

Supplementary Table 3. Indicator species analysis results of plant species present in study sites. Species are ranked by their indicator value and frequency indicates the number of sites a plant species is present in.

Dakota skipper site	Species	Indicator value	P-value	Frequency
Negative	<i>Rosa arkansana</i>	0.546	0.111	33
	<i>Solidago mollis</i>	0.333	0.240	16
	<i>Medicago lupulina</i>	0.216	0.254	8
	<i>Campanula rotundifolia</i>	0.229	0.304	12
	<i>Achillea millefolium</i>	0.414	0.306	28
	<i>Gaillardia aristata</i>	0.189	0.311	7
	<i>Grindelia squarrosa</i>	0.162	0.389	6
	<i>Taraxacum officinale</i>	0.284	0.390	18
	<i>Symphoricarpos occidentalis</i>	0.501	0.423	39
	<i>Astragalus species</i>	0.162	0.434	6
	<i>Ambrosia coronopifolia</i>	0.135	0.473	5
	<i>Avenula hookeri</i>	0.195	0.543	12
	<i>Geum triflorum</i>	0.108	0.569	4
	<i>Agropyron cristatum</i>	0.108	0.570	4
	<i>Melilotus albus</i>	0.115	0.571	6
	<i>Hordeum jubatum</i>	0.108	0.571	4
	<i>Artemisia ludoviciana</i>	0.447	0.586	36
	<i>Elymus trachycaulus</i>	0.306	0.594	22
	<i>Cirsium flodmanii</i>	0.328	0.605	25
	<i>Spiraea alba</i>	0.081	0.618	3
	<i>Galium boreale</i>	0.358	0.625	28
	<i>Liatris ligulistylis</i>	0.127	0.628	7
	<i>Mulgedium pulchellum</i>	0.343	0.636	26
	<i>Artemisia absinthium</i>	0.097	0.663	5
	<i>Anemone patens</i>	0.331	0.690	26
	<i>Asclepias speciosa</i>	0.142	0.698	10
	<i>Koeleria macrantha</i>	0.262	0.700	20
	<i>Monarda fistulosa</i>	0.123	0.709	8
	<i>Potentilla norvegica</i>	0.201	0.717	15
	<i>Ratibida columnifera</i>	0.354	0.720	29
	<i>Artemisia cana</i>	0.081	0.747	3
	<i>Artemisia frigida</i>	0.470	0.796	41
	<i>Thermopsis rhombifolia</i>	0.175	0.796	13
	<i>Penstemon gracilis</i>	0.054	0.828	2
	<i>Prunus virginiana</i>	0.054	0.831	2
	<i>Comandra umbellata</i>	0.350	0.836	30
<i>Agrostis scabra</i>	0.054	0.842	2	
<i>Erigeron glabellus</i>	0.054	0.842	2	
<i>Tragopogon dubius</i>	0.155	0.875	13	
<i>Polygala alba</i>	0.081	0.889	6	

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Supplementary Table 3: Continued

Dakota skipper site	Species	Indicator value	P-value	Frequency	
Negative	<i>Oxytropis lambertii</i>	0.097	0.915	8	
	<i>Cirsium arvense</i>	0.105	0.947	9	
	<i>Pascopyrum smithii</i>	0.172	0.983	16	
	<i>Lycopodium species</i>	0.060	1.000	4	
	<i>Amelanchier alnifolia</i>	0.054	1.000	2	
	<i>Asclepias ovalifolia</i>	0.054	1.000	2	
	<i>Carex species</i>	0.054	1.000	2	
	<i>Escobaria vivipara</i>	0.054	1.000	2	
	<i>Heuchera richardsonii</i>	0.054	1.000	2	
	<i>Poa palustris</i>	0.054	1.000	2	
	<i>Sphaeralcea coccinea</i>	0.054	1.000	2	
	<i>Symphyotrichum ericoides</i>	0.054	1.000	2	
	<i>Trifolium hybridum</i>	0.054	1.000	2	
	<i>Sonchus arvensis</i>	0.053	1.000	4	
	<i>Lysimachia maritima</i>	0.051	1.000	4	
	<i>Bouteloua curtipendula</i>	0.027	1.000	1	
	<i>Brassica rapa</i>	0.027	1.000	1	
	<i>Erigeron acris</i>	0.027	1.000	1	
	<i>Erigeron caespitosus</i>	0.027	1.000	1	
	<i>Euphorbia esula</i>	0.027	1.000	1	
	<i>Lilium philadelphicum</i>	0.027	1.000	1	
	<i>Lithospermum canescens</i>	0.027	1.000	1	
	<i>Polygala senega</i>	0.027	1.000	1	
	<i>Rumex crispus</i>	0.027	1.000	1	
	<i>Rumex species</i>	0.027	1.000	1	
	Positive	<i>Schizachyrium scoparium</i>	0.561	0.016	22
		<i>Ziza aptera</i>	0.207	0.038	4
<i>Pediomelum argophyllum</i>		0.637	0.050	42	
<i>Lygodesmia juncea</i>		0.204	0.059	4	
<i>Bouteloua gracilis</i>		0.203	0.064	5	
<i>Erigeron philadelphicus</i>		0.111	0.181	1	
<i>Orthocarpus luteus</i>		0.111	0.190	1	
<i>Potentilla species</i>		0.111	0.192	1	
<i>Hesperostipa comata</i>		0.535	0.196	39	
<i>Gutierrezia sarothrae</i>		0.111	0.208	1	
<i>Symphyotrichum falcatum</i>		0.111	0.219	1	
<i>Antennaria parvifolia</i>		0.265	0.250	13	
<i>Nassella viridula</i>		0.321	0.267	17	
<i>Bromus inermis</i>		0.381	0.338	25	
<i>Cornus sericea</i>		0.066	0.343	2	
<i>Andropogon gerardii</i>		0.061	0.346	2	
<i>Elymus repens</i>		0.083	0.358	3	

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Supplementary Table 3: Continued

Dakota skipper site	Species	Indicator value	P-value	Frequency
Positive	<i>Astragalus bisulcatus</i>	0.055	0.359	2
	<i>Fragaria virginiana</i>	0.069	0.362	2
	<i>Medicago sativa</i>	0.265	0.390	24
	<i>Liatris punctata</i>	0.202	0.487	12
	<i>Vicia americana</i>	0.323	0.576	24
	<i>Glycyrrhiza lepidota</i>	0.295	0.627	22
	<i>Solidago missouriensis</i>	0.131	0.661	8
	<i>Linum rigidum</i>	0.086	0.668	4
	<i>Oenothera biennis</i>	0.105	0.707	6
	<i>Heterotheca villosa</i>	0.178	0.751	12
	<i>Linum lewisii</i>	0.203	0.754	16
	<i>Solidago rigida</i>	0.176	0.790	14
	<i>Helianthus annuus</i>	0.356	0.805	30
	<i>Echinacea angustifolia</i>	0.346	0.822	30
	<i>Poa pratensis</i>	0.507	0.867	46
	<i>Eleagnus commutata</i>	0.221	0.880	29
	<i>Thalictrum venulosum</i>	0.061	0.882	4
	<i>Melilotus officinalis</i>	0.094	0.893	7
	<i>Gaura coccinea</i>	0.391	0.911	35
	<i>Dalea purpurea</i>	0.362	0.926	33
	<i>Anemone cylindrica</i>	0.169	0.943	15
	<i>Astragalus agrestis</i>	0.144	0.992	15
	<i>Juniperus horizontalis</i>	0.070	1.000	5
	<i>Oxtropis species</i>	0.050	1.000	4
	<i>Cerastium nutans</i>	0.050	1.000	2
	<i>Astragalus crassicaarpus</i>	0.045	1.000	3

Supplementary Table 4. Soil laboratory analysis methods and procedures used on soil samples taken from 0–15 cm.

Variable	Sites	Method	Analysis	Citation
Gravimetric content of field-moist soil	2015, 2016	Oven dry method		Ellert <i>et al.</i> 2007
Gravimetric content of air-dry soils	2015, 2016	Oven dry method		Ellert <i>et al.</i> 2007
Bulk density	2015, 2016	Standard core method		Hao <i>et al.</i> 2008
Particle analysis	2015, 2016	Modified pipette procedure		Indorante <i>et al.</i> 1990
Ammonium (NH_4^+)	2015, 2016	Potassium chloride (KCl) extraction	Colorimetry using a technicon auto analyzer	Maynard <i>et al.</i> 2008
Ammonia (NO_3^-)	2015, 2016	Potassium chloride (KCl) extraction	Colorimetry using a technicon auto analyzer	Maynard <i>et al.</i> 2008
pH	2015	1:2 ratio of soil to water		Hendershot <i>et al.</i> 2008
Electrical conductivity (EC)	2015	1:2 ratio of soil to water		Miller and Curtin 2008
Sodium (Na)	2015	Mehlich 3-Extractable Elements	Flame emission on Agilent's atomic absorption spectrometer AA240	Ziadi and Sen Tran 2008
Calcium (Ca)	2015	Mehlich 3-Extractable Elements	Atomic absorption on Agilent's atomic absorption spectrometer AA240	Ziadi and Sen Tran 2008
Magnesium (Mg)	2015	Mehlich 3-Extractable Elements	Atomic absorption Agilent's atomic absorption spectrometer AA240	Ziadi and Sen Tran 2008

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Variable	Sites	Method	Analysis	Citation
Potassium (K)	2015	Mehlich 3-Extractable Elements	Flame emission Agilent's atomic absorption spectrometer AA240	Ziadi and Sen Tran 2008
Phosphorous (PO_4^{-3})	2015	Modified Kelowna extractions	Colorimetry on technicon auto analyzer	Ashworth and Mrazek 1995
Organic carbon (C)	2015	Pretreated with hydrochloric acid (HCl), combustion at 1100°C	LECO C632 carbon combustion analyzer	Skjemstad and Baldock 2008
Inorganic C	2015	Difference of total carbon and organic carbon		Skjemstad and Baldock 2008
Total C	2015, 2016	Combustion at 1100°C	LECO C632 carbon combustion analyzer	Skjemstad and Baldock 2008