



Perennial Food Plot Study

Annual Report
2005

**North Dakota Game and Fish Department
and
USDA-NRCS Bismarck Plant Materials Center**

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This is a cumulative report on project activities of the Perennial Food Plot Study started in 2003. This study is a cooperative project between the USDA Natural Resources Conservation Service, Plant Materials Center, Bismarck, North Dakota and the North Dakota Game and Fish Department, Bismarck, North Dakota.

Objective:

The objective of this 5-year study is to evaluate establishment and plant performance of species in two perennial seed mixes, a native mix and an introduced mix. Establishment and growth characteristics will be documented for each mix. Recommended species and seeding rates for wildlife perennial food plots is a potential outcome of this study.

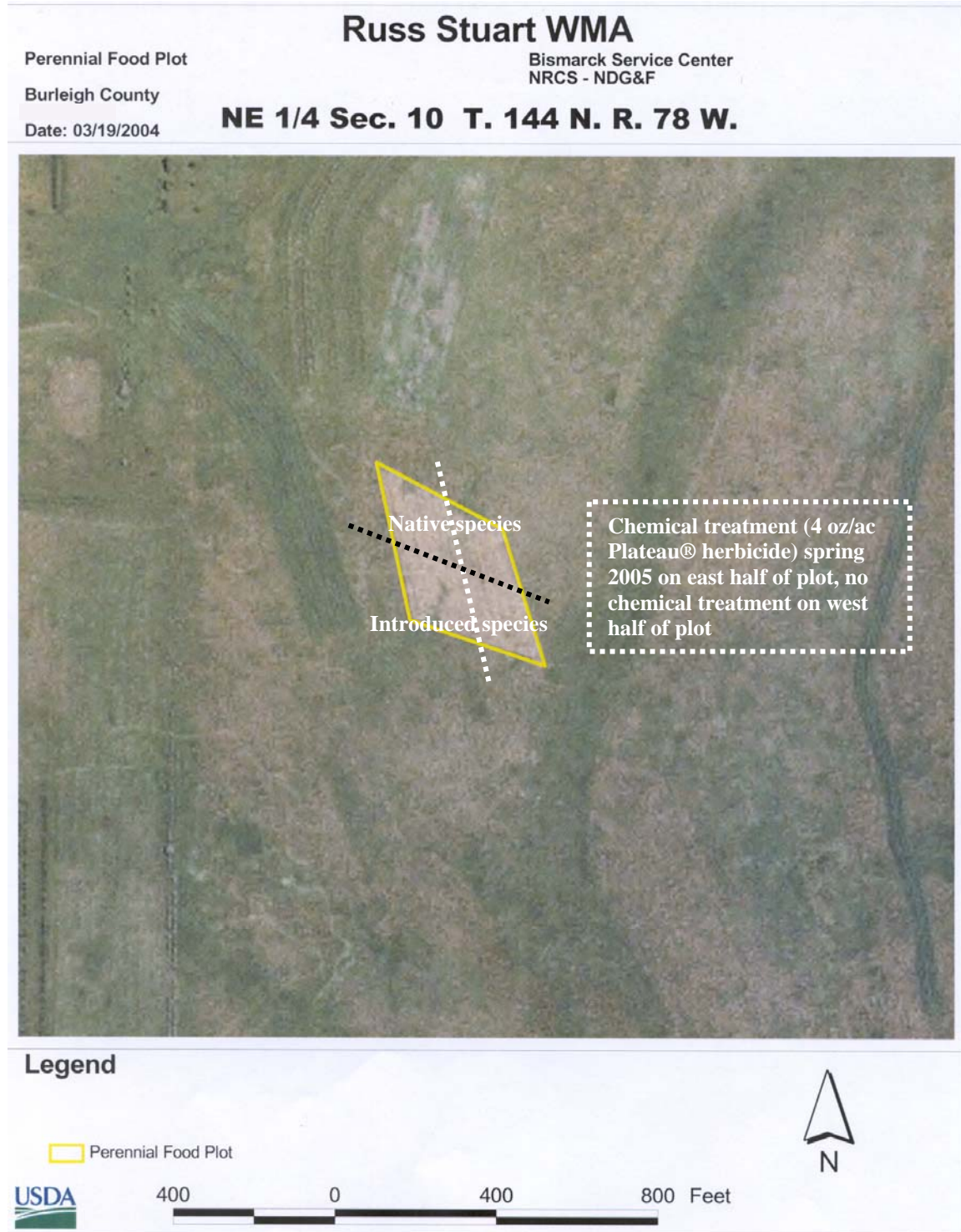
The study is located northeast of Wilton, North Dakota, on the Russell Stuart Wildlife Management Area (WMA) and Old John's Lake Wildlife Management Area. Two sites were identified, one on each of the wildlife management areas.



Site description:

The site is a 2.4 acre plot located on the Russell Stuart Wildlife Management Area in Burleigh County, North Dakota. The site is fairly level and is comprised primarily of Bearden silty clay loam; slight or very slight saline. The ecological site is “limy subirrigated.” See Figure 1 for aerial view of the site.

Figure 1.



Site description:

The site is a 2.4 acre plot located on Old John's Lake Wildlife Management Area in Sheridan County, North Dakota. Soils are mapped as a Williams loam on B slope. The ecological site is loamy. See Figure 2 for an aerial view of the site.

Figure 2.



Site Preparation and Seeding:

Both sites were chemically treated on June 10, 2003 and July 15, 2003, with a tank mix of 1 quart/ac of glyphosate and 1 pint/ac Poast®. The plot borders were mowed on August 8, 2004. A third chemical application of 2 quarts of glyphosate, 11 ounces of Stinger®, 2 pints of 2,4-D amine and 3 gallons of ammonia sulfate were applied on August 13, 2004. The plots were burned by the North Dakota Game and Fish Department on October 11, 2004.



Plots were planted on November 4, 2004, using a no-till Truax grass drill. Each site (2.4 acres) was split in half to make two plots (1.2 acre) per site. The south half of each plot was seeded to an introduced mix and the north half was seeded to a native mix. See Tables 1 and 2 for a list of native species and seeding information. See Tables 3 and 4 for a list of introduced species and seeding information. Each of the two plots was also split in half from north to south to compare establishment with and without herbicide application.

2004 Observations:

The dense sod of Kentucky bluegrass and other low growing vegetation did not burn well at the Russell Stuart WMA site leaving large areas of litter on the soil surface. Kentucky bluegrass sod retained a large mass of both above and below ground residue that impacted seed to soil contact when no-till seeding into the killed and burned residue. Burning removed most of surface litter at the Old John's Lake WMA. The site was



predominantly smooth brome grass and sideoats grama, which provided a much more desirable seedbed. Available soil moisture at the time of seeding was good at both sites.

Table 1. List of native species, including trees and shrubs, planted 11/04/2004 on two 1.2 acre sites.

Species	Name	Type*	Seeds per lb	Russ Stuart Planted PLS lb/ac	Old John's Planted PLS lb/ac
<i>Elymus canadensis</i>	Canada wildrye	g	115000	0.37	0.37
<i>Panicum virgatum</i>	switchgrass	g	390000	0.11	0.11
<i>Andropogon gerardii</i>	big bluestem	g	176000	0.21	0.21
<i>Dalea candida</i>	white prairieclover	l	278000	0.28	0.24
<i>Dalea purpurea</i>	purple prairieclover	l	290000	0.27	0.27
<i>Astragalus canadensis</i>	Canada milkvetch	l	266000	0.29	0.29
<i>Amorpha canescens</i>	leadplant	l	200000	0.39	0.38
<i>Chamaecrista nictitans</i>	partridge pea	l	50000	1.57	1.57
<i>Helianthus maximiliani</i>	Maximilian sunflower	f	250000	0.17	0.17
<i>Helianthus pauciflorus</i>	stiff sunflower	f	85000	0.51	0.51
<i>Silphium perfoliatum</i>	cup plant	f	34000	1.28	1.28
<i>Linum lewisii</i>	wild blue flax	f	287000	0.15	0.15
<i>Ratibida columnifera</i>	longheaded coneflower	f	737000	0.12	0.06
<i>Liatris punctata</i>	dotted gayfeather	f	63000	0.32	0.32
<i>Echinacea angustifolia</i>	echinacea	f	120000	0.36	0.37
<i>Gaillardia aristata</i>	blanket flower	f	157000	0.27	0.27
<i>Penstemon grandiflorus</i>	penstemon	f	273000	0.16	0.16
<i>Rudbeckia laciniata</i>	golden glow-cutleaf	f	252222	0.06+.12**	0.06+.12**
<i>Solidago rigida</i>	stiff goldenrod	f	772000	0.06	0.06
<i>Agastache foeniculum</i>	giant hyssops	f	1538000	0.03	0.03
<i>Desmodium canadense</i>	showy tick trefoil	f	88000	0.26	0.26
<i>Monarda fistulosa</i>	wild bergamot	f	1463000	0.03	0.03
<i>Liatris ligulistylis</i>	meadow blazingstar	f	90000est	0.09	0.09
<i>Rosa arkansana</i>	rose	w	45000	0.25	0.25
<i>Shepherdia argentea</i>	buffaloberry	w	41000	0.40	0.40
<i>Amorpha fruticosa</i>	false indigo	w	52000	0.32	0.32
<i>Amelanchier alnifolia</i>	juneberry	w	82000	0.20	0.20
<i>Symphoricarpos occidentalis</i>	snowberry	w	74400	0.22	0.22
<i>Ribes aureum</i>	currant	w	240000	0.07	0.07
<i>Prunus virginiana</i>	chokecherry	w	4790	3.40**	3.40**
<i>Cornus sericea</i>	redosier dogwood	w	18500	0.78	0.78
<i>Coreopsis tinctoria</i>	plains coreopsis	a	1650000	0.08	0.08

*Type: g=grasses; l=legumes; f=forbs; w=woodies; a=annuals

**bulk seed amount, not PLS

Table 2. Seeding information for native species, including trees and shrubs.

Type	grasses	legumes	forbs	woodies	annuals	Total seeds/ft ² *
number	3	5	15	8	1	30
%of mix	10	30	50	10	10	
seeds/ft ² /specie	1.00	1.80	1.00	0.38	3.00	
seeds/acre**	43560	78408	43560	16335	130680	

*Annuals were not counted in the 30 seeds/ft² seeding rate

**Actual amount of seed planted for a species may differ from target seeding rate due to seed availability, quality and variation in seeds/pound (depending on reference).

Table 3. List of introduced species and native trees/shrubs planted 11/04/2004 on two 1.2 acre sites.

Species	Name	Type	Seeds per lb	Russ Stuart Planted PLS lb/ac	Old John's Planted PLS lb/ac
<i>Leymus racemosus</i>	mammoth wildrye	g	55000	3.58	3.55
<i>Thinopyrum intermedium</i>	intermediate wheatgrass	g	88000	0.76	0.76
<i>Elymus dahuricus</i>	dahurian wildrye	g	86000	0.76	0.76
<i>Thinopyrum ponticum</i>	tall wheatgrass	g	79000	0.82	0.82
<i>Medicago sativa</i>	alfalfa	l	210000	1.10	1.10
<i>Astragalus cicer</i>	cicer milkvetch	l	134000	1.37	1.37
<i>Trifolium pratense</i>	red clover	l	275000	0.67	0.67
<i>Onobrychis vicifolia</i>	sainfoin	l	22000	8.30	8.30
<i>Vicia villosa</i>	hairy vetch	l	20000	9.55	9.55
<i>Rosa arkansana</i>	rose	w	45000	0.37	0.37
<i>Sherpherdia argentea</i>	buffaloberry	w	41000	0.40	0.40
<i>Amorpha fruticosa</i>	false indigo	w	52000	0.32	0.32
<i>Amelanchier alnifolia</i>	juneberry	w	82000	0.20	0.20
<i>Symphoricarpos occidentalis</i>	snowberry	w	74400	0.22	0.22
<i>Ribes aureum</i>	currant	w	240000	0.07	0.07
<i>Cornus sericea</i>	redosier dogwood	w	18500	1.06	1.06
<i>Prunus virginiana</i>	chokecherry	w	4790	3.4**	3.4**
<i>Coreopsis tinctoria</i>	plains coreopsis	a	1650000	0.08	0.08

*Type: g=grasses; l=legumes; f=forbs; w=woodies; a=annuals

**bulk seed amount, not PLS

Table 4. Seeding information for introduced species and native trees/shrubs.

Type	grasses	legumes	forbs	woodies	annuals	Total seeds/ft ² *
number	4	5	0	8	1	30
%of mix	20	70	0	10	10	
seeds/ft ² /specie	1.50	4.20	0	0.38	3.00	
seeds/ac/specie**	65340	182952	0	16335	130680	

*Annuals were not counted in the 30 seeds/ft² seeding rate

**Actual amount of seed planted for a species may differ from target seeding rate due to seed availability, quality and variation in seeds/pound (depending on reference).



2005 Observations:

General

Both the Russell Stuart WMA and the Old John's Lake WMA plots were split in half from north to south to allow half of the native seeding and half of the introduced seeding to have herbicide applied in 2005. A 4 oz/acre rate of Plateau® herbicide was applied on May 5, 2005. No surfactant was used in the application.



No planted seedlings were actively growing on any of the eight treatments at the time of the Plateau® herbicide application on May 5, 2005. Canada thistle, absinth wormwood, and other weedy species seedlings were observed in low numbers for all treatments at this time. The Old John's Lake WMA plot had less actively growing weeds and less surface residue after over-wintering as compared to the Russell Stuart WMA plot. The surface (1-2 inch depth) soil moisture conditions in the plots were very dry.

Plants were evaluated on July, 2005. Species counts were randomly taken using a 2.4-ft² frame. See Attachment 1 for data collected on the Russell Stuart WMA and Old John's Lake WMA plots.



On September 9, 2005, general stand observations were noted. The following comments were recorded. All treatments on the Russell Stuart WMA plots had higher planted species densities and much less weed competition than the Old John's Lake WMA plots. All plots planted with native species had the greatest seedling emergence and stand establishment (at Russell Stuart WMA and Old John's Lake WMA plots). Lack of surface residue, which exposed black mineral soil, may have contributed to the poorer stands at Old John's Lake WMA plots. The soil surface may have warmed too soon in the spring, causing seeds to germinate, and seedlings to freeze. The Russell Stuart WMA site had more surface residue and was lower in elevation which probably resulted in cooler soil temperatures that reduced the chances for sprouting and emergence

of the planted species. Evaluations will be taken in 2006 on stand establishment and individual species performance.

Russell Stuart WMA Plot

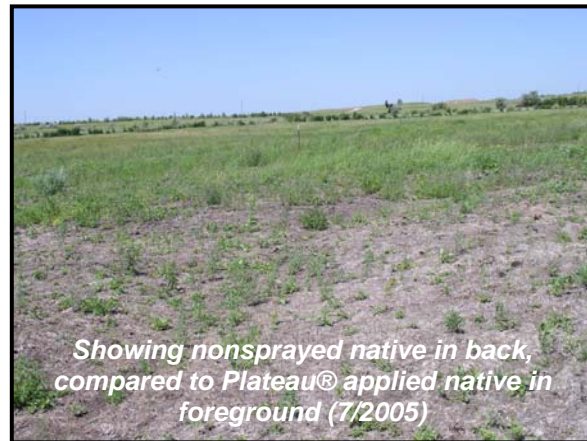
Russell Stuart WMA native species seeding without Plateau® herbicide applied



Weed competition from annual weeds was much higher compared to the native plot that had Plateau® herbicide applied. Annual weeds showing the highest populations were lambsquarter, common ragweed, and kochia. Most of the planted species were observed in the plot. Native shrubs including buffaloberry, golden currant, redosier dogwood, western snowberry and Juneberry were observed in this plot.

Russell Stuart WMA native species seeding with Plateau® herbicide applied

Large areas of bare ground were observed on this site. Higher Canada thistle densities were observed compared to the unsprayed native plot. Most planted species were present but their growth was suppressed considerably. Maximilian sunflower and stiff sunflower appeared to be the least affected by the Plateau® herbicide in growth suppression. The overall stand composition was very similar to the unsprayed native plot but most of the actively growing species, both planted and weeds, showed signs of growth suppression.



Russell Stuart WMA introduced species seeding with Plateau® herbicide applied

A higher percentage of open ground was observed compared to the other three plots. Lower numbers of planted species were observed as compared to the unsprayed plot. Planted species present showed suppressed growth and lower vigor than the unsprayed introduced plot. Canada thistle populations were higher and annual weeds were lower on the sprayed plot compared to the unsprayed plot.



Russell Stuart WMA introduced species seeding without Plateau® herbicide applied

Annual weed population is similar to the native species seeding without the Plateau® herbicide application. Higher densities of annual weeds occur compared to the introduced species seeding that was sprayed with the Plateau® herbicide. Intermediate wheatgrass, tall wheatgrass, and Dahurian wildrye were the dominant planted grass species observed. The grasses observed were healthy and vigorous, many were headed out, and contained good seed fill. Alfalfa, sanfoin and cicer milkvetch were the dominant planted forbs observed.

Old John's Lake WMA Plot

Old John's Lake WMA native species seeding without Plateau® herbicide applied

Very high weed competition, including high densities of quackgrass, green foxtail, smooth brome grass, and absinth wormwood were present. This plot had the most planted species present in the planting. The population of both Maximilian and stiff sunflower was less compared to the sprayed native plot. Very little bare ground was present at this time. The best stands were observed on the higher aspects of the site due to the decreased weed competition as compared to the lower site. Good densities of switchgrass and big bluestem were seen.



Old John's Lake WMA native species seeding with Plateau® herbicide applied

More bare ground occurred than on the unsprayed plot. Sweetclover and Canada thistle densities were higher on this site as compared to the unsprayed plot. Planted species densities were less and had suppressed growth when compared to the unsprayed.

Old John's Lake WMA introduced species seeding without Plateau® herbicide applied

The heaviest concentrations of absinth wormwood were observed on this site. The stand was poor and very few of the planted species were observed. Highest densities of sweetclover, smooth brome grass and annual weeds occurred compared to the other three treatments.



Old John's Lake WMA introduced species seeding with Plateau® herbicide applied

The overall stand was poor. Some of the planted species were present in very low numbers. Their growth was suppressed. A higher percentage of bare ground was observed.

Attachment 1.

Table 5A. Russell Stuart WMA; native species seeded with herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft ²)																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot																					0
blanketflower	1	2								1										1	5
blue flax	1	1	3											1							6
Canada milkvetch	1							1													2
coreopsis				2	1			1											1		5
cup plant																					0
dotted blazing star																					0
echinacea-coneflower											1					1					2
golden glow																					0
hyssops		1																			1
leadplant					3		1								1			1	1		7
longheaded coneflower																					0
Maximilian sunflower		1			1			1		3										1	7
meadow blazing star																					0
partridge pea		1	2																		3
penstemon	3	1	4													1					9
purple prairieclover														1							1
stiff goldenrod	1							1													2
stiff sunflower				2			2	1		1		4									10
tick trefoil	2		1							1								2			6
white prairieclover	1	1																			2
yellow coneflower				1			1														2
big bluestem							1				1									1	3
Canada wildrye						1				1				2				1			5
switchgrass	1			1				1		1											4
buffaloberry					1				1												2
chokecherry																					0
currant																					0
false indigo							1													1	2
juneberry																					0
prairie rose																					0
red dogwood	2																				2
snowberry																					0
% Weed Canopy	5	3	3	15	45	2	5	5	1	1	1	0	2	10	1	2	0	0	0	0	
Remarks:	No forbs in frames 13 and 17.																				

Table 5B. Russell Stuart WMA; native species seeded with no herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft ²)																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot		1									1										2
blanketflower	1								2		1								1		5
blue flax			2		1						1			1		2		1			8
Canada milkvetch				2		1												3			6
coreopsis	1	1	2	1	2	11						4	4				1		2		29
cup plant	2		1					2	1							2					8
dotted blazing star									1						1					1	3
echinacea-coneflower				1			1		3	2										1	8
golden glow					1																1
hyssops						1					1		1		1						4
leadplant				2								1			1	1					5
longheaded coneflower			2																		2
Maximilian sunflower	1		2	1		1					2	1	2	2				1			13
meadow blazing star												1									1
partridge pea					2			3			1		1			1					8
penstemon		3			1	1					1							1			7
purple prairieclover	1			1									1			1					4
stiff goldenrod			1	2	1	2	1					1	1		2						11
stiff sunflower		1	1		2	3						1			1		1	1	1		12
tick trefoil		1											1			1		1			4
white prairieclover						1															1
yellow coneflower												2	1		1					2	6
big bluestem	1	1																			2
Canada wildrye		2	1		1				1	1		1	1			1		1			10
switchgrass													1								1
buffaloberry						1															1
chokecherry																					0
currant																					0
false indigo					2				1	1											4
juneberry											1										1
prairie rose																					0
red dogwood									2	1					1						4
snowberry																					0
% Weed Canopy	50	2	40	30	70	25	1	15	15	40	5	10	10	10	15	20	45	55	50	5	

Remarks: Mustard and lambsquarters were the major annual weeds present. Plants are vigorous. Greatest population of planted species of all treatments.

Table 5C. Russell Stuart WMA, introduced species seeded with herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft ²)																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
alfalfa	1	1														1					3
cicer milkvetch							1														1
hairy vetch																					0
plains coreopsis																					0
red clover																					0
sainfoin								1													1
Grasses	10	1	3	4	2	1	5	0	0	6	3	0	5	5	2	0	7	2	3	3	62
buffaloberry		2						1											1		4
chokecherry																					0
false indigo																					0
golden currant																					0
juneberry																					0
redosier dogwood			1																		1
rose																					0
snowberry	1												1								2
% Weed Canopy	2	1	5	10	2	0	10	2	5	3	3	15	3	2	3	1	2	0	10	20	
Remarks: More forbs were present on the north end of this treatment. South end very uneven ground surface. All plants stunted and yellow-colored.																					

Table 5D. Russell Stuart WMA; introduced species seeded with no herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft ²)																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
alfalfa													1	1	1						3
cicer milkvetch											2	1									3
hairy vetch					1							1									2
plains coreopsis							1								1						3
red clover																					0
sainfoin				1				1		1			1			1			2	1	8
Grasses	0	0	3	9	7	2	1	5	0	4	3	2	0	2	8	3	5	3	2	10	69
buffaloberry															1						1
chokecherry																					0
false indigo				1			1	1													3
golden currant																					0
juneberry																					0
redosier dogwood					2																2
rose																					0
snowberry																					0
% Weed Canopy	60	30	80	30	0	5	15	35	30	60	10	5	35	50	35	75	60	95	50	75	
<p>Remarks: Lambsquarters and mustard are the major annual weeds present. Less weeds than in native planting. Red clover present in plots, but not counted. This treatment has the highest wormwood densities. Sainfoin most prevalent of planted legumes.</p>																					

Table 5E. Old John's Lake WMA; native species seeded with herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft ²)																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot																					0
blanketflower	1										1	1									3
blue flax						1				1					1					1	4
Canada milkvetch																					0
coreopsis				1						2								1			4
cup plant		1				1													1		3
dotted blazing star																	1				1
echinacea-coneflower						2												2		1	5
golden glow																					0
hyssops																					0
leadplant																					0
longheaded coneflower																					0
Maximilian sunflower				1																	1
meadow blazing star																					0
partridge pea			1																1		2
penstemon					1	1							3					1		1	7
purple prairieclover							1						2		1			1			5
stiff goldenrod																					0
stiff sunflower				1		1	1	1	1	1			1	1	1			1			10
tick trefoil																					0
white prairieclover	1						1					1									3
yellow coneflower																					0
big bluestem																			1		1
Canada wildrye													1					1			2
switchgrass																					0
buffaloberry					1																1
chokecherry																					0
currant																					0
false indigo															1						1
juneberry																					0
prairie rose																					0
red dogwood																					0
snowberry																					0
% Weed Canopy	5	3	2	20	1	10	10	15	65	20	1	25	15	75	15	2	2	3	20	35	
Remarks: Nothing found in frame 16; less stunted than at Russell Stuart site; seeded plants are more vigorous than at Russell Stuart site; large quackgrass patches; more weeds than at Russell Stuart site.																					

Table 5F. Old John's Lake WMA; native species seeded with no herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft ²)																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
bergamot																					0
blanketflower															1						1
blue flax											1		1		1			2			5
Canada milkvetch																					0
coreopsis											1						1				2
cup plant											1										1
dotted blazing star								1													1
echinacea-coneflower			1								1				1			1			4
golden glow																					0
hyssops																					0
leadplant																					0
longheaded coneflower																					0
Maximilian sunflower															1	1					2
meadow blazing star																					0
partridge pea																					0
penstemon						1					1			1							3
purple prairieclover																		1			1
stiff goldenrod															1						1
stiff sunflower	1		1											2	1		2		1		8
tick trefoil														1							1
white prairieclover											1				3					1	5
yellow coneflower																					0
big bluestem		1									1	1				1					4
Canada wildrye																				1	1
switchgrass																1		1			2
buffaloberry			1																		1
chokecherry																					0
currant																					0
false indigo																					0
juneberry																					0
prairie rose																					0
red dogwood																					0
snowberry																					0
% Weed Canopy	15	15	20	75	70	90	70	40	80	90	50	15	25	65	40	30	15	25	30	65	

Table 5G. Old John's Lake WMA; introduced species seeded with herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft ²)																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
alfalfa	1	2	2	2			3			1			2							1	14
cicer milkvetch	1	2	1	1							1		2						1	1	10
hairy vetch																					0
plains coreopsis																					0
red clover																					0
sainfoin				1																	1
Grasses	1		2						1		0		0			4	6	0	0	0	14
buffaloberry																					0
chokecherry																					0
false indigo							1														1
golden currant																					0
juneberry																					0
redosier dogwood																					0
rose																					0
snowberry																					0
% Weed Canopy	50	20	25	25	60	5	35	35	15	35	20	20	15	70	10	15	60	15	10	15	
<p>Remarks: Many Canada thistle patches, particularly frames 17, 18, and 19; sideoats grama in frame 7; high density of sweetclover; quackgrass; less sainfoin than Russell Stuart WMA site; less grasses than Russell Stuart WMA site.</p>																					

Table 5H. Old John's Lake WMA; introduced species seeded with no herbicide application, random species counts taken 7/6/2005.

SPECIES	FRAME (2.4-ft ²)																				Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
alfalfa									1	1				1							3
cicer milkvetch										1	1			1							3
hairy vetch																					0
plains coreopsis																					0
red clover																					0
sainfoin															1						1
Grasses			2	3	6	6		2	2		2	2	3	9	3					0	40
buffaloberry																				1	1
chokecherry																					0
false indigo																					0
golden currant																					0
juneberry																					0
redosier dogwood												2									2
rose																					0
snowberry																					0
% Weed Canopy	70	40	50	35	40	70	30	60	65	70	75	50	90	95	95	75	70	85	30	60	
Remarks: Large sweetclover patches and quackgrass; poor establishment from seeded species.																					