Vegetation Community Composition within Bison Wallows in a Lowland Tallgrass Prairie

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Vegetation Community Composition within Bison Wallows in a Lowland Tallgrass Prairie

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†Photo Credit: Tim Smith, Crane Trust
Site Description – Subirrigated Lowland Tallgrass Prairie

Map Adapted From:
Figure Adapted From:
Aerial Photo of Shoemaker and Mormon Islands: Ridge and Swale Topography

Photo Credit, Eric Fowler, Nebraskaland Magazine
Wallows within our study site – April 2016
Methods

Diameter

Depth

Vegetation Quadrats
Wallow no. 2 throughout our study
Wallow use by soil type as compared to availability within study area

**Wallow Use**

- Bolent-Calamus Complex
- Calamus Loamy Fine Sand
- Gothenburg Loam
- Inavale Loamy Sand
- Platte-Bolent Complex

**Available Pasture**

- Bolent-Calamus Complex
- Calamus Loamy Fine Sand
- Gothenburg Loam
- Inavale Loamy Sand
- Platte-Bolent Complex
General Findings

• We identified 109 species of vascular plants within wallows and in surrounding controls
• 18 species were more abundant within wallows
• 19 species were more abundant outside of them
• 35 species demonstrated no significant difference
• There was insufficient data to categorize the response of 37 species.
Count of species with a higher percent cover in wallow or control plots by status as exotic and native

<table>
<thead>
<tr>
<th>Plot Type</th>
<th>Exotic</th>
<th>Native</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Wallow</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

$X = 0.084, p = 0.772$
Number of species with a higher percent cover in wallow or control plots by life cycle

<table>
<thead>
<tr>
<th>Life Cycle</th>
<th>Control</th>
<th>Wallow</th>
<th>X</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual</td>
<td>1</td>
<td>14</td>
<td>26.5</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Biennial</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perennial</td>
<td>10</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ X = 26.5, p < 0.0001 \]
Number of species with a higher percent cover in wallow or control plots by growth habit

\[ X = 8.18, \ p = 0.017 \]
Number of Species with a higher percent cover within wallow or control plots by wetland indicator status

\[ X = 5.46, \ p = 0.141 \]
Number of Species with a higher percent cover in wallow or control plots by Plant Family

- **Amaranthaceae**
- **Asteraceae**
- **Boraginaceae**
- **Brassicaceae**
- **Cactaceae**
- **Cyperaceae**
- **Euphorbiaceae**
- **Fabaceae**
- **Malvaceae**
- **Molluginaceae**
- **Onagraceae**
- **Poaceae**

**Plant Family**

**No. Species**

- **Control**
- **Wallow**
Percent cover of Poaceae spp. in wallow or control plots by scientific name

Scientific Name

- Agrostis stolonifera
- Andropogon gerardii var. gerardii
- Bromus inermis
- Bromus japonicus
- Calamagrostis longiglumis
- Chlorella verticillata
- Digitaria crenata
- D. sanguinalis
- Echinochloa crus-galli
- Elymus repens
- E. smithii
- Eragrostis spectabilis
- Eragrostis trichodes
- Hordeum jubatum
- Hordeum pusillum
- Panicum capillare
- Panigum oligosanthes
- Perpion variegatum
- Phalaris canariensis
- Poa pretiosa
- Schiedonurus arenicola
- Setaria palmata
- Setaria verticillata
- Sporobolus cryptandrus
- Sporobolus compositus
- Trachyspermum portulacastrum
- Valonia octoflora

Wallow
Control

* indicates significant difference at p < 0.05.
Percent cover of Asteraceae spp. in wallow or control plots by scientific name

Scientific Name

Achillea millefolium
Ambrosia artemisiifolia
Ambrosia psorriacea
Aster ericoides
Aster praeclaus
Coryza canadensis
Grindelia squarrosa
Heliandus maximilianii
Heterotheca villosa
Iva canescens
Iva siphonifolia
Solidago canadensis
Solidago missouriensis
Taraxacum officinale
Xanthium strumarium

% Cover
Correlates of Spp. richness within wallows: Differing patterns at different spatial scales

- **Spp. Richness/ Wallow Quad**
  - $r = -0.66^{**}$
  - $r = 0.41^{^\wedge}$

- **Cumulative Spp. Richness per Site (wallows + control)**
  - $r = 0.55^*$
  - $r = 0.79^{***}$

- **Spp. Richness/Control Quad**
  - $r = 0.42^{^\wedge}$
  - $r = -0.32$
Correlates of Spp. richness within and outside of wallows: Hydrological and topographical variation

- **Spp. Richness/Wallow Quad**
  - $p = 0.406$

- **Spp. Richness/Control Quad**
  - $p = 0.0457^*$
  - $r = 0.60^{**}$
  - $r = 0.23$
Large wallow with summer regrowth: interior dominated by a few early successional species, 07-25-17 [↓ Spp. richness per quad, ↑ Spp. richness per wallow]
Small wallow with summer regrowth: a diversity of species inhabit a relatively wide buffer surrounding the wallow’s edge, 07-25-17 [↑ Spp. richness per quad, ↓ Spp. richness per wallow]
Select individual species that respond positively to wallows

Cut-Leaf Evening-Primrose – *Oenothera laciniata*

Green Carpetweed – *Mollugo verticilata*
Top Variables/Models Predicting Spp. Richness within wallows

### Model Selection Table – Total Species Richness in Wallows

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Intercept</th>
<th>Size 16</th>
<th>Regrowth 17</th>
<th>Depth 17</th>
<th>df</th>
<th>logLik</th>
<th>AICc</th>
<th>delta</th>
<th>weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size + Depth</td>
<td>2.647</td>
<td>0.0051</td>
<td></td>
<td>0.0139</td>
<td>3</td>
<td>-58.25</td>
<td>124</td>
<td>0</td>
<td>0.282</td>
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<tr>
<td>Size</td>
<td>2.898</td>
<td>0.0048</td>
<td></td>
<td></td>
<td>2</td>
<td>-60.097</td>
<td>124.9</td>
<td>0.9</td>
<td>0.180</td>
</tr>
<tr>
<td>Size + Regrowth</td>
<td>2.836</td>
<td>0.0041</td>
<td>0.2655</td>
<td></td>
<td>3</td>
<td>-58.839</td>
<td>125.2</td>
<td>1.18</td>
<td>0.157</td>
</tr>
</tbody>
</table>

### Model Selection Table – Species Richness per Quadrat in Wallows

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Intercept</th>
<th>Size 16</th>
<th>Active 17</th>
<th>Length 17</th>
<th>df</th>
<th>logLik</th>
<th>AICc</th>
<th>delta</th>
<th>weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>4.757</td>
<td></td>
<td>-0.04804</td>
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<td>3</td>
<td>-23.384</td>
<td>54.3</td>
<td>0</td>
<td>0.311</td>
</tr>
<tr>
<td>Length</td>
<td>5.478</td>
<td></td>
<td></td>
<td>-0.2584</td>
<td>3</td>
<td>-23.798</td>
<td>55.1</td>
<td>0.83</td>
<td>0.206</td>
</tr>
</tbody>
</table>
Questions?