Descriptions of Manitoba’s Grassland Plant Communities of the Aspen Parkland and Assiniboine Delta Rangeland Ecoregions for Rangeland Health Monitoring

First Approximation

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Acknowledgements

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Project Goals

Combine plant community data sources from MB’s rangelands

Describe potential reference plant communities on ecosites and how they change with disturbance (e.g. grazing, fire or lack-of)

- First draft for the province of MB!

Develop a plant community guide that can be used with Manitoba’s range and pasture health assessment form
Rangeland Ecoregions
Thorpe 2014

Determined by climate and major geological features

Focus on describing grassland plant communities in the Aspen Parkland and Assiniboine Delta
Aspen Parkland
Thorpe 2014

- West of the Manitoba Escarpment
- Black soil zone (Black Chernozems)
- Relatively xeric climate
- Moisture increases northward and eastward
- Cropland and tame forage
Assiniboine Delta
Thorpe 2014

- Climate similar to Aspen Parkland, distinguished by landscape features
- Sandy delta created by the Assiniboine River & modified by wind
- Vegetated sand dunes
Assiniboine Delta
Thorpe 2014

- Greater occurrence of species associated with tallgrass prairie (Henderson and Koper 2014)
Ecosites
Defined by the Society for Range Management (1998)

A kind of land with a specific potential natural community and specific physical site characteristics, differing from other kinds of land in its ability to produce vegetation and to respond to management.

Differentiated by edaphic and landscape characteristics: soil texture, drainage, slope, proximity to bedrock, and degree of salinity or calcareousness.
Ecosites
Key Concepts & Guiding Principles of Range Management
Potential Plant Community
Defined by the Society for Range Management (1998)

The biotic community that establishes on an ecosite after succession without interference by man under the current environmental conditions.

Also known as a Reference Community.

Interpreted as a community that develops under ungrazed or lightly grazed conditions.

There can be more than 1!

Hesperostipa spartea - Festuca hallii
Sand Ecosite
Potential Plant Community
Defined by the Society for Range Management (1998)

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_Hesperostipa spartea / Andropogon gerardii_
Moist Sand Ecosite
Decreasers vs. Increasers
Defined by the Society for Range Management (1998)

The reference plant community will be dominated by plants that decrease in cover/biomass with disturbance.

**Decreasers**

For a given plant community, those species that decrease in amount as a result of a specific abiotic/biotic influence or management practice

Notable reduction of decreasers with monitoring under current management can indicate declining rangeland health
Decreasers vs. Increasers
Defined by the Society for Range Management (1998)

Increasers
For a given plant community, those species that increase in amount as a result of a specific abiotic/biotic influence or management practice

Mid seral and early seral communities will have greater representation of forb and grass increasers

Contribute diversity
Invaders
Defined by the Society for Range Management (1998)

Plant species that were absent in undisturbed portions of the original vegetation of a specific range site and will invade or increase following disturbance or continued heavy grazing.

Includes noxious weeds and introduced forages or cool-season grasses that displace native vegetation.

Note: Forages are assessed differently for modified and tame communities
State-and-Transition
Briske et al. 2005

Plant communities are dynamic!
- Communities can shift along multiple non-linear pathways
- Thresholds can be crossed which create new stable states.

Express the multivariate nature of vegetation dynamics.
State-and-Transition
Briske et al. 2005

Moves away from linear Clementsian models of community assembly and succession that informed past methods of grassland assessment like range condition.
State-and-Transition
Briske et al. 2005

Plant communities can shift between different stable states.

Conceptual Model of Multiple Stable States
State-and-Transition
Briske et al. 2005

Plant communities can shift with disturbance within a stable state.

Some state-transitions may be irreversible without significant intervention. **Crossing a threshold.** Think displacement of native species.

*Conceptual Model of Multiple Stable States*
Data Sets & Sources

Combined data from key resources like the PFRA, Wildlife Management Areas, Nature Conservancy of Canada, Spruce Woods Provincial Park, and Riding Mountain National Park

Plant community data from Saskatchewan (adjacent to Manitoba within the Parkland) was used

Data from adjacent boreal plains was incorporated with discretion (close proximity, occurrence of fescue grassland)
Assignment of Ecosite

Typically provided by the observer

When absent this was extracted from descriptions of soil texture, drainage, etc. from available reports

When absent ArcMap was used in combination with plant community composition

Note that ground truthing is the most accurate and reliable method of ecosite assignment
Plant Community

Collected using various methods, where relative biomass was the most common estimate of composition.

- Transformed composition data to relative values (total 100%)

To aid in data interpretation dominant plants were identified and a successional index (0 to 1) was tabulated that incorporated plant dominance and grazing response (Thorpe 2014).

Assignment of plant communities was guided based on:

- Dendrogram analysis
- Non-metric multidimensional scaling (NMDS)
- Dominance of plant species & knowledge of grassland community responses to disturbance, invasions, grazing, woody encroachment, etc.
Dendrogram of Plant Communities

Provided a framework for major plant community divisions

Chord-Ward method with hclust() in R (Borcard et al. 2011)

- Bray-Curtis distance

Included plant communities with > 50% native cover
Plant Communities & Ecosite

We have data from 12 ecosites in the Aspen Parkland and Assiniboine Delta, including grassland and forest.

For the first available version of the guide descriptions from dominant important ecosites will become available first:

- Loam
- Sand
- Moist Sand
- Dune

Descriptions will be updated over time.

These results are preliminary - revisions will be made.
Sand Ecosite

Well drained uplands with coarser textured soils, which lack the hills and ridges found on dune ecosites. Includes coarse textured soils containing fine and course gravel.

![Graph showing Sand Ecosite data](image)
Reference Communities

SD1a Festuca hallii – Avenula hookeri – Hesperostipa curtiseta – Hesperostipa spartea Reference Community

SD1b Hesperostipa curtiseta – Festuca hallii – Avenula hookeri – Hesperostipa spartea Reference Community / Minor Alteration

SD1c Festuca hallii / Sporobolus heterolepis Reference Community No Data

SD1d Hesperostipa spartea / Festuca hallii – Juniperus horizontalis Reference Community No Data

SD2 Hesperostipa curtiseta – Avenula hookeri – Carex

SD3 Hesperostipa curtiseta – Carex – Bouteloua gracilis – Koeleria macrantha

SD4 Koeleria macrantha – Hesperostipa comata / Dichanthelium wilcoxianum

SD5 Hesperostipa curtiseta – Poa pratensis / Carex

SD6 Hesperostipa curtiseta – Agropyron cristatum - Carex

SD7 Hesperostipa comata / Symphoricarpus occidentalis – Poa pratensis

SD8 Poa pratensis – Hesperostipa comata / Artemisia frigida

SD9 Hesperostipa spartea – Bouteloua gracilis – Juniperus horizontalis

SD10 Hesperostipa spartea – Carex – Bouteloua gracilis – Juniperus horizontalis

SD11 Hesperostipa spartea – Poa pratensis – Carex

SD12 Agropyron cristatum – Hesperostipa spartea / Poa pratensis

SD13 Juniperus horizontalis – Schizachyrium scoparium – Carex

SD14 Carex – Schizachyrium scoparium

SD15 Carex – Juniperus horizontalis – Poa compressa / Artemisia frigida

SD16 Rosa – Euphorbia esula – Juniperus horizontalis – Schizachyrium scoparium / Carex

SD17 Euphorbia esula – Juniperus horizontalis – Poa pratensis

SD18 Andropogon gerardii – Symphoricarpus occidentalis – Poa pratensis

SD19 Hesperostipa spartea – Symphoricarpus occidentalis / Poa pratensis

SD20 Symphoricarpus occidentalis – Poa pratensis – Elaeagnus commutata – Artemisia frigida

SD21 Symphoricarpus occidentalis – Elaeagnus commutata – Agropyron cristatum – Medicagosativa

SD22M Poa pratensis – Artemisia ludoviciana / Gallium boreale / Vicia americana Modified

SD23M Poa pratensis / Bromus inermis – Artemisia ludoviciana Modified

SD24M Elymus repens – Agropyron cristatum – Poa pratensis Modified

Threshold > 50% Introduced

Disturbance

Alteration

Fire?

Lack of Fire

Shrub Encroachment

Leafy Spurge Invasion

SD22M

SD23M

SD24M
Sand Ecosite
Reference Communities

Plains rough fescue (*Festuca hallii*) was likely historically dominant in later seral communities on sand.

Needle grasses shift in dominance with climate. Western porcupine-grass (*Hesperostipa curtiseta*) is more abundant on more xeric sand ecosites (SW). Porcupine-grass (*Hesperostipa spartea*) becomes more dominant northward, eastward, and in the Assiniboine Delta.
Sand Ecosite

Each plant community is described in detail

Features Unique to MB’s Guide

- Native & Introduced species richness
- Shannon’s Diversity Index

More Data Required

- Plant community productivity
- Fallen litter mass

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SD1a

*Festuca hallii – Avenula hookeri – Hesperostipa curtiseta – Hesperostipa spartea*

Plains Rough Fescue – Hooker’s Oatgrass – Western Porcupine-grass – Porcupine-grass

Sandy

(n=6) Potential reference community for sandy fescue grassland. Community dominated by grasses sensitive to disturbance and overgrazing. Community lacks introduced species but is susceptible to Kentucky bluegrass invasion (*Poa pratensis*). Soil surface is covered by litter and a substantial soil crust.

<table>
<thead>
<tr>
<th>Species Composition</th>
<th>% Biomass (n=6)</th>
<th>% Foliage Cover (n=6)</th>
<th>% Relative (n=6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Graminoids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plains rough fescue (<em>Festuca hallii</em>)</td>
<td>21.6</td>
<td>8.4</td>
<td>20.7</td>
</tr>
<tr>
<td>Hooker’s oatgrass (<em>Avenula hookeri</em>)</td>
<td>15.2</td>
<td>5.6</td>
<td>14.5</td>
</tr>
<tr>
<td>Western porcupine-grass (<em>Hesperostipa curtiseta</em>)</td>
<td>12.3</td>
<td>0</td>
<td>10.3</td>
</tr>
<tr>
<td>Porcupine-grass (<em>Hesperostipa spartea</em>)</td>
<td>6.7</td>
<td>8</td>
<td>8.2</td>
</tr>
<tr>
<td>Junegrass (<em>Koeleria macrantha</em>)</td>
<td>5.4</td>
<td>5</td>
<td>5.1</td>
</tr>
<tr>
<td>Awned wheatgrass (<em>Elymus trachycaulus ssp. subsecundus</em>)</td>
<td>6.7</td>
<td>0</td>
<td>5.6</td>
</tr>
<tr>
<td>Grassland sedge (<em>Carex sp.</em>)</td>
<td>5.2</td>
<td>0</td>
<td>4.4</td>
</tr>
<tr>
<td>Little bluestem (<em>Schizachyrium scoparium</em>)</td>
<td>4.9</td>
<td>0</td>
<td>4.1</td>
</tr>
<tr>
<td>Blue grama (<em>Bouteloua gracilis</em>)</td>
<td>2.3</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td>Sheep fescue (<em>Festuca saximontana</em>)</td>
<td>1.6</td>
<td>1.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Kentucky bluegrass (<em>Poa pratensis</em>)</td>
<td>1.3</td>
<td>0</td>
<td>1.1</td>
</tr>
<tr>
<td>Low sedge (<em>Carex duriuscula</em>)</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Plains reedgrass (<em>Calamagrostis montana var</em>)</td>
<td>0.4</td>
<td>0</td>
<td>0.3</td>
</tr>
</tbody>
</table>

**Major Forbs**

- Northern bedstraw (*Galium boreale*)
- Sunflower (*Helianthus spp.*)
- Prairie crocus (*Pulsatilla patens*)
- Bastard toadflax (*Comandra umbellata*)
- Prairie smoke (*Geum triflorum*)
- Common yarrow (*Achillea millefolium*)
- Purple prairie clover (*Dalea purpurea*)
- Fringed sage (*Atriplex frigida*)
- Blue-eyed grass (*Sisyrischium montanum*)
- False dandelion (*Agoseris gilva*)
- Cut-leaved anemone (*Anemone multifida*)
- Chickweed (*Cerasstium arvense*)
- Narrow-leaved milkvetch (*Astragalus pectinatus*)
- Yellow owl-clover (*Orthocarpus luteus*)
- Tufted white prairie aster (*Symphyotrichum arctoides*)
- Harebell (*Campanula rotundifolia*)
- (Potentilla pensylvanica)
- Ground plum (*Astragalus caesius*)

<table>
<thead>
<tr>
<th>Structure</th>
<th>%</th>
<th>Origin and Diversity</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbaceous (n=4)</td>
<td>57 (48-74)</td>
<td>Relative Native (%)</td>
<td>98.9</td>
</tr>
<tr>
<td>Club moss (n=5)</td>
<td>7 (0-26)</td>
<td>Min. Native Richness</td>
<td>27</td>
</tr>
<tr>
<td>Litter (n=5)</td>
<td>38 (0-60)</td>
<td>Relative Introduced (%)</td>
<td>1.1</td>
</tr>
<tr>
<td>Bare soil (n=4)</td>
<td>0</td>
<td>Min. Introduced Richness</td>
<td>0.9</td>
</tr>
<tr>
<td>Lichen (n=1)</td>
<td>13</td>
<td>Shannon’s Diversity Index</td>
<td>2.3</td>
</tr>
<tr>
<td>Moss (n=1)</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Loam Ecosite

Well drained uplands with loam, silty loam, and clay loam textured soils.

Dominant ecosite in Aspen Parkland.
Loam Ecosite
Reference Communities

Plains rough fescue (*Festuca hallii*) in association with Porcupine-grass (*Hesperostipa spartea*) is a likely common reference community on Loam.

Susceptible to significant alteration by exotic bluegrass(es).
Sand deposits shaped into hills and ridges by wind.

Porcupine-grass (*H. spartea*) dominant with bluestems (*Andropogon* spp.) are more likely to dominate reference communities. More data collection may be required.
Moist Sand Ecosite

Imperfectly drained coarse textured soils including gravel and sandy loams. Evidence of gleying.

Porcupine-grass (*H. spartea*) and big bluestem (*Andropogon gerardii*) are more likely to dominate reference communities. Decreasers that indicate moisture like tufted hairgrass (*Deschampsia cespitosa*), slender WG (*Elymus trachycaulus* ssp.), and sedges.

Disturbance

- **MS1**
  - *Hesperostipa* – *Andropogon*
  - *Carex* – *Deschampsia*
  - Reference Community
  - No Data

- **MS2**
  - *Carex* – *Poa pratensis* – *Equisetum* – *Poa palustris* – *Hesperostipa spartea*

- **MS3**
  - *Poa pratensis* – *Carex* – *Solidago* – *Danthonia spicata*

- **MS4**
  - *Poa Pratensis* – *Andropogon gerardii* – *Carex*

- **MS5**
  - *Symphoricarpus* – *Bromus inermis* / *Sporobolus cryptandrus* – *Hesperostipa curtiseta*

- **MS6**
  - *Fragaria* – *Rosa* – *Poa pratensis*
  - Overgrazed Shrubland?

- **MS7M**
  - *Poa pratensis* – *Agrostis stolonifera* – *Trifolium*
  - Modified

**Threshold > 50% Introduced**
Potential Applications

- Range health monitoring can advise grazing management

- Monitoring industrial disturbances and assessing the return of ecological function in addition to plant community composition (Desserud et al. 2010)

- Advise prairie restoration & reclamation projects for diverse ecosites
  - Decreaser species, target community
  - Diversity
  - Trajectory

- Describing wild life habitat (structure, distribution, etc.)
Potential Applications

- Inform future range management & grassland ecology research in the province of Manitoba
  - This data set alone enables us to ask new ecological questions
- Inform knowledge gaps
Want More Information?

- Google “Manitoba Ecosite and Rangeland Health Initiative”

- Resources will become available on the Manitoba Forage & Grassland Association website

- Contacts
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