A Systematic Survey of Vegetation at Little Bighorn Battlefield National Monument

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Final Report to Michael Stops, Chief Ranger and Resource Manager, of the Little Bighorn Battlefield National Monument, Montana; on the FY 2000, Baseline Inventory of Vascular Plants, NRPP Small Park Proposal (PMIS: LIBI-N-41185, 41193, 40943).

INTRODUCTION

A vegetation survey at Little Bighorn Battlefield National Monument was conducted in accordance with National Park Service (NPS) resource management goals to improve the inventory of native and introduced plant species. In addition to expanding baseline inventories of the flora at the Monument, this study will contribute information on the extent and locations of alien invasive plant species in the Monument that will aid in developing priorities for invasive species control. Improved information on vegetation patterns will also contribute to research on the uses and significance of the surrounding vegetation to past and present inhabitants, as well as the history of fire and its role in maintaining the native plant communities and the historic scene at the Monument.

METHODS

Study Area

As summarized in the Resource Management Plan (LIBI 1999), the historic battlefield is located along the banks of the Little Bighorn River in a northern high plains environment. Moderate precipitation with abundant sunshine, low relative humidity, and clay soils combine to produce a suitable environment for middle to tall grass prairies. Described as relatively pristine among southeastern Montana grasslands, dominant vegetation types at the Monument have been identified as the Northern mixed grass

prairie with sections of sagebrush-dominated shrub steppe. Recent fires (the 1983 fire in particular) resulted in widespread mortality of sagebrush (*Artemisia tridentata* Nutt.), and a shift to dominant native and non-native grasses (Bock et al. 1987). Cottonwood (*Populus deltoides* Bartr. ex Marsh) and sedge (*Carex* spp. L.) riparian areas exist along the Little Bighorn River, and numerous shrub-lined ravines are associated with temporary streams and runoff. Although grazing has been excluded from the battlefield since 1891 and from the Reno-Benteen Battlefield since 1954, natural patterns and processes at the Monument are influenced by the invasion of alien plant species from outside the Monument, high visitation rates, maintenance of the national cemetery and other historic features, and surrounding land uses.

Vegetation Sampling

Common and rare (but important) vegetation types at the Monument were identified using topographic maps, satellite images, and existing baseline information on natural resources. We used stratified random sampling to select potential sample locations in upland and riparian habitats. In June and July 2000, 4 multiple scale plots (20 m x 50 m) and one transect (1000m in length) were established and sampled for vascular plant species richness and cover. While some plants could not be identified to species because of phenology or condition, the presence and cover of all "unknowns" was recorded using descriptive codes.

The Modified-Whittaker plot for vegetation sampling consists of 10 1-m^2 subplots, two 10-m^2 subplots (in opposite corners), and one 100-m^2 subplot (in plot center) all contained within the 20 m x 50 m plot (Stohlgren et al., 1995). The plot is designed to capture site heterogeneity by maximizing the distance between the 6 1-m^2 subplots around the inside of the plot perimeter and four 1-m^2 subplots on the outside

perimeter of the 100-m^2 subplot. Within each 1-m^2 subplot, taxonomists identified all vascular plant species, recorded their average height, and estimated their cover to the nearest percent. In the 10-m^2 subplots and the 100-m^2 subplot, we recorded species presence. Finally, the entire 1000-m^2 plot was surveyed for any previously undetected species. For crew safety, the vegetation sampling along the Little Bighorn River was modified to avoid dense stands of poison ivy (*Toxicodendron rydbergii* (Small) Greene). Plant species richness and percent cover were recorded in 10 1m^2 subplots, and all species within 5m were recorded, on a 1000m transect along the Little Bighorn River.

For analyses, we erred on the side of caution by including all "unknowns" that could be assigned Natural Resources Conservation Service (USDA, NRCS 2001) genus or species codes. Vascular plant species lists were compiled for plots to determine the total numbers of species, similarity in species composition, as well as the species unique to a vegetation type. The different plots and subplots allowed for preliminary estimates of plant species richness and cover in each vegetation type. For each plant species, experienced botanists categorized nativity using regional databases and available literature (Native, Introduced and Unknown). Species-log(plot area) curves, hereafter called species accumulation curves, were constructed using the mean number of plant species found in each subplot for the 1-m^2 and 10-m^2 subplots and the total number of plant species found in the 100-m^2 subplot and the full 1000-m^2 plot (Figure 1).

RESULTS

By using a stratified random sampling design and multi-scale plots, we were able to efficiently gain valuable information on distribution and abundance of both native and introduced plant species at the Monument. We recorded at least 95 plant species from just four 0.1-hectare plots and one 1000m transect (Appendix 1). Thirty-nine of these records represent species that were not previously documented from the Monument. Twenty-two of the "unknowns" could be identified to genus, many of which are likely to represent additional species. In all, this survey resulted in 66 new plant records, and improved documentation for 51 previously reported plant taxa in the NPSpecies database for the Monument.

A total of twenty-seven species were classified as introduced, or non-native (Appendix 1). Introduced species represent 12 of the 39 species that were not previously documented from the Monument. Three introduced species were recorded at every one of the sample locations, including *Bromus tectorum* L., *Alyssum alyssoides* (L.)L., and *Melilotus officinalis* (L.) Lam (Appendix 1). In terms of occurrence (total number of times recorded in the plots and subplots), these species ranked second (48), third (39) and fifth (35), respectively.

For analyses of species richness and cover, all plant species and genera associated with NRCS (USDA, NRCS 2001) accepted codes are hereafter referred to as "species" (see Appendix 1). Species richness recorded in the different plots ranged from 28 in the Rolling Hills grassland location to 42 in the Reno Benteen Ravine/Draw location (Table 1). The number of native species was highest at the Ravine/Draw (28), followed by the Ridgetop grassland site (22). The number of unique species (found in only one plot) ranged from two in the Rolling Hills grassland to 11 at both the Ravine/Draw and Upper

Draw locations. The number of introduced species per plot ranged from five in the Rolling Hills grassland to 13 in the Upper Draw. At the Upper Draw location, the number of introduced species represented 34% of the total number of species recorded, and four of the 11 unique species were also classified as introduced.

Although not directly comparable to the Modified-Whittaker plots, the total number of species recorded on the Riparian transect was 68, including 39 unique species that were not recorded in any of the plots. Of the total number of species recorded, 42 were classified as "native", 10 of "unknown nativity" and 16 species as "introduced" (representing 24% of the total number of species recorded from the transect). Of the 39 "unique species", at least ten were classified as introduced.

Plot species lists were compared using Jaccard's Coefficient to estimate similarity or overlap in species composition. Percent similarity between plots ranged from 43% overlap between the Rolling Hills and the Ravine/Draw to 18% between the Rolling Hills and the Riparian transect. The two grassland plots showed 41% overlap, while the two draw types showed only 27% similarity. The Riparian transect along the Little Bighorn River showed an average of only 20.5% similarity to the other types.

Plots and subplot richness measurements were used to construct species accumulation curves in the different plots (Figure 1). Species richness values for the plots and subplots best fit the power function, indicating that many species would have been missed using only smaller plots. Relative slope for the different plot locations can also be used as an index of total species richness, and was greatest for the Ridgetop grassland location ($y = 9.25x^{0.2}$, $r^2 = 0.98$).

At the 1-m^2 scale, average basal cover of all vascular plants in the different plots ranged from 49.5% in the Upper Draw to 80.1% in the Rolling Hills grassland, with

native species occupying from 25.3% to 66.2%, respectively (Table 3). Introduced species cover ranged from 7.5% in the Ridgetop grassland to 23.9 % in the Upper Draw. The Upper Draw site showed the highest percent cover of introduced plants, while ranking lowest for both total and native plant species cover. Invasive grass species, *Bromus tectorum* L., and *Poa pratensis* L., ranked second and third in terms of cover at this site, respectively (Table 4). All of the sample locations contained at least one introduced species with cover greater than 0.5%, based on average cover for the 10 $1m^2$ subplots (Table 4).

Table 1:
Summary of vascular plant species recorded in the different plots (plants that were assigned NRCS codes).

	Rolling Hills	Upper Draw	Ridgetop	Ravine/ Draw	Riparian
Total number of vascular plant species	28	38	41	42	68
Number of species unique to each plot	2	11	9	11	39
Number of native species	17	19	22	28	42
Number of species with unknown nativity	6	6	10	4	10
Number of introduced species	5	13	9	10	16
Percentage introduced (of the total number)	18	34	22	23	24

Table 2:
Percent Similarity (Jaccard's Coefficient X100) among plant species composition in the 5 plots.

	Ridgetop	Rolling Hills	Ravine/Draw	Upper Draw
Riparian	21	18	24	19
Upper Draw	34	29	27	-
Ravine/Draw	32	43	-	
Rolling Hills	41	-		
Ridgetop	-			

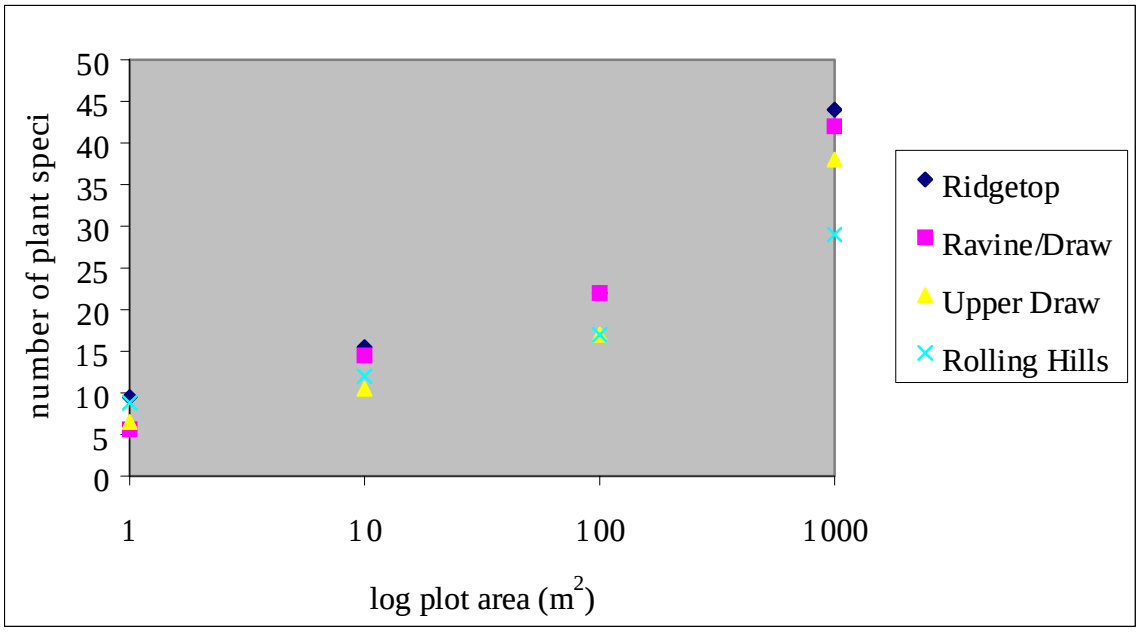
Table 3:
Percent cover of plants in the different plots
(average basal cover in the 10 1m^2 subplots).

	Total	Native	Introduced
Ridgetop	57.1	46.6	7.5
Rolling Hills	80.1	66.2	13.1
Ravine/Draw	70.0	62.9	6.8
Upper Draw	49.5	25.3	23.9
Riparian	67.4	47.8	11.4

Table 4:
Vascular plant species with at least 0.5 percent cover in each plot, based on average cover for the 10 1-m^2 subplots. Introduced species are highlighted in bold.

Species	%Cover
Ridgetop, grassland	
Pseudoroegneria spicata ssp. spicata (Pursh) A. Löve	3.40
Pascopyrum smithii (Rydb.) A. Löve	2.22
Achillea millefolium L.	1.20
***Bromus tectorum* L.**	**0.54**
Koeleria macrantha (Ledeb.) J.A. Schultes	0.54
Phlox hoodii Richards.	0.52
Yucca glauca Nutt.	0.50
Rolling Hills, grassland at Reno-Benteen	
Pseudoroegneria spicata ssp. spicata (Pursh) A. Löve	4.10
Pascopyrum smithii (Rydb.) A. Löve	3.30
Bouteloua curtipendula (Michx.) Torr.	2.00
Achillea millefolium L.	2.00
***Bromus tectorum* L.**	**1.07**
***Melilotus officinalis* (L.) Lam**	**1.04**
Nassella viridula (Trin.) Barkworth	0.68
Psoralidium tenuiflorum (Pursh) Rydb.	0.51
Ravine/Draw, at Reno Benteen	
Poa palustris L.	5.54
Pseudoroegneria spicata ssp. spicata (Pursh) A. Löve	2.96
Symphoricarpos occidentalis Hook.	1.73
Artemisia ludoviciana Nutt.	0.64
Pascopyrum smithii (Rydb.) A. Löve	0.63
***Cirsium arvense* (L.) Scop.**	**0.58**
Upper Draw, shrub-lined draw	
Pascopyrum smithii (Rydb.) A. Löve	3.42
***Bromus tectorum* L.**	**3.04**
***Poa pratensis* L.**	**1.22**
Achillea millefolium L.	0.58
Riparian transect, along Little Bighorn R.	
Pascopyrum smithii (Rydb.) A. Löve	2.28
Symphoricarpos occidentalis Hook.	2.04
Carex species L.	1.02
***Melilotus officinalis* (L.) Lam**	**0.82**
Poa compressa L.	0.78
***Lolium pratense* (Huds.) S. J. Darbyshire**	**0.74**
Agoseris aurantiaca (Hook.) Greene	0.60

Figure 1: Species accumulation in the different plots. The Riparian transect is not represented because $10m^2$ and $100m^2$ subplots were not sampled (an average of 7.7 species were recorded in the 10 $1m^2$ subplots and a total of 68 species were recorded on this 1000m transect along the Little Bighorn River).



DISCUSSION

By using a stratified random sampling design and multi-scale plots, we were able to efficiently gain valuable information on distribution and abundance of both native and introduced plant species at the Monument. Preliminary results support two main conclusions and suggest several management implications.

1) Vegetation survey at the Monument is incomplete:

Species-rich and unique habitats have been missed in previous surveys, including riparian areas, ravines, and native prairie grasslands. From less than one hectare of sampled area, we detected 39 new species to the Monument flora, and improved documentation for 56 previously reported species. The fit of the power function to the species accumulation curves indicates that any additional survey effort will be productive. This figure also demonstrates that we would not have detected differences among types using only smaller scale plots. Additional, systematic vegetation sampling with large plots will be required to meet resource management objectives, and NPS Inventory and Monitoring Program goals.

The ravine and riparian types showed very high numbers of native plant species and the highest numbers of unique species. The Riparian transect showed the lowest average similarity in species composition to the other types, followed by the more heavily invaded Upper Draw location. Although more plots are needed to evaluate within and between type similarity, preliminary analysis suggests that riparian areas are unique among vegetation types at the Monument.

High uniqueness and plant species richness in the Ridgetop grassland versus the Rolling Hills grassland indicates that rare and unique habitats are hidden within the general upland classification. From the species accumulation curves, the relative slope

was greatest for the Ridgetop grassland, indicating a need for increased sampling in rare and unique upland vegetation types. Appropriate stratification for upland areas might include grama stands and other native grassland types, burned and unburned areas, and areas heavily invaded by introduced species. It may also be useful to include areas with concentrated recreational use or targeted for management activities.

2) Invasive species threaten natural and cultural resources at the Monument:

Our results indicate that alien species invasion threatens every vegetation type at the Monument. We are particularly concerned that species-rich vegetation types at the Monument also contain high species richness and cover of introduced plants. This provided further evidence for a trend that has been observed in other systems: hotspots of native plant diversity are being invaded by alien plant species (Stohlgren et al. 1999). Management actions to control invasive species must be done carefully to avoid damaging native plant species and co-occurring animals.

Our results are consistent with previous research on alien plant species invasion in the central grasslands of the US. Large scale vegetation sampling in Colorado, Wyoming and South Dakota has shown that (1) species rich and productive riparian zones are particularly susceptible to invasion in grassland ecosystems; and (2) riparian zones may act as havens, corridors, and sources of alien plant invasions for upland sites and pose a significant challenge to land managers and conservation biologists (Stohlgren et al. 1998). With the exception of the heavily invaded Upper Draw location (13 of 38 plant species were introduced, representing 23.9% of the total plant cover), the number of native species was highest in the ravine and riparian types. These types also contained the highest numbers of unique species, yet are the same areas of alien species invasion.

In fact, species classified as both unique *and* introduced were found only in the riparian and ravine sample locations.

This could point to the source of alien species in this landscape, supporting field observations that weeds appear to be moving (from the riparian area) up the ravines and draws at the Monument. As weeds readily move across fencelines and boundaries, surrounding land use will continue to be an issue. For example, the riparian fenceline currently extends to 50-100m from the Little Bighorn River, while the Monument manages land to the river edge. The river meanders, and grazing animals, water, wind and other dispersal mechanisms may influence introduced plant establishment into the Monument. Proactive management and partnerships with surrounding landowners could minimize potential impacts to the natural and cultural resources at the Monument.

Management Recommendations

1) Additional biological inventory is needed for rare and unique habitats at the Monument, such as riparian areas and native prairie remnants.

Historically undersampled vegetation types at the Monument contained the highest number of native and unique plant species, and our analysis suggests that additional sampling will be valuable in all habitats. Field observations and existing information suggests that "hotspots" of native plant species richness extend across multiple taxonomic groups (e.g., birds, mammals, butterflies, etc.). Logistical issues must be overcome, as the riparian areas are very difficult to sample, due to cliffs, poison ivy, mud bogs, etc. A systematic inventory of biological diversity patterns is essential to identify and evaluate the effects of human-caused impacts to Monument resources, and to form the basis for developing and implementing sound management strategies.

Coordination of efforts must be encouraged to meet natural resource inventory objectives. Systematic inventories are always constrained by available resources. Therefore, sources of local expertise and volunteer effort must be encouraged and supported. For example, expert identification is needed for plant specimens that were collected from the native prairies of the Monument by Little Bighorn College students. During the summer of 1996, the students spent more than a week collecting, identifying, pressing, and mounting the plant specimens that may include completely new records to the Monument. A relatively small investment would allow these and other previously collected voucher specimens to be confirmed with official identification for cataloging purposes.

2) Knowledge of the extent and locations of invasive plant species at the Monument, and in the surrounding landscapes, must be expanded and considered in developing priorities for the management and protection of natural resources.

Based on this assessment, vegetation types containing disproportionately high numbers of native plant species are also the areas of alien species invasion. Control of invasive species in rare but important habitats must be done carefully because these areas also contain unique assemblages of native species. It will be necessary to evaluate both introduced species and removal methods in terms of their potential threats to the native vegetation patterns that characterize the cultural and historical landscape at the Monument.

These results should place renewed emphasis on the role of natural processes such as fire in maintaining landscape-scale biodiversity. However, researchers and managers must be especially attentive to processes that encourage native species regeneration or establishment (e.g., fire, flood, disturbance) as these processes may also facilitate

introduced species establishment. Patterns of natural and human caused erosion at the Monument should be evaluated in terms of vulnerability of the different habitats to invasion by alien species. Connectivity of native vegetation remnants in relation to introduced plant species movement and establishment will be an important factor in disturbance recovery both on and offsite.

Information on the patterns of land use and alien species invasion in the surrounding landscapes will be critical to the success of any control efforts. Successful vegetation management at the monument will depend on coordination among adjacent landowners.

3) Natural resource staffing, organization, and funding are needed.

Committed natural resource staff may be necessary to meet the demands of vegetation projects at the Monument. At this time, most natural resource responsibilities are incorporated into the GS-0025-11 Chief Ranger position at the Monument. Additional staff and training in both natural and cultural management may be necessary to fulfill research and management goals involving natural resources. Responsibilities could include maintaining Resource Management Plans and the PMIS database with annual updates, coordination of research and Investigator's Annual Reports, writing proposals for Natural Resource funding calls, managing and implementing an Integrated Pest Management program, maintaining collections and participating in inventory and monitoring programs.

Although their schedules are typically full within their respective assignments, existing staff members at the Monument are very knowledgeable and should be supported in their involvement with natural resource related programs both on and offsite at the Monument. Michael Stops, Chief Ranger; Gerard Baker, Superintendent; Cliff Arbogast,

Chief of Maintenance; Kitty Deernose, Park Curator; John Doerner, Chief of Interpretation/Historian; Greg Mclure, and others should be encouraged to develop partnerships and participate in ongoing projects at the Monument:

LIBI-N-100.001	Natural Resources Baseline Information Assessment/Evaluation
LIBI-N-101.001	Complete Minimum Level Baseline Information for Natural Resources
LIBI-N-102.001	Prepare A Long-Term Monitoring Plan for Natural Resources
LIBI-N-104.001	Aerial Inventory of Battlefield
LIBI-N-200.001	Prepare IPM Plan for Little Bighorn BNM
LIBI-N-105.001	Prepare Weed (Exotics) Management Plan
LIBI-N-106.001	Control Erosion Along Deep Ravine (Little Bighorn River
LIBI-N-400.01	Survey Park Lands for T&E Species
LIBI-N-500.001	Provide Training to Staff On Use of GIS/GPS Systems
LIBI-N-103.001	Prepare Fire Management Plan
LIBI-I- 700.001	Develop Management GIS Capability: ARCVIEW
LIBI 41193	N5 Prepare exotic weed management plan

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Appendix 1: List of species recorded in the different plots, including accepted names (USDA, NRCS 2001), common names and previously recorded synonyms, nativity classification, and the total number of times recorded in each plot (maximum of 14, if recorded from all 13 subplots and the entire 1000m^2 plot).

Figures 2-6: Representative photos of the different sample locations, including Ravine/Draw, Ridgetop, Rolling Hills, Upper Draw, and the Riparian transect.

NRCS Accepted Name	Common name, recorded synonyms	nativit	Ravine/Draw	Ridgetop	RollingHills	UpperDraw	Riparian
Achillea millefolium L.	common yarrow	N	3	11	8	9	1
Agoseris aurantiaca (Hook.) Greene	orange agoseris	N					1
Allium geyeri S. Wats.	geyer's onion	N	1				
Alyssum alyssoides (L.)L.	pale madwort	I	7	14	8	6	4
Apocynum androsaemifolium L.	spreading dogbane	N					1
Aristida purpurea Nutt.	purple threeawn	N		2			
Artemisia cana Pursh	silver sagebrush	N					1
Artemisia frigida Willd.	fringed sagewort	N		1			1
Artemisia ludoviciana Nutt.	louisiana sagewort	N	3			4	1
Artemisia tridentata Nutt.	big sagebrush	N				1	1
Asclepias speciosa Torr.	showy milkweed	N					3
Aster species L.	aster	U	1	3	1	1	3
Berteroa incana (L.) DC.	hoary false madwort	I				3	
Bouteloua curtipendula (Michx.) Torr.	sideoats grama	N	5		10		
Bouteloua gracilis (Willd. ex Kunth) Lag. ex Griffiths	blue grama	N	1			2	2
Bromus species L.	brome	I				6	
Bromus hordeaceus L.	soft brome, *Bromus mollis*	I		4			1
Bromus inermis Leyss.	smooth brome, *Bromopsis inermis*	I	1		1		1
Bromus japonicus Thunb. Ex Murr.	japanese brome	I	1	2			
Bromus secalinus L.	rye brome	I					1
Bromus tectorum L.	cheatgrass	I	5	13	12	14	4
Calochortus nuttallii Torr. & Gray	sego lily	N		1		1	
Carex species L.	sedge	N					5
Chamaesyce glyptosperma (Engelm.) Small	spurge, euphorbia	N	1				
Chenopodium album L.	lambsquarters	I					1
Chenopodium berlandieri Moq.	pitseed goosefoot	N	1				
Cichorium intybus L.	chicory	I					2
Cirsium arvense (L.) Scop.	canadian thistle	I	4				
Collinsia parviflora Lindl.	smallflower blue eyed mary	N			1	8	
Collomia linearis Nutt.	narrowleaf mountaintrumpet	N		6			
Comandra umbellata (L.) Nutt.	bastard toadflax	N			1		
Convolvulus arvensis L.	field bindweed	I					1
Crepis acuminata Nutt.	longleaf hawksbeard	N	1		1		
Cryptantha species Lehm. Ex G. Don	cryptantha	U	1				
Deschampsia species Beauv.	hairgrass	N					1
Descurainia sophia (L.) Webb ex Prantl	herb sophia	I					1
Draba species L.	whitlowgrass	U	4	2	1		1
Echinacea angustifolia DC.	blacksamson echinacea	N		1			
Elymus trachycaulus ssp. trachycaulus (Link) Gould ex Shinners	wild rye, *Agropyron trachycaulum*	N	1				
Epilobium species L.	willowweed	U					1
Escobaria missouriensis (Sweet) D.R. Hunt	missouri foxtail cactus, *Coryphantha*	N					1

NRCS Accepted Name	Common name, recorded synonyms	nativ!!	Ravine/Draw	Ridgetop	RollingHills	UpperDraw	Riparian
Euphorbia esula L.	leafy spurge	I				1	
Festuca species L.	fescue	U	1	5	1		
Fraxinus pennsylvanica Marsh.	green ash	N					1
Gaura coccinea Nutt. ex Pursh	scarlet beeblossom	N	1		4	2	
Gayophytum species A. Juss.	groundsmoke	U		1			
Glycyrrhiza lepidota Pursh	american licorice	N					3
Grindelia squarrosa (Pursh) Dunal	curlycup gumweed	N					1
Gutierrezia sarothrae (Pursh) Britt. & Rusby	broom snakeweed	N		3			1
Helianthella species Torr. & Gray	helianthella	U					1
Heliomeris species Nutt.	heliomeris	U			1		
Hesperostipa comata ssp. comata (Trin. & Rupr.) Barkworth	needle and thread, *Stipa comata*	N		3		1	
Hordeum jubatum L.	foxtail barley	N					2
Iva axillaris Pursh	povertyweed	N					1
Juniperus scopulorum Sarg.	rocky mountain juniper	N	1				
Koeleria macrantha (Ledeb.) J.A. Schultes	prairie junegrass	N	1	11	1	1	1
Krascheninnikovia lanata (Pursh) A.D.J. Meeuse & Smit	winterfat, *Ceratoides*	N				2	
Lactuca serriola L.	prickly lettuce	I	1	1		2	1
Lactuca tatarica (L.) C.A. Mey	blue lettuce	N	1				
Larix occidentalis Nutt.	western larch	N					1
Lepidium species L.	pepperweed	U				2	
Lesquerella species Watson	bladderpod	U					1
Lesquerella alpina (Nutt.) S. Wats.	alpine bladderpod	N	1				
Linum lewisii Pursh	prairie flax	N			1		1
Lolium pratense (Huds.) S.J. Darbyshire	meadow fescue, *Festuca pratensis*	I					3
Lupinus species L.	lupine	U		1	4		
Maianthemum racemosum (L.) Link	false solomon's seal, *Smilacina racemosa*	N	6				1
Medicago lupulina L.	black medick	I					1
Melilotus officinalis (L.) Lam	yellow sweetclover	I	7	6	13	5	4
Mentha arvensis L.	wild mint	N					1
Muhlenbergia species Schreb.	muhly	U					1
Nassella viridula (Trin.) Barkworth	green needlegrass, *Stipa*	N	4	6	7	7	1
Opuntia polyacantha Haw.	plains pricklypear	N	1	2	2	2	2
Orthocarpus luteus Nutt.	yellow owlclover	N		3			
Pascopyrum smithii (Rydb.) A. Löve	western wheatgrass, *Agropyron smithii*	N	9	12	13	14	9
Phleum pratense L.	timothy	I					2
Phlox hoodii Richards.	spiny phlox	N	1	11	8		
Phragmites australis (Cav.) Trin ex Steud.	common reed	N					1
Plagiobothrys parishii I.M. Johnston	woolly plantain, *Plantago patagonica*	N		1		1	
Plantago species L.	plantain	U					1
Poa species L.	bluegrass	U		4		2	1
Poa compressa L.	canada bluegrass	N					2

NRCS Accepted Name	Common name, recorded synonyms	nativit	Ravine/Draw	Ridgetop	RollingHills	UpperDraw	Riparian
Poa palustris L.	fowl bluegrass	N	7				1
Poa pratensis L.	kentucky bluegrass	I				8	
Poa secunda J. Presl	sandberg bluegrass	N		4			
Populus deltoides Bartr. ex Marsh	eastern cottonwood	N					2
Prunella vulgaris L.	common selfheal	N				2	
Prunus virginiana L.	common chokecherry	N	1				1
Pseodoregneria spicata ssp. spicata (Pursh) A. Löve	wheatgrass, *Agropyron spicatum*	N	7	14	13	2	
Psoralidium tenuiflorum (Pursh) Rydb.	psoralea tenuiflora	N	1	7	12	6	
Ratibida columnifera (Nutt.) Woot & Standl.	upright prairie coneflower	N					1
Rheum rhabarbarum L.	garden rhubarb	I					1
Ribes aureum Pursh	golden currant	N				2	1
Ribes cereum Dougl.	wax currant	N	2				
Rosa species L.	rose	U				1	
Rosa woodsii Lindl.	woods' rose	N	2				2
Rumex species L.	dock	U					1
Salsola kali L.	prickly russian thistle, *Salsola iberica*	I					1
Sarcobatus vermiculatus (Hook.) Torr.	greasewood	N		1			2
Sedum species L.	stonecrop	U		2			
Shepherdia argentea (Pursh) Nutt.	silver buffaloberry	N					1
Silene antirrhina L.	sleepy silene	N				1	
Silene conoidea L.	weed silene	I	4				
Sisymbrium altissimum L.	tall tumblemustard	I				1	
Solidago canadensis L.	canada goldenrod	N					2
Sphaeralcea coccinea (Nutt.) Rydb.	scarlet globemallow	N		2	3	5	1
Sporobolus airoides (Torr.) Torr.	alkali sacaton	N		2			
Sporobolus cryptandrus (Torr.) Gray	sand dropseed	U		3		2	
Stipa species L.	needlegrass	U		2			
Symphoricarpos species Duhamel	snowberry	N				2	
Symphoricarpos occidentalis Hook.	western snowberry	N	6				3
Symphyotrichum ericoides var. ericoides (L.) Nesom	heath aster, *Aster ericoides*	N					1
Taraxacum officinale	common dandelion	I	2	5		1	
Thalictrum species L.	meadowrue	U					1
Thlaspi arvense L.	field pennycress	I					1
Tragopogon dubius Scop.	yellow salsify	I	1	5	4	6	
Trifolium species L.	clover	U		3	3		
Vicia species L.	vetch	U				5	
Vicia americana Muhl. ex Willd.	american vetch	N	5	7	1		1
Yucca glauca Nutt.	small soapweed yucca	N	1	2	1		

Figure 2: Ridgetop Grassland.

Figure 3: Ravine/Draw location at Reno-Benteen.

Figure 4: Rolling Hills grassland.

Figure 5: Upper Draw.

Figure 6: Riparian transect along the Little Bighorn River.