

Article Title: Site preparation drives long-term plant community dynamics in restored tallgrass prairie: a case study in southeastern South Dakota

Journal: Environmental Management

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Online Resource 1. Seed mixes (kg/ha) spread at Spirit Mound, SD in the reconstruction in former cropland (reconst) and rehabilitation in former non-cropland (rehab) during the tallgrass prairie restoration initiated in 2001 (Vote 2004). The rehabilitation was also planted with seedlings (plugs) during the restoration in 2001. More diverse seed was spread along the trail, which is in the reconstruction area where one sampling transect intersected it. Other is an additional seed mix that was spread in a small area in the northeastern section of Spirit Mound that could have propagated in the surrounding reconstruction since the seeding in 2001. Seed mixes were purchased from Ion Exchange (Harpers Ferry, IA).

Scientific Name	Common name	Reconst kg/ha	Rehab kg/ha	Rehab plugs/ha	Trail kg/ha	Other kg/ha
<i>Amorpha canescens</i>	Leadplant	0.01	0.06	0.00	0.11	0.00
<i>Andropogon gerardii</i>	Big bluestem	1.12	0.11	0.00	0.11	1.12
<i>Artemisia ludoviciana</i>	White sagebrush	0.01	0.06	13.23	0.01	0.00
<i>Asclepias incarnata</i>	Swamp milkweed	0.00	0.00	0.00	0.00	0.28
<i>Asclepias tuberosa</i>	Butterfly milkweed	0.01	0.11	13.23	0.56	0.00
<i>Asclepias verticillata</i>	Whorled milkweed	0.00	0.00	13.23	0.00	0.00
<i>Astragalus canadensis</i>	Canada milkvetch	0.00	0.06	0.00	0.11	0.00
<i>Bidens cernua</i>	Bur marigold	0.00	0.00	0.00	0.00	0.28
<i>Bouteloua curtipendula</i>	Sideoats grama	0.56	1.91	13.23	2.24	0.00
<i>Chamaecrista fasciculata</i>	Partridge pea	0.00	0.28	0.00	0.56	0.00
<i>Dalea candida</i>	White prairie clover	0.00	0.28	0.00	0.56	0.00
<i>Dalea purpurea</i>	Purple prairie clover	0.00	0.56	0.00	0.56	0.00
<i>Doellingeria umbellata</i>	Flat-topped Aster	0.00	0.00	0.00	0.00	0.22
<i>Echinacea angustifolia</i>	Purple coneflower	0.11	0.22	13.23	0.22	0.00
<i>Elymus canadensis</i>	Canada wildrye	1.12	0.22	0.00	0.22	0.00

<i>Eupatorium perfoliatum</i>	Common boneset	0.00	0.00	0.00	0.00	0.28
<i>Eutrochium maculatum</i>	Spotted joe pye weed	0.00	0.00	0.00	0.00	0.28
<i>Geum triflorum</i>	Prairie smoke	0.00	0.00	13.23	0.00	0.00
<i>Glycyrrhiza lepidota</i>	Wild licorice	0.00	0.00	0.00	0.00	0.01
<i>Helenium autumnale</i>	Common sneezeweed	0.00	0.00	0.00	0.00	0.28
<i>Helianthus pauciflorus</i>	Stiff sunflower	0.01	0.11	13.23	0.06	0.00
<i>Heliopsis helianthoides</i>	Smooth oxeye	0.56	0.22	0.00	0.22	0.00
<i>Hesperostipa spartea</i>	Porcupinegrass	0.11	0.11	13.23	0.11	0.00
<i>Lespedeza capitata</i>	Roundhead lespedeza	0.01	0.06	0.00	0.06	0.00
<i>Liatris aspera</i>	Tall blazing star	0.01	0.06	13.23	0.11	0.00
<i>Mimulus ringens</i>	Allegheny monkey flower	0.00	0.00	0.00	0.00	0.06
<i>Monarda fistulosa</i>	Wild bergamot	0.09	0.22	0.00	0.22	0.11
<i>Oligoneuron rigidum</i>	Stiff goldenrod	0.34	0.11	13.23	0.22	0.00
<i>Panicum virgatum</i>	Switchgrass	0.01	0.00	0.00	0.01	0.11
<i>Penstemon grandiflorus</i>	Large beardtongue	0.00	0.06	0.00	0.11	0.00
<i>Phlox pilosa</i>	Prairie phlox	0.00	0.06	0.00	0.11	0.00
<i>Potentilla arguta</i>	Tall cinquefoil	0.00	0.11	0.00	0.22	0.00
<i>Pulsatilla patens</i>	Eastern pasqueflower	0.00	0.00	13.23	0.00	0.00
<i>Ratibida columnifera</i>	Upright prairie coneflower	0.00	0.56	13.23	0.00	0.00
<i>Ratibida pinnata</i>	Pinnate prairie coneflower	0.67	0.00	0.00	0.56	0.00
<i>Rudbeckia hirta</i>	Blackeyed Susan	0.11	0.22	0.00	0.34	0.00
<i>Schizachyrium scoparium</i>	Little bluestem	0.56	2.80	13.23	2.45	0.00
<i>Silphium laciniatum</i>	Compass plant	0.06	0.00	0.00	0.00	0.00
<i>Silphium perfoliatum</i>	Cup plant	0.56	0.00	0.00	0.00	0.56
<i>Solidago nemoralis</i>	Grey goldenrod	0.00	0.06	13.23	0.11	0.00
<i>Solidago speciosa</i>	Showy goldenrod	0.01	0.06	13.23	0.11	0.00
<i>Sorghastrum nutans</i>	Indiangrass	1.89	0.22	0.00	0.22	0.00
<i>Spartina pectinata</i>	Prairie cordgrass	0.00	0.00	0.00	0.00	4.48
<i>Sporobolus clandestinus</i>	Rough dropseed	0.11	0.11	13.23	0.11	0.00
<i>Sporobolus heterolepis</i>	Prairie dropseed	0.11	0.11	13.23	0.11	0.00
<i>Symphyotrichum laeve</i>	Smooth blue aster	0.01	0.11	0.00	0.11	0.00
<i>Symphyotrichum novae-angliae</i>	New England aster	0.01	0.00	0.00	0.11	0.06
<i>Symphyotrichum oolentangiense</i>	Sky blue aster	0.00	0.01	13.23	0.01	0.00
<i>Symphyotrichum sericeum</i>	Western silver aster	0.00	0.02	13.23	0.11	0.00
<i>Tradescantia bracteata</i>	Longbract spiderwort	0.00	0.06	13.23	0.06	0.00
<i>Verbena hastata</i>	Swamp verbena	0.04	0.00	0.00	0.00	0.22

<i>Verbena stricta</i>	Hoary verbena	0.00	0.22	13.23	0.45	0.00
<i>Vernonia fasciculata</i>	Prairie ironweed	0.22	0.00	0.00	0.00	0.34
	Forb	2.87	3.96	N/A	6.02	2.98
Total	Grass	5.60	5.60	N/A	5.60	5.72

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Online Resource 2. The effects of restoration method (reconstruction versus rehabilitation), year (2004, 2013), and the restoration method*year interaction on diversity, richness, evenness, and non-native species relative abundance. Reconstruction n=5, rehabilitation n=4. (Repeated measures mixed ANOVA.)

Effect	Diversity				Richness			
	<i>num df</i>	<i>den df</i>	<i>f value</i>	<i>p-value</i>	<i>num df</i>	<i>den df</i>	<i>f value</i>	<i>p-value</i>
Restoration Method	1	7	29.03	0.001	1	7	31.92	0.0008
Year	1	7	21.84	0.0023	1	7	67.69	<.0001
Interaction	1	7	14.86	0.0062	1	7	9.49	0.0178

Effect	Evenness				Non-native Species Relative Abundance			
	<i>num df</i>	<i>den df</i>	<i>f value</i>	<i>p-value</i>	<i>num df</i>	<i>den df</i>	<i>f value</i>	<i>p-value</i>
Restoration Method	1	7	2.15	0.1864	1	7	28.48	0.0011
Year	1	7	108.56	<.0001	1	7	0.07	0.7958
Interaction	1	7	25.12	0.0015	1	7	2.15	0.1861

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Online Resource 3. The effects of restoration method (reconstruction versus rehabilitation), year (2004, 2013) and the restoration method*year interaction on the abundance of the functional groups. Functional groups were divided into native and non-native forbs, legumes, C₃ grasses, and C₄ grasses. No non-native C₄ grasses were present. Woody plants were excluded because they made up less than 1% of the data. Reconstruction n=5, rehabilitation n=4. (Repeated measures mixed ANOVA.)

Effect	Native forbs				Non-native forbs			
	<i>num</i> <i>df</i>	<i>den</i> <i>df</i>	<i>f value</i>	<i>p-value</i>	<i>num</i> <i>df</i>	<i>den</i> <i>df</i>	<i>f value</i>	<i>p-value</i>
Restoration Method	1	7	15.05	0.0061	1	7	0.22	0.6510
Year	1	7	3.44	0.1060	1	7	8.05	0.0251
Interaction	1	7	3.33	0.1109	1	7	0.46	0.5183

Effect	Native legumes				Non-native legumes			
	<i>num</i> <i>df</i>	<i>den</i> <i>df</i>	<i>f value</i>	<i>p-value</i>	<i>num</i> <i>df</i>	<i>den</i> <i>df</i>	<i>f value</i>	<i>p-value</i>
Restoration Method	1	7	0.90	0.3735	1	7	1.18	0.3127
Year	1	7	1.18	0.3140	1	7	0.76	0.4134
Interaction	1	7	0.90	0.3735	1	7	2.13	0.1877

Effect	Native C ₃ grasses				Non-native C ₃ grasses			
	<i>num</i> <i>df</i>	<i>den</i> <i>df</i>	<i>f value</i>	<i>p-value</i>	<i>num</i> <i>df</i>	<i>den</i> <i>df</i>	<i>f value</i>	<i>p-value</i>
Restoration Method	1	7	50.05	0.0002	1	7	60.11	0.0001
Year	1	7	76.22	<.0001	1	7	1.28	0.2951
Interaction	1	7	91.06	<.0001	1	7	2.11	0.1897

Effect	Native C ₄ grasses			
	<i>num</i> <i>df</i>	<i>den</i> <i>df</i>	<i>f value</i>	<i>p-value</i>
Restoration Method	1	7	5.32	0.0545
Year	1	7	6.72	0.0358
Interaction	1	7	13.77	0.0075

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Online Resource 4. The effects of restoration method (reconstruction versus rehabilitation), year (2004, 2013) and the restoration method*year interaction on richness of the functional groups. Functional groups were divided into native and non-native forbs, legumes, C₃ grasses, and C₄ grasses. No non-native C₄ grasses were present. Woody plants were excluded because they made up less than 1% of the data. Reconstruction n=5, rehabilitation n=4. (Repeated measures mixed ANOVA.)

Effect	Native forbs				Non-native forbs			
	<i>num df</i>	<i>den df</i>	<i>f value</i>	<i>p-value</i>	<i>num df</i>	<i>den df</i>	<i>f value</i>	<i>p-value</i>
Restoration Method	1	7	20.10	0.0029	1	7	0.24	0.6394
Year	1	7	15.99	0.0052	1	7	10.12	0.0155
Interaction	1	7	3.59	0.1001	1	7	0.00	0.9940

Effect	Native legumes				Non-native legumes			
	<i>num df</i>	<i>den df</i>	<i>f value</i>	<i>p-value</i>	<i>num df</i>	<i>den df</i>	<i>f value</i>	<i>p-value</i>
Restoration Method	1	7	0.54	0.4877	1	7	0.82	0.3959
Year	1	7	2.66	0.1472	1	7	1.24	0.3020
Interaction	1	7	0.54	0.4877	1	7	1.24	0.3020

Effect	Native C ₃ grasses				Non-native C ₃ grasses			
	<i>num df</i>	<i>den df</i>	<i>f value</i>	<i>p-value</i>	<i>num df</i>	<i>den df</i>	<i>f value</i>	<i>p-value</i>
Restoration Method	1	7	12.72	0.0091	1	7	26.85	0.0013
Year	1	7	11.00	0.0128	1	7	0.56	0.4774
Interaction	1	7	17.49	0.0041	1	7	2.12	0.1885

Effect	Native C ₄ grasses			
	<i>num df</i>	<i>den df</i>	<i>f value</i>	<i>p-value</i>
Restoration Method	1	7	14.71	0.0064
Year	1	7	16.95	0.0045
Interaction	1	7	5.38	0.0535