

Vegetation Monitoring on Lacreek National Wildlife Refuge

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Introduction

Like many areas in the Northern Plains Lacreek National Wildlife Refuge (NWR) has been invaded by non-native grasses and forbs. Crested wheatgrass was planted during the dust bowl because of its resistance to drought, and other species like smooth brome and Kentucky bluegrass became extremely invasive once established and out competed many native grasses. Today approximately one third of Lacreek NWR is comprised exotic grasses, primarily crested wheatgrass, Kentucky bluegrass, and smooth brome. Additionally, other species such as Canada thistle and reed canary have established themselves in disturbed or drawdown areas. The Service realizes the importance of native vegetation on the landscape and has begun a widespread effort to restore some of these areas in the Plains. At Lacreek restoration strategies have included using fire, grazing, mowing, chemical treatment, and planting small areas (100 to 200 acres) back to native grasses. More recently the refuge has been planting and interseeding areas with a high diversity native mix that includes both grasses and forbs.

Restoring areas on the refuge that are dominated by exotics has become a priority, and was an important component of the refuge's Comprehensive Conservation Plan (CCP). The plan provides direction for management of refuge habitats for the next 15 years and strategies to accomplish objectives. To monitor the effects of chosen strategies, the Floristic Quality Assessment (FQA) technique was chosen. FQA was developed by Swink and Wilhelm (1979, 1994) to measure the floristic quality of a natural area. It has been used to determine the effectiveness of restoration efforts, monitor natural areas, and determine the floristic intactness of an area in Wisconsin, Illinois, and the Dakotas (Taft et al 1997, USGS 2001, Bernthal 2003). In 2005, this technique was used to inventory and get some baseline information about wet meadow and upland areas on the refuge. This is the fifth year the survey was conducted and will be used to assess restoration efforts as part of adaptive management.

Belt transects were used to evaluate grasslands in addition to Modified-Whittaker plots because an entire unit can be surveyed quickly and efficiently. Although Whittaker technique provides very species specific data and are a good for determining the "floristic quality" of a unit it is time consuming, and requires a fairly high level of plant identification skills. Whereas belt transects require less rigorous plant identification skills and are less time intensive. Composition for a unit is determined and categorized into broad categories e.g., warm or cool season natives, smooth brome, other weeds etc, but can be modified for species specific information.

Methods

Modified-Whittaker plots-

A total of 13 plots were completed in August of 2010. The 20 m x 50 m Modified-Whittaker plots were located throughout the refuge and evenly distributed between

upland and wet meadow areas (Fig. 1). Aspects such as tolerance of a plant species to disturbance and fidelity to a specific habitat integrity are used to assign each native plant a coefficient of conservatism (C).

Vegetation Monitoring Locations 2010

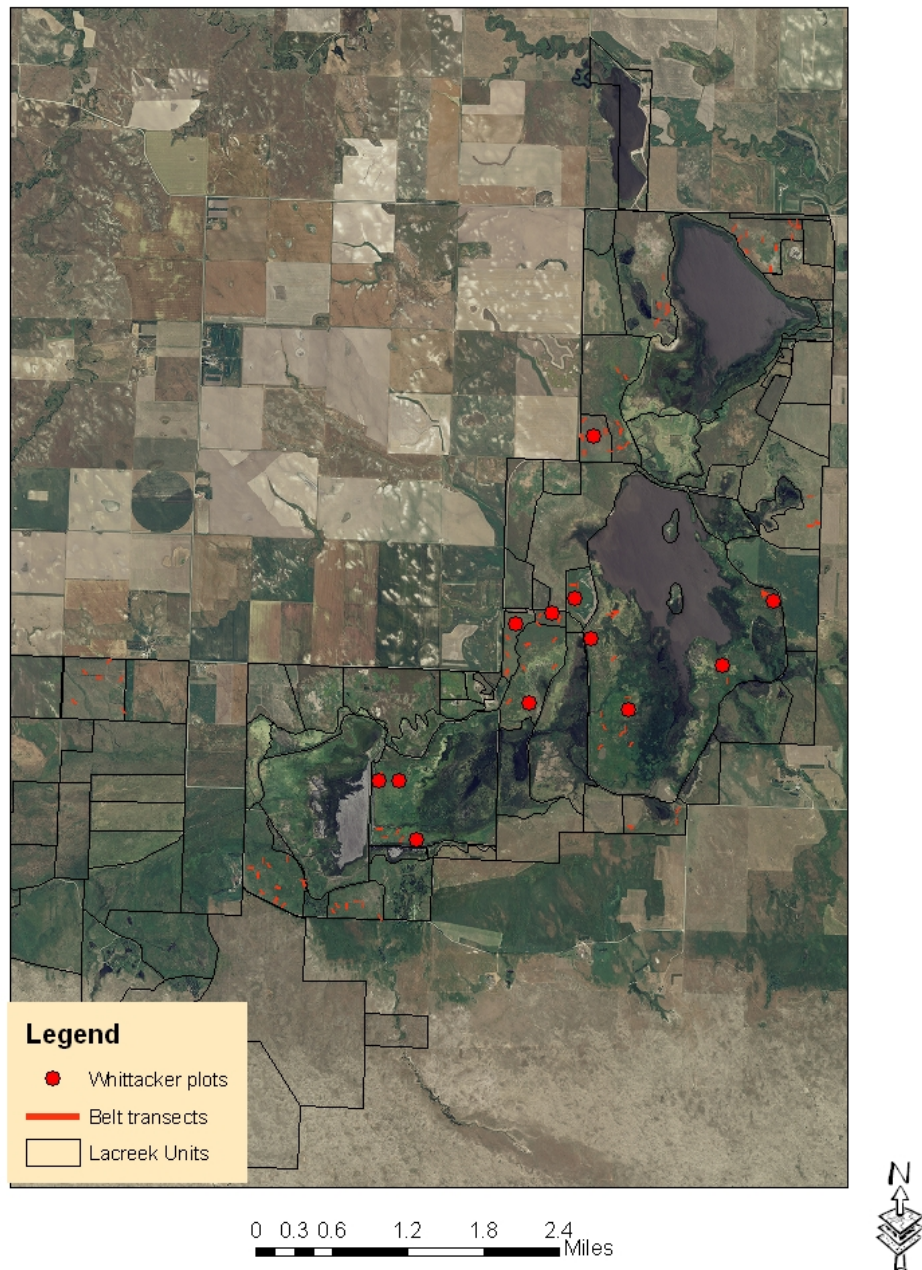


Figure 1. Locations of the Modified-Whittaker plots and belt transects completed in 2010.

The coefficient for each species is determined by its conservatism relative to other native species in the area. Once an area has been surveyed, a mean C value is calculated and the higher C value the higher the quality of a natural area ($C = 0$ to 10). Survey methods for the Floristic Quality Assessment followed Mushet and Euliss (2005), with the following exceptions: (1) there were no cover estimates determined in the 2 m x 5 m or the 5 m x 20 m subplots, (2) vegetation height measurements were taken at all plots for a total of 25 measurements, (3) 0.91 m plastic fence posts were used to temporarily mark corners and ropes were used to delineate edges of the 20 m x 50 m plot. Vegetation heights were measured with a Robel pole and the effective vegetation height was recorded in centimeters. Measurements were taken at the 0.5 m x 2 m subplots first starting in the SW corner each time, and then the 20 m x 50 m plot was walked and any additional species not already observed in the smaller subplots was identified and recorded (Fig. 2).

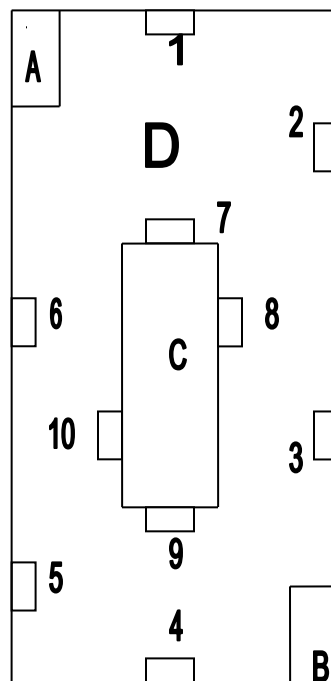


Figure 2. The Modified-Whittaker plot design. Plots labeled 1 to 10 are 0.5 m X 2 m plots, plots A and B is 2 m X 5 m, plot C is 5 m X 20 m, and plot D is 20 m X 50 m. One vegetation height measurement was taken at each small plot, and at each corner of the larger plots for a total of 25 height measurements.

Belt transects-

Transects were established using an Arcview extension that creates random transects inside a polygon (management unit). Vegetation is measured along randomly placed 25 meter transects; categorizing vegetation every 0.5 meter. The investigator holds the tape loosely above ground and walks steadily along it while looking down and classifying the plant group for each segment. The investigator must only note points on the meter tape at which the vegetation class changes, and the nature of change (Grant et al. 2004). An assistant records the data using numbers that represent different categories, i.e., cool

season native grass and forbs. Letter modifiers can be attached to numbers to identify specific species of cool or warm season grasses (Appendix A).

Results

A total of 16 units were evaluated using either Modified-Whittacker plots, belt transects, or both methods. Summaries were calculated for each unit and all units total. There were a total of thirteen Whittacker plots and ninety four belt transects completed. The majority of units or plots evaluated were dominated by natives; 8 units using the belt transect method and 10 Whittacker plots. Native grasses made up the majority of species composition when all the Whittacker plot results were totaled. When ranking the top five dominate species by total summaries of all belt transects; Kentucky bluegrass was the most abundant and the least was native forbs.

Modified-Whittacker Plots-

This is the fifth year Whittacker plots were completed and different plots have been measured every year since 2005, with the exception of 2007 when no surveys were completed. Some units contained only one plot, while other units had multiple plots. The average C value for all plots combined was 3.04, and FQI was 11.49. These scores are slightly lower, but comparable to 2009 values (Table 1). The plot with the highest average C value, FQI, and native species composition was on Pool 5. A plot on Pool 8 also had a high native species composition (98%), and a plot on Pool 9 had the highest native species richness. However, when these values were averaged with other plot values in these units these values ranked lower. When totaling species composition across all plots native composition was greater than both exotic and litter composition, and this has been consistently the case since 2006 (Table 1). Native species composition consisted of largely grasses, but forbs and sedges were also important components (Table 2).

Table 1. Modified-Whittacker plot values from 2005 to 2010.

Value	2005	2006	2008	2009	2010
Mean C value	2.47	2.94	3.51	3.22	304
FQI	9.54	10.56	14.67	12.72	11.49
Native % Comp	374	461	690	670	870
Exotic % Comp	451	244	378	493	306
Litter % Comp	143	125	107	124	123

Table 2. Modified-Whittacker plot results per unit for 2010.

Plot number	5N	5N	6N1	6N1	5N-1S	10SW3	Pool 8	Pool 8	Pool 5	Pool 9	Pool 9	Pool 9	Pool 9	Ave/Total
Mean C value	2.93	3.86	1.91	1.91	3.18	3.78	3.90	3.31	4.12	2.43	2.73	2.52	3.00	3.04
Total species richness	21	12	10	19	22	16	22	18	22	21	18	26	26	19.46
Native species richness	14	7	7	11	18	9	20	13	17	14	15	21	23	14.54
FQI	10.96	10.21	5.05	6.33	13.48	11.33	17.44	11.93	16.98	9.09	10.59	11.57	14.39	11.49
Native grass	70%	65%	28%	28%	64%	63%	40%	10%	78%	25%	63%	40%	26%	599%
Native forb	3%	0%	5%	5%	1%	0%	48%	17%	8%	14%	19%	40%	7%	169%
Native shrub	0%	0%	0%	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%	5%
Native sedge	0%	0%	0%	0%	4%	0%	10%	22%	11%	0%	2%	4%	42%	94%
Native composition	73%	65%	35%	33%	69%	63%	98%	54%	98%	39%	83%	84%	74%	870%
Exotic composition	27%	17%	60%	60%	15%	4%	1%	46%	2%	58%	0%	9%	8%	306%
Litter composition	14%	5%	7%	7%	14%	33%	1%	0%	0%	7%	12%	7%	16%	123%
Bareground composition	3%	13%	0%	0%	1%	0%	0%	0%	0%	3%	5%	0%	1%	26%
Heights (average cm)	45	47	78	78	42	44	108	103	63	77	52	68	85	69
Heights (range cm)	30-60	30-110	30-140	30-140	20-90	30-60	30-140	45-170	40-110	35-125	25-75	35-120	35-120	32-105

Belt Transects-

Refuge staff began using this technique as a supplement to the Whittaker method in 2007, and every unit on the refuge has been evaluated as of this year. Some units have been evaluated twice since 2007 to determine changes in vegetation. Management techniques that were used since 2007 were determined for each unit measured this year. The results of each unit are summarized (Table 3) and comparisons made to previous years if belt transect data was available.

Pool 10NE-2

This unit was comprised mostly of Kentucky bluegrass and smooth brome, but a third was cool season native grasses and forbs. Since it was first evaluated it was grazed and seeded once, but sprayed the past three years. Also, the amount of cool season native grasses decreased a little, while smooth brome stayed the same and Kentucky bluegrass increased. However, other non-native grasses decreased and kochia dropped out completely.

Pool 1-3

Although there is still a smooth brome component in this unit, over half the unit was composed of native forbs, wet meadow, and warm season native grasses. The percent of smooth brome dropped about half from 48% to 26%, and Kentucky bluegrass dropped to less than 1%; other weeds and warm season native grasses increased slightly. Grazing and spraying have been the primary management tools used in this unit, and both have occurred three times since last evaluated. Grazing in May as early as possible (May 1) seems to be decreasing the cool season exotics while favoring the warm season grasses and forbs.

Pool 1-1

This unit was grazed with Pool 1-3, and this management action also decreased cool season exotics while increasing native forbs and wet meadow. Warm season grasses remained unchanged and still comprise about a quarter of this unit. However, this early grazing has decreased the amount of cool season native grass, but it appears they were replaced by cool season wet meadow species. This unit was sprayed twice for Canada thistle and mullein, but the amount of noxious weeds is minimal.

Table 3. Belt transect results for 2010.

Categories and Percent Composition	Unit Names														
	Pool 10NE-2	Pool 1-3	Pool 1-1	Hazel Pond	Pool 11-2	Pool 5N1W	Pool 10SW-2	Pool 10NW-1	LCN-2F	Pool 5N-1S	Pool 10SW-3	Pool 6N1	Pool 9	Pool 8	Total
Dense, low shrub	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
low shrub/native grass	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
low shrub/KYBG	0%	2.4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%
low shrub/brome	0%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%
tall shrub	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	0%	3%
Cool season native grasses	18%	0%	1.33%	0%	0%	66%	0%	0%	23%	13%	82%	18%	0%	0.3%	222%
Warm season native grasses	1%	7%	26%	0%	0%	5%	0%	0%	0%	0%	2%	0%	0%	19%	61%
Native forbs	17%	31%	16%	48%	0%	0%	15%	4%	0.3%	4%	0%	5%	10%	14%	164%
Wet meadow	0%	19%	23%	32%	0%	0%	5%	14%	3%	42%	0%	4%	42%	62%	245%
Wetland	0%	0%	0%	11%	0%	0%	0%	2%	0.3%	0%	0%	0%	40%	0%	53%
Kentucky bluegrass dominant	21%	0.5%	10%	0%	65%	1%	47%	77%	38%	18%	14%	0%	0%	1%	292%
Smooth brome dominant	24%	26%	7%	0%	35%	23%	24%	0%	25%	6%	2%	0%	0%	0%	171%
Crested wheatgrass dominant	0%	0%	0%	0%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%	4%
Quackgrass	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Non native wheatgrass	10%	0%	0%	9%	0%	1%	0%	2%	0.3%	3%	0%	2%	0%	0%	27%
Other non-native grass	8%	0%	0%	0%	0%	0%	0%	0%	8%	3%	0%	0%	0%	0%	19%
reed canary grass	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	4%	0%	4%
wormwood	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Canada thistle	0%	1.6%	1.0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	4%
sow thistle	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%	4%
Other weeds (kochia, ragweed)	0%	9%	14%	0%	0%	3%	2%	0%	0%	7%	1%	71%	0%	0%	105%
Other noxious weeds	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Tall introduced legume	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Crop	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%	1%	0%	0%	4%
Barren, unvegetated	1%	0%	2.3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%
Other (rock, ant hill, etc.)	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
TOTAL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	100%	100%	100%	100%	100%	100%	97%	100%	100%	100%	100%	100%	100%	100%	1396%

Hazel Pond

This unit remains to be composed of wet meadow and wetland species, and the amount of non-native wheatgrass and cool season native grasses have decreased since 2007. The biggest change since then was an increase in forb species, which went from 7% to 48%. Although this unit has been burned several times it has not been burned since 2007, but it has been grazed, sprayed and seeded twice. Reed canary has become established in this unit, but was aggressively treated in 2009 which helped decrease the amount moving into wetland fringe areas.

Pool 11-2

This unit did have a small component of wet meadow (7%) and cool season native grass (6%), but these were not detected on transects measured this year. Instead this unit is completely dominated by Kentucky bluegrass and smooth brome. Reed canary grass has replaced Canada thistle and has completely over taken the wetland area. This unit has been grazed in early summer the last tree years, and sprayed every year but in 2010. It was also broadcast seeded in 2009, but it may be too early for that seeding to become established. Treatment on this unit will have to be aggressive to decrease the amount of reed canary, Kentucky bluegrass, and smooth brome. Fire has not been on option for treatment thus far because of the amount of trees in this unit, but it may have to be considered in addition to adjusting the timing of grazing. Burning and grazing as early as possible with intensive interseeding and spraying should be applied and the results monitored.

Pool 5N-1W

This is a restoration unit that was farmed, planted back to natives, and burned this year. It has also been sprayed and interseeded twice. Although cool season and warm season native grasses dominate this unit, smooth brome is starting to invade from the ditches. Smooth brome next to the ditches was mowed this fall and will be sprayed twice next year; once in the spring and fall. This will be done in an attempt to end this invasion. Kochia and Canada thistle have decreased, and native forbs like vervain and coneflower have become established although they were not detected on transects.

Pool 10SW-2

The biggest change in this unit was the drop in the amount of cool season native grasses and wet meadow species. Kentucky bluegrass and smooth brome now dominates this unit, but the native forb component is increasing. This unit was burned in 2007 and grazed that same year as well as 2009. It was also sprayed three years for Canada thistle control, which appears to be affective at reducing this noxious weed. The combination of fire and grazing the same year may reduce the amount of cool season exotics and favor cool season native grasses; both are scheduled for 2011.

Pool 10NW-1

Kentucky bluegrass was a major component both times this unit was surveyed, but native forbs are establishing. Canada thistle and warm season native grasses both dropped out since 2007, while wet meadow remained unchanged. Management has been limited to seeding and spraying, and no grazing or burning has been completed because of a large prairie dog town in this unit. This unit may have to be combined with 10SW-2 in order to provide a unit large enough to burn and/or graze, while fencing off the prairie dog town. Aggressive treatment using grazing, burning, and interseeding will be needed to reduce the amount of cool season exotics.

LCN-2F

Nonnative grasses dominated this unit both times it was surveyed, but the amount of cool season natives did increase to 23% this year. This unit was grazed once in 2008 and was sprayed twice, burning has been absent because of the prairie dog town in and adjacent to this unit and trees rows located throughout the unit. Fire and grazing may increase the amount of cool season grasses further. There are portions of the unit that are likely native sod and are located on hilltops and hillsides. Even though prescribed burning may provide some challenges, it is still possible to conduct and should be considered along with grazing. Prairie dog expansion will have to be considered though, and perhaps burning and grazing would occur less frequently than in some other upland units.

Pool 5N-1S

This biggest change in this unit was that kochia was greatly reduced while wet meadow increased from 14% to 42%. Kentucky blue grass and cool season grasses did not change since 2008. This unit was burned in the spring and shallowly flooded shortly after, which apparently increased wet meadow species especially prairie cordgrass and sedges. This unit has been sprayed three times for Canada thistle and reed canary control, and seeded once in 2009 with a wet meadow mixture.

Pool 10SW-3

This is a restoration unit that was farmed and planted to native grasses, it was burned this year in late March which may have been a little too early to damage the cool season exotic grasses in this unit. When it was last measured in 2008, it was 95% native cool season grass with a small amount of nonnative grass, while this year the Kentucky bluegrass and smooth brome made up 16% of this unit which invaded from the ditches. However, warm season native grasses are beginning to establish and the burn may have encouraged this. This unit has been sprayed twice and seeded this year with a forb mix after the burn. This unit was also mowed this fall and will be sprayed twice next year to address the invasion from the ditches.



Photograph 1. Pool 5 burned and shallowly flood in 2010.

Pool 6N1

This is a restoration unit that was farmed and planted to native grasses. It is a relatively new restoration and annual weeds like kochia are still dominate, but cool season natives like Canada wildrye and some forbs are becoming established. This unit was sprayed twice, and burned and seeded with a forb mix this year. It may have been a little soon to burn this unit, but it has been five years since it was planted to native grasses so hopefully kochia will began to decrease as has happened in other restoration units.

Pool 9

This is the first year this unit was evaluated using the belt transect method, and results show it is mostly wetland and wet meadow with native forbs. Reed canary is extensive throughout this unit and was detected in transects. This unit has been burned, grazed, and sprayed many times since 2007, and this should continue to promote native species and keep reed canary under control.

Pool 8

This is the first year this unit was evaluated using the belt transect method, and results show it is mostly wet meadow and warm season grasses with native forbs. This unit has

been burned twice since 2008, including this year which seemed to promote prairie cordgrass and sunflowers. This is the first year native forbs have been evident to such as extent, and were found mostly on the north side of the channel. Also this unit was burned in early May which may be the appropriate time for promoting warm season grasses and forbs in wet meadow units.



Photograph 2. Sunflowers, goldenrod, and prairie cordgrass on the north side of Pool 8 during 2010.



Photograph 3. Warm season native grass on the Southside of Pool 8 in 2010.

Discussion

It appears that some type of treatment, either burning, grazing or both, is needed to reduce cool season exotics and increase native species. Units not treated with one of these management tools since 2007 were generally dominated by either smooth brome or Kentucky bluegrass. However, timing of a burn and graze are also important factors that could influence dominance. It seems if a burn is conducted too early in the growing season it may favor cool season exotics by removing litter, but not damage the plant because it may not be far enough along in the early growth stage. An early burn on exotics may be acceptable if a unit is planned for an early season graze that same year. If a unit is mostly natives and the burn is for maintenance purposes, it may be reasonable to burn early and not harm cool season natives. Additionally, if a burn can not be completed for whatever reason; grazing multiple years seems to reduce exotics. Wet meadow habitats may handle this multi-year grazing pressure better than some of the drier upland units. It is also important to monitor cool season natives that decreased with three years of consecutive grazing.

It would be ideal to burn and graze most units in the same year, but this is not always possible. The exception would be units that were farmed and restored to natives, most of these unit have not established to the extent they could tolerate both in one season. However, to control invasion of brome they should be mowed once and sprayed twice a

year. Wet meadow units should not be idle for no more than two years and upland units no more than three years to control or reduce exotics.

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Appendix A. I) Belt transect directions and categories for South Dakota, and II) species list from Modified-Whittaker plots (2005-2010).

I) South Dakota Upland Plant Associations

- Record 1 of below types
- Based on Daubenmire canopy cover of >50%
- These categories are designed for monitoring plant community composition of native sod, planted natives, and DNC
- Revised from Grant/Madden-JCS, Madden 1996, Hegstad 1973
- *Optional* Forb Modifier: Document presence of >50% native forbs by adding “9” to any category (e.g., 21 = 219). Alternatively, the category 75 (Other Weeds) can be used to document large patches of weeds that typically dominate disturbed sites.
- Litter is not a category in itself, therefore assign litter to category it applies to (e.g., Kentucky bluegrass litter = 31)

SHRUB & TREE TYPES

Low shrub (generally 0.5 to 1.5 m tall, e.g. western snowberry)

- 11 dense low shrub, other plants few or none
- 12 low shrub, remainder native grass and forb
- 13 low shrub, remainder KY bluegrass
- 14 low shrub, remainder brome or quackgrass

Tall shrub (generally 1.5 to 5 m tall)

- 15 tall shrub, native
- 16 tall shrub, exotic

Trees

- 17 Native trees (e.g. cottonwood, green ash, bur oak)
- 18 Non-native trees (e.g. Japanese elm, Russian olive)

NATIVE GRASS TYPES^{ab}

- 21 cool season grasses & forbs A) green needle, B) western wheatgrass, C) porcupine grass E) C. rye
- 22 warm season grasses & forbs A) big bluestem, B) switch, C) Indian, D) little bluestem E) sideoats

NON-NATIVE GRASS TYPES

- 31 Kentucky bluegrass dominant
- 41 Smooth brome dominant
- 51 Crested wheatgrass dominant

- 61 Tall, intermediate, or pubescent wheatgrass^c
- 62 Other non-native grass (quackgrass, downy/Japanese brome, etc.)
- 63 DNC (planted, introduced wheatgrass/legume mix)

NOXIOUS & OTHER WEED TYPES

- 71 Leafy spurge
- 72 Canada thistle
- 73 Sow thistle
- 74 Wormwood
- 75 Other weeds (kochia, ragweed, cocklebur, etc.)
- 76 Other noxious weed (user-defined)

OTHER

- 81 Tall introduced legume (sweet clover or alfalfa)
- 82 Wet meadow (sedges, rushes, dock, smartweed, cordgrass, reedgrass, horsetail, etc.)
- 83 Cactus

84 Clubmoss/Lichen

91 Barren, unvegetated (bare soil, gopher mound)

92 Other (rock, manure, hole, ant hill)

^aOptional Species Modifier: Document dominant native grass sp. using the respective letter

^bForbs can account for anywhere between 0% to >50% of Native Grass Types. If desired, native forbs >50% can be specifically noted using the Optional Forb Modifier described above.

^cUse to document degraded DNC that no longer contains an appreciable legume component

II) Lacreek plants species list from Modified-Whittacker plots 2005-2010.

Scientific Name	Common Name	C-Value	Origin
<i>Medicago sativa</i>		*	Non-native
	alfalfa		
<i>Lycopus americanus</i>	American bugleweed	4	Native
<i>Vicia americana</i> var. <i>minor</i>	american vetch	3	Native
<i>Eriogonum annuum</i>	annual buckwheat	6	Native
<i>Polygonum sagittatum</i>	arrowleaf tearthumb	9	Native
<i>Juncus balticus</i>	baltic rush	5	Native
<i>Echinochloa muricata</i> var. <i>microstachya</i>	barnyardgrass	0	Native
<i>Andropogon gerardii</i>	big bluestem	5	Native
<i>Bouteloua gracilis</i>	blue grama	7	Native
<i>Lactuca oblongifolia</i>	blue lettuce	1	Native
<i>Verbena hastata</i>	blue vervain	5	Native
<i>Typha latifolia</i>	broadleaf cattail	2	Native
<i>Symphoricarpos occidentalis</i>	buckbrush	3	Native
<i>Calamagrostis canadensis</i>	Canada bluejoint	5	Native
<i>Solidago canadensis</i>	Canada goldenrod	1	Native
<i>Cirsium arvense</i>		*	Non-native
	Canada thistle		
<i>Elymus canadensis</i>	Canada wildrye	3	Native
<i>Nepeta cataria</i>	catnip	*	Native
<i>Carex preagracilis</i>	clustered field sedge	5	Native
<i>Xanthium strumarium</i>		*	Non-native
	cocklebur		
<i>Taraxacum officinale</i>	common dandelion	0	Native
<i>Verbascum thapsus</i>	common mullein	*	Non-native
<i>Ambrosia artemesifolia</i>	common ragweed	0	Native
<i>Phragmites australis</i>	common reed	0	Native
<i>Helianthus annuus</i>	common sunflower	0	Native
<i>Cicuta maculata</i>	common water hemlock	4	Native
<i>Alopecurus arundinaceus</i>	creeping foxtail	6	Native
<i>Juncus subtilis</i>		*	Non-native
	creeping rush		

<i>Agropyron cristatum</i>	crested wheatgrass	*	Non-native
<i>Rumex crispus</i>	curly dock	*	Non-native
<i>Erigeron bellidiastrum</i>	daisy fleabane	3	Native
<i>Scirpus atrovirens</i>	dark green bulrush	*	Non-native
<i>Bromus tectorum</i>	downy brome or cheatgrass	5	Native
<i>Juncus dudleyi</i>	Dudley rush	3	Native
<i>Oenothera flava</i>	Evening primrose	8	Native
<i>Panicum dichotomiflorum</i>	fall panicum	0	Native
<i>Munroa squarrosa</i>	false buffalograss	5	Native
<i>Carex brevoir</i>	fescue sedge	4	Native
<i>Convolvulus arvensis</i>	field bindweed of creeping Jenny	*	Non-native
<i>Mentha arvensis</i>	field mint	3	Native
<i>Sonchus arvensis</i>	field sow thistle	*	Non-native
<i>Carex vulpinoidea</i>	fox sedge	2	Native
<i>Hordeum jubatum</i>	foxtail barley	0	Native
<i>Teucrium canadense</i>	germander	3	Native
<i>Sparganium eurycarpum</i>	giant burreed	4	Native
<i>Solidago gigantea</i>	giant goldenrod	4	Native
<i>Ambrosia trifida</i>	giant ragweed	0	Native
<i>Tragopogon dubius</i>	goatsbeard	*	Non-native
<i>Rumex maritimus</i>	golden dock	1	Native
<i>Chenopodium bushianum</i>	goosefoot	0	Native
<i>Amaranthus albus</i>	gray pigweed or tumble pigweed	0	Native
<i>Setaria viridis</i>	Green foxtail	*	Non-native
<i>Asclepias viridiflora</i>	green milkweed	8	Native
<i>Stipa viridula</i>	green needlegrass	5	Native
<i>Mirabilis hirsuta</i>	hairy four-o'clock	4	Native
<i>Aster ericoides</i>	heath or white aster	2	Native
<i>Verbena stricta</i>	hoary vervain	2	Native
<i>Equisetum laevigatum</i>	horsetail or smooth scouring rush	3	Native
<i>Conyza canadensis</i>	horseweed	0	Native
<i>Sorghastrum nutans</i>	Indian grass	6	Native
<i>Distichlis spicata</i>	inland saltgrass	2	Native
<i>Agropyron intermedium</i> var. <i>intermedium</i>	intermediate wheatgrass	*	Non-native
<i>Vernonia fasciculata</i>	ironweed	3	Native
<i>Bromus japonicus</i>	Japanese brome	*	Non-

			native
<i>Eupatorium maculatum</i>	Joe-pye weed	9	Native
<i>Koeleria macrantha</i>	junegrass	7	Native
<i>Poa pratensis</i>		*	Non-native
	Kentucky bluegrass		
<i>Polygonum douglasii</i>	knotweed	3	Native
<i>Kochia scoparia</i>	kochia	*	Non-native
<i>Chenopodium album</i>		*	Non-native
	lambsquarters		
<i>Schizachyrium scoparium</i>	little bluestem	6	Native
<i>Stachys palustris</i>	marsh hedgenettle	3	Native
<i>Muhlenbergia racemosa</i>	marsh muhly	10	Native
<i>Almutaster pauciflorus</i>	marsh or few-flowered aster	4	Native
<i>Muhlenbergia richardsonis</i>	mat muhly	10	Native
<i>Helianthus maximiliani</i>	maximilian sunflower	5	Native
<i>Solidago missouriensis</i>	Missouri or prairie goldenrod	5	Native
<i>Carduus nutans</i>		*	Non-native
	musk or nodding thistle		
<i>Eleocharis acicularis</i>	needle spikerush	3	Native
<i>Calamagrostis stricta</i>	northern or slimstem reedgrass	5	Native
<i>Puccinellia nuttalliana</i>	Nuttall's alkaligrass	4	Native
<i>Helianthus nuttallii</i>	Nuttall's sunflower	8	Native
<i>Polygonum lapathifolium</i>	pale smartweed (annual)	1	Native
<i>Coreopsis palmata</i>	palmate coreopsis	8	Native
<i>Opuntia polyacantha</i>	plains pricklypear	3	Native
<i>Helianthus petiolaris</i>	plains sunflower	0	Native
<i>Toxicodendron rydbergii</i>	poison ivy	3	Native
<i>Ratibida columnifera</i>	prairie coneflower (yellow)	3	Native
<i>Spartina pectinata</i>	prairie cordgrass	5	Native
<i>Sporobolus heterolepis</i>	prairie dropseed	10	Native
<i>Calamovilfa longifolia</i>	prairie sandreed	3	Native
<i>Rosa arkansana</i>	prairie wild rose	3	Native
<i>Agropyron repens</i>	quackgrass	*	Non-native
<i>Polygonum convolvulus</i>	red bindweed or wild buckwheat	*	Non-native
<i>Amaranthus retroflexus</i>	red root pigweed	0	Native
<i>Trifolium pratense</i>	redclover	*	Non-native
<i>Agrostis stolonifera</i>	redtop	2	Native
<i>Phalaris arundinacea</i>	reed canarygrass	2	Native
<i>Leersia oryzoides</i>	rice cutgrass	2	Native
<i>Scirpus fluviatilis</i>	river bulrush	2	Native

<i>Cleome serrulata</i>	Rocky Mt. bee plant	2	Native
<i>Salsola iberica</i>	Russian thistle	5	Native
<i>Distichlis spicata</i>	salt grass	2	Native
<i>Muhlenbergia pungens</i>	sand muhly	7	Native
<i>Salix exigua</i> ssp. <i>Interior</i>	sandbar willow	2	Native
<i>Helianthus grosseserratus</i>	sawtooth sunflower	4	Native
<i>Muhlenbergia asperifolia</i>	scratchgrass	5	Native
<i>Asclepias speciosa</i>	showy milkweed	4	Native
<i>Bouteloua curtipendula</i>	sideoats gramma	6	Native
<i>Psoralea argophylla</i>	silverleaf scurfpea	4	Native
<i>Scutellaria lateriflora</i>	skull cap	6	Native
<i>Agropyron caninum</i>	slender wheatgrass	6	Native
<i>Carex atherodes</i>	slough sedge	4	Native
<i>Bromis inermis</i>	smooth brome	8	Native
<i>Solidago mollis</i>	soft goldenrod	0	Native
<i>Schoenoplectus tabernaemontani</i>	softstem bulrush	3	Native
<i>Euphorbia maculata</i>	spotted spurge	0	Native
<i>Solidago rigida</i>	stiff goldenrod	4	Native
<i>Helianthus rigidus</i>	stiff sunflower	8	Native
<i>Urtica dioica</i>	stinging nettle	0	Native
<i>Carex heliophila</i>	sun sedge	7	Native
<i>Asclepias incarnata</i>	swamp milkweed	5	Native
<i>Polygonum amphibium</i> var. <i>emersum</i>	swamp smartweed (perennial)	1	Native
<i>Panicum virgatum</i>	switchgrass	5	Native
<i>Sporobolus asper</i>	tall or rough dropseed	2	Native
<i>Descurainia pinnata</i>	tansy mustard	*	Non-native
<i>Phleum pretense</i>	timothy	0	Native
<i>Juncus torreyi</i>	Torrey's rush	6	Native
<i>Sysymbrium altissimum</i>	tumbling mustard	0	Native
<i>Gaura parviflora</i>	velvety gaura	1	Native
<i>Physalis virginiana</i>	Virginia groundcherry	4	Native
<i>Cicuta maculata</i>	water hemlock	4	Native
<i>Polygonum hydropiper</i>	water pepper	*	Non-native
<i>Alisma</i> spp.	water plaintain	2	Native
<i>Cirsium undulatum</i>	wavyleaf thistle	7	Native
<i>Erigeron bellidiastrum</i>	western fleabane	3	Native
<i>Ambrosia psilostachya</i>	western ragweed	2	Native
<i>Agropyron smithii</i>	western wheatgrass	4	Native
<i>Artemesia ludoviciana</i>	white sage	3	Native
<i>Melilotus alba</i>	white sweetclover	*	Non-native

<i>Scolochloa festucacea</i>	whitetop (sprangletop)	6	Native
<i>Glycyrrhiza lepidota</i>	wild or American licorice	2	Native
<i>Epilobium ciliatum</i>	willow herb	3	Native
<i>Epilobium leptophyllum</i>	willow leaf (narrowleaf willow herb)	6	Native
<i>Panicum capillare</i>	witchgrass	0	Native
<i>Carex lanuginosa</i>	woolly sedge	4	Native
<i>Setaria glauca</i>	yellow foxtail	*	Non-native
<i>Cyperus esculentus</i>	yellow nutsedge	0	Native
<i>Melilotus officinalis</i>	yellow sweetclover	*	Non-native