73	0.0068
SPOROBOLUS ASPER	Tall dropseed	20.00%	0.50	0.0064
BOUTELOUA CURTIPENDULA	Side-oats grama-grass	25.00%	0.50	0.0064
PHYSALIS HETEROPHYLLA	Clammy ground cherry	25.00%	0.50	0.0062
LESPEDEZA VIOLACEA	Violet lespedeza	2.50%	37.50	0.0060
SETARIA FABERI	Nodding or giant foxtail-grass	20.00%	1.13	0.0055
CROTON CAPITATUS	Woolly croton	15.00%	0.92	0.0055
HORDEUM PUSILLUM	Little barley	20.00%	0.50	0.0052
SETARIA VIRIDIS	Green foxtail-grass	22.50%	0.50	0.0051
CROTON GLANDULOSUS	Tooth-leaved croton	20.00%	0.50	0.0046
NUTTALLANTHUS TEXANUS	Texas toadflax	17.50%	0.50	0.0043
BRICKELLIA EUPATORIOIDES	Aster	7.50%	6.17	0.0042
BARBAREA VULGARIS	Yellow rocket	15.00%	0.92	0.0039
CRUCIATA PEDEMONTANA	piedmont bedstraw	15.00%	0.50	0.0039
MELILOTUS OFFICINALIS	Yellow sweet clover	12.50%	0.50	0.0038
KRIGIA CESPITOSA	Sunflower	15.00%	0.50	0.0036

Species	Common Name	Frequency	Mean Cover	Importance Value
STYLOSANTHES BIFLORA	Sidebeak pencilflower	15.00%	0.50	0.0035
POTENTILLA RECTA	Sulphur five-fingers	15.00%	0.50	0.0035
VICIA SATIVA	Garden vetch	5.00%	7.75	0.0034
ROSA CAROLINA	Pasture rose	2.50%	15.00	0.0031
CONYZA CANADENSIS	Horseweed	12.50%	0.50	0.0030
ACHILLEA MILLEFOLIUM	Common yarrow	12.50%	0.50	0.0030
STELLARIA MEDIA	Common chickweed	12.50%	0.50	0.0029
LESPEDEZA VIRGINICA	Virginia lespedeza	10.00%	1.13	0.0027
VALERIANELLA RADIATA	Corn salad	10.00%	0.50	0.0027
VULPIA OCTOFLORA	Six-weeks fescue	10.00%	0.50	0.0026
VERONICA ARVENSIS	Corn speedwell	10.00%	0.50	0.0026
SALVIA AZUREA	Sage	10.00%	0.50	0.0023
ERIGERON STRIGOSUS	Rough fleabane	10.00%	0.50	0.0023
POLYGONUM PENSYLVANICUM	Pennsylvania smartweed	5.00%	1.75	0.0019
ASCLEPIAS VIRIDIS	Ozark milkweed	7.50%	0.50	0.0019
GLANDULARIA CANADENSIS	Rose vervain	7.50%	0.50	0.0018
VERBENA SIMPLEX	Narrow-leaved vervain	7.50%	0.50	0.0018
AMBROSIA BIDENTATA	Lanceleaf ragweed	7.50%	0.50	0.0017
LOLIUM ARUNDINACEUM	Tall Fescue	7.50%	0.50	0.0017
TEUCRIUM CANADENSE	American germander	7.50%	0.50	0.0017
LESPEDEZA CUNEATA	Chinese lespedeza	5.00%	1.75	0.0016
DESMODIUM PANICULATUM	Tick-trefoil	5.00%	1.75	0.0016
SCHRANKIA NUTTALLII	Sensitive brier	5.00%	1.75	0.0015
DESMODIUM ILLINOENSE	Prairie tick-trefoil	5.00%	1.75	0.0015
KOELERIA MACRANTHA	Junegrass	5.00%	0.50	0.0015
MELILOTUS SPP	M. albus , M. officinalis	2.50%	3.00	0.0014
OENOTHERA SPECIOSA	White evening-primrose	5.00%	0.50	0.0013
RUDBECKIA HIRTA	Black-eyed Susan	5.00%	0.50	0.0013
SMILAX BONA-NOX	Saw greenbrier	5.00%	0.50	0.0012
DIANTHUS ARMERIA	Deptford pink	5.00%	0.50	0.0012
TRIFOLIUM PRATENSE	Red clover	5.00%	0.50	0.0012
HYPERICUM PUNCTATUM	Spotted St. John's wort	5.00%	0.50	0.0012
LACTUCA CANADENSIS	Tall lettuce	5.00%	0.50	0.0012
ASCLEPIAS SPP	Milkweed	5.00%	0.50	0.0012
CHAMAECRISTA FASCICULATA	Partridge-pea; locust-weed	5.00%	0.50	0.0012
VERNONIA BALDWINII	Western ironweed	2.50%	3.00	0.0009
PARTHENOCISSUS QUINQUEFOLIA	Virginia-creeper, woodbine	2.50%	3.00	0.0009
DESMODIUM SPP	Tick Trefoil	2.50%	0.50	0.0009
ERIGERON SPP	Fleabane	2.50%	0.50	0.0009
PHYSALIS VIRGINIANA	Virginia ground cherry	2.50%	0.50	0.0009
GALIUM APARINE	Cleavers	2.50%	0.50	0.0009
DIGITARIA SANGUINALIS	Northern crab-grass	2.50%	0.50	0.0009
SYMPHORICARPOS OCCIDENTALIS	Wolfberry	2.50%	0.50	0.0006
BROMUS INERMIS	Smooth brome	2.50%	0.50	0.0006
CHENOPODIUM SPP	Pigweed	2.50%	0.50	0.0006
CHAEROPHYLLUM TAINTURIERI	Southern chervil	2.50%	0.50	0.0006

Species	Common Name	Frequency	Mean Cover	Importance Value
LEUCANTHEMUM VULGARE	Ox-eye daisy	2.50%	0.50	0.0006
PTILIMNIUM NUTTALLII	Laceflower	2.50%	0.50	0.0006
CHENOPODIUM ALBUM	Lamb's quarters, pigweed	2.50%	0.50	0.0006
ASTER PILOSUS	Awl wild aster	2.50%	0.50	0.0006
HIERACIUM LONGIPILUM	Long-haired hawkweed	2.50%	0.50	0.0006
PENSTEMON DIGITALIS	Talus slope penstemon	2.50%	0.50	0.0006
RHUS GLABRA	Smooth sumac	2.50%	0.50	0.0006
APOCYNUM CANNABINUM	Hemp dogbane	2.50%	0.50	0.0006
ASCLEPIAS STENOPHYLLA	Narrow-leaved milkweed	2.50%	0.50	0.0006
ASCLEPIAS VIRIDIFLORA	Green milkweed	2.50%	0.50	0.0006
TEPHROSIA VIRGINIANA	Virginiana tephrosia	2.50%	0.50	0.0006
TARAXACUM OFFICINALE	Common dandelion	2.50%	0.50	0.0006
TRAGOPOGON DUBIUS	Fistulous goat's beard	2.50%	0.50	0.0006
DIODIA TERES	Poorjoe	2.50%	0.50	0.0006
ERIGERON ANNUUS	Annual fleabane	2.50%	0.50	0.0006
EUPHORBIA DAVIDII	David's spurge	2.50%	0.50	0.0006
CYPERUS ECHINATUS	Globe flatsedge	2.50%	0.50	0.0006
DIGITARIA COGNATA	Carolina crab grass	2.50%	0.50	0.0006

Table 3b. Plant Community Composition: Exotic Species.

Species	Common Name	Frequency	Mean Cover	Importance Value
PLANTAGO LANCEOLATA	Narrowleaf plantain	52.50%	0.50%	0.0133
POA PRATENSIS	Kentucky bluegrass	37.50%	1.00%	0.0098
TRIFOLIUM CAMPESTRE	Pinnate hop-clover	12.50%	8.40%	0.0096
RUMEX ACETOSELLA	common sheep sorrel	32.50%	0.69%	0.0080
RUMEX CRISPUS	Curly dock	27.50%	0.50%	0.0076
ANNUAL BROMUS SPP	B. tectorum, B. japonicus	27.50%	0.73%	0.0068
SETARIA FABERI	Nodding or giant foxtail-	20.00%	1.13%	0.0055
SETARIA VIRIDIS	Green foxtail-grass	22.50%	0.50%	0.0051
BARBAREA VULGARIS	Yellow rocket	15.00%	0.92%	0.0039
CRUCIATA PEDEMONTANA	Piedmont bedstraw	15.00%	0.50%	0.0039
MELILOTUS OFFICINALIS	Yellow sweet clover	12.50%	0.50%	0.0038
POTENTILLA RECTA	Sulphur five-fingers	15.00%	0.50%	0.0035
VICIA SATIVA	Garden vetch	5.00%	7.75%	0.0034
STELLARIA MEDIA	Common chickweed	12.50%	0.50%	0.0029
VERONICA ARVENSIS	Corn speedwell	10.00%	0.50%	0.0026
LOLIUM ARUNDINACEUM	Tall Fescue	7.50%	0.50%	0.0017
LESPEDEZA CUNEATA	Chinese lespedeza	5.00%	1.75%	0.0016
MELILOTUS SPP	M. albus , M. officinalis	2.50%	3.00%	0.0014
TRIFOLIUM PRATENSE	Red clover	5.00%	0.50%	0.0012
DIANTHUS ARMERIA	Deptford pink	5.00%	0.50%	0.0012
DIGITARIA SANGUINALIS	Northern crab-grass	2.50%	0.50%	0.0009
LEUCANTHEMUM VULGARE	Ox-eye daisy	2.50%	0.50%	0.0006
BROMUS INERMIS	Smooth brome	2.50%	0.50%	0.0006
TARAXACUM OFFICINALE	Common dandelion	2.50%	0.50%	0.0006
EUPHORBIA DAVIDII	David's spurge	2.50%	0.50%	0.0006
TRAGOPOGON DUBIUS	Fistulous goat's beard	2.50%	0.50%	0.0006