Large Scale, High Diversity Restoration as a Threat Reduction Strategy in a High Priority, Fragmented Landscape

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Location – eastern edge of the Central Tallgrass Prairie Ecoregion
Kankakee Sands Landscape Timeline

Historic Ag Conversion

Ecological healing

Restoration

Intact mosaic
Presentation Goals

Explain the rational for **restoration as a strategy** (not a goal) for conserving in-situ diversity in a fragmented landscape

Elaborate on the implications relative to restoration design and long-term assessment of restoration success
Supports a unique assemblage of moderate to high-quality ecosystem remnants and rare species.

Most of the “parts” are still present – but are scattered haphazardly across the landscape.
<table>
<thead>
<tr>
<th>Portfolio Status</th>
<th>Common Name</th>
<th>Viability Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmed</td>
<td>Pin Oak - Swamp White Oak Sand Flatwoods</td>
<td>B</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Midwest Dry-Mesic Sand Prairie</td>
<td>B</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Tussock Sedge Wet Meadow</td>
<td>B</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Midwest Dry Sand Prairie</td>
<td>B</td>
</tr>
<tr>
<td>Unknown</td>
<td>Water-lily Aquatic Wetland</td>
<td>U</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Black Oak / Lupine Barrens</td>
<td>B</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Shrubland Hardhack Wet-Mesic Sand Shrub Meadow</td>
<td>B</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Mesic Sand Tallgrass Prairie</td>
<td>B</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Central Wet-Mesic Sand Tallgrass Prairie</td>
<td>B</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Central Cordgrass Wet Sand Prairie</td>
<td>B</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Swamp White Oak Woodland</td>
<td>A</td>
</tr>
<tr>
<td>Bird</td>
<td>Ammodramus henslowii / Henslow’s Sparrow</td>
<td>B</td>
</tr>
<tr>
<td>Insect</td>
<td>Speyeria idalia / Regal Fritillary</td>
<td>B</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Papaipema beeriana / Blazing Star Stem Borer</td>
<td>B</td>
</tr>
<tr>
<td>Vascular Plant</td>
<td>Hypericum adpressum / Creeping St. John’s-wort</td>
<td>B</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Echinodorus parvulus / North American Dwarf Burhead</td>
<td>C</td>
</tr>
<tr>
<td>Unknown</td>
<td>Schoenoplectus hallii / Hall’s Bulrush</td>
<td>U</td>
</tr>
</tbody>
</table>
Our primary interest at Kankakee Sands

Ensure the continued viability of this important concentration of native habitats and all native grassland and barrens species, both common and rare.
In other words,

It is the pre-existing prairie and oak barrens remnants that we actually care about.

The restoration is simply the tool we are using to ensure that these ecosystem remnants remain viable into the future.
A **threats analysis** indicated that long-term viability of prairie and oak barrens is compromised by a variety of ongoing stressors at the Macrosite.

<table>
<thead>
<tr>
<th></th>
<th>Habitat Size</th>
<th>Wind Power Development</th>
<th>Hydrologic Alteration</th>
<th>Invasive Plants</th>
<th>Invasive Animals</th>
<th>Fire Suppression</th>
<th>Deer Browse</th>
<th>Inappropriate Fire Management</th>
<th>Geographic Distribution of Suitable Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand Prairie</td>
<td>High</td>
<td>Med</td>
<td>High</td>
<td>Med</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black Oak Barrens</td>
<td>High</td>
<td>Med</td>
<td></td>
<td>High</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand Flatwoods</td>
<td>High</td>
<td>Med</td>
<td>High</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-emergent and Emergent Wetlands</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Grassland birds</td>
<td>High</td>
<td>Med</td>
<td>Low</td>
<td>Med</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shorebirds and Marsh Birds</td>
<td>High</td>
<td>Med</td>
<td></td>
<td>Med</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Herptile Communities</td>
<td>High</td>
<td>Med</td>
<td>High</td>
<td>Med</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remnant-dependent Insects</td>
<td>High</td>
<td>High</td>
<td></td>
<td>Low</td>
<td>Med</td>
<td>Med</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regal Fritillary Butterfly</td>
<td>High</td>
<td>High</td>
<td></td>
<td>Low</td>
<td>Med</td>
<td>Med</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Weighted threat rank          | High         | Low         | Med         | High         | Low         | Med         | Low         | Med         | Med                     |                                               |


And that historic land conversion results in habitat fragmentation, creating artificial metapopulations that are vulnerable to stochastic extinction events…,

with reduced opportunities for recolonization or gene flow
Analysis of threats highlighted the potential for restoration as a strategy to reduce threats to biodiversity at the site.
A priori, we set explicit goals to be achieved by the restoration strategy.

- Restore connectivity between isolated plant and animal populations to heal artificial metapopulation structure
- Restore ecological gradients across the landscape to maximize ecological complexity
- Increase habitat size for habitat restricted species (both plants and animals)
- Buffer existing ecosystem remnants from incompatible adjacent land uses
Note that none of these goals revolve around achieving “botanical authenticity”

All goals are functional –

- designed to reduce threats to native species assemblages,

- and are best assessed by functionality rather than botanical compositional comparison to ecosystem remnants
In other words, restoration is used to create a landscape that is permeable to native species and communities and which facilitates ecological connectivity.

NOT to create a prairie wonderland…
Setting these *a priori* goals had a ripple effect throughout all aspects of the restoration design.
Design implications of strategies

Restore connectivity

- Over 8,000 acres purchased to date

- Additional purchases will be required to fully address connectivity
Design implications of strategies

Increase habitat size for habitat restricted species
- Minimum size driven by key low density species
- Local genotype seed sources
- Entire local plant community to be restored (> 600 species)
- Very low density of warm season grasses planted
Design implications of strategies

Restore ecological gradients

- To the maximum extent possible without off-site impacts, all agricultural drainage was eliminated
Design implications of strategies

- Restore ecological gradients

- Initial plantings designed to emulate natural community patterning across the landscape (based on soil and restored hydrology)
Design implications of strategies

Buffer existing ecosystem remnants
- local genotype seed sources
- aggressive invasive species management on restored acres
- additional land protection required
Design implications of strategies

Initial restoration cost is high

Range between $1,200 and $1,500 per acre (not including land acquisition costs)

Restoration maintenance is resource intensive

Four FTEs devoted to the project

Five 6-month “seasonal interns” per year
Design implications of strategies

Restoration assessment is critical

Did the restoration achieve ecological goals?

Is high diversity restoration required to achieve ecological goals?

Are the strategies exportable to other sites across the ecoregion?
Preliminary *a priori* goal assessments

- Restore ecological gradients across the landscape to maximize ecological complexity

The “bottom” of the hydrologic gradient is easy to restore at the site and can be successfully seeded into a diverse wetland mosaic.
Preliminary *a priori* goal assessments

- Restore ecological gradients across the landscape to maximize ecological complexity

Summer 2014 – quantitative assessment of community mosaic planned to assess patterning and ecological complexity of the restoration
Preliminary *a priori* goal assessments

Restore connectivity between isolated plant and animal populations to heal artificial metapopulation structure

The planting mosaic has established very well,

and over 500 native plant species have been recorded across the restoration units
Preliminary *a priori* goal assessments

Restore connectivity between isolated plant and animal populations to heal artificial metapopulation structure

Increase habitat size for habitat restricted species (both plants and animals)
### Preliminary *a priori* goal assessments

**Restore connectivity & Increase habitat size**

**Table 9. Distribution of conservative insect species richness within the greater KSR Landscape (2009).**

<table>
<thead>
<tr>
<th>Taxa</th>
<th>TOTAL KSands LANDSCAPE&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Beaver Lake</th>
<th>KSands restoration plots</th>
<th>KSands old fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>moths</td>
<td>126</td>
<td>78</td>
<td>56</td>
<td>16</td>
</tr>
<tr>
<td>butterflies</td>
<td>24</td>
<td>17</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>homoptera</td>
<td>73</td>
<td>37</td>
<td>32</td>
<td>8</td>
</tr>
<tr>
<td>others</td>
<td>13</td>
<td>8</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>236</td>
<td>140</td>
<td>95</td>
<td>28</td>
</tr>
</tbody>
</table>

<sup>1</sup> KSands LANDSCAPE = Beaver Lake + KSands restoration plots + KSands old fields.
Preliminary *a priori* goal assessments

**Restore connectivity between isolated plant and animal populations to heal artificial metapopulation structure**

**Increase habitat size for habitat restricted species (both plants and animals)**

**Breeding pool use by Amphibians**
Preliminary *a priori* goal assessments

- Buffer existing ecosystem remnants from incompatible adjacent land uses

Restoration buffers reduce the dominance of invasive species in edges of native prairie
Where does the Project go from here?

• 2014 Strategy assessment – designed to explicitly assess threat reduction across the

• 2013-2015 – approximately 350 additional acres will be restored.

• Bison introduction – as ecological disturbance

• Ongoing ecological management
  • Invasive species
  • Prescribed Fire

• Address fragmentation concerns across the entire macrosites
Acknowledgements - too many to list individually

Lilly Endowment
NRCS
..., and many TNC members