Combining species distribution models and disturbance to select native plant species for restoration

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Photo: Sphaeralcea parvifolia. CP2, Seeds of Success, 2015.
STRATEGY
VISION AND MISSION

Vision
The right seed in the right place at the right time.

Mission
To ensure the availability of genetically appropriate seed to restore viable and productive plant communities and sustainable ecosystems.
species distribution models (SDMs) model species occurrences with environmental variables in order to predict probability of occurrence.
developing a **framework** to intersect **SDMs** with **disturbance** to identify which species are predicted to perform **best** in areas where restoration is likely to occur.
<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Species Code</th>
<th>Common Name</th>
<th>Family</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achnatherum hymenoides</td>
<td>ACHY</td>
<td>Indian ricegrass</td>
<td>Poaceae</td>
<td>Grass</td>
</tr>
<tr>
<td>Astragalus lonchocarpus</td>
<td>ASLO3</td>
<td>rushy milkvetch</td>
<td>Fabaceae</td>
<td>Forb</td>
</tr>
<tr>
<td>Bouteloua gracilis</td>
<td>BOGR2</td>
<td>blue grama</td>
<td>Poaceae</td>
<td>Grass</td>
</tr>
<tr>
<td>Cleome lutea</td>
<td>CLLU2</td>
<td>yellow spiderflower</td>
<td>Capparaceae</td>
<td>Forb</td>
</tr>
<tr>
<td>Elymus elymoides</td>
<td>ELEL5</td>
<td>squirrelltail</td>
<td>Poaceae</td>
<td>Grass</td>
</tr>
<tr>
<td>Heliomeris multiflora</td>
<td>HEMU3</td>
<td>showy goldeneye</td>
<td>Asteraceae</td>
<td>Forb</td>
</tr>
<tr>
<td>Koeleria macrantha</td>
<td>KOMA</td>
<td>prairie Junegrass</td>
<td>Poaceae</td>
<td>Grass</td>
</tr>
<tr>
<td>Machaeranthera canescens</td>
<td>MACA2</td>
<td>hoary tansyaster</td>
<td>Asteraceae</td>
<td>Forb</td>
</tr>
<tr>
<td>Pleuraphis jamesii</td>
<td>PLJA</td>
<td>James' galleta</td>
<td>Poaceae</td>
<td>Grass</td>
</tr>
<tr>
<td>Sporobolus cryptandrus</td>
<td>SPCR</td>
<td>sand dropseed</td>
<td>Poaceae</td>
<td>Grass</td>
</tr>
<tr>
<td>Sphaeralcea parvifolia</td>
<td>SPPA2</td>
<td>small-leaf globemallow</td>
<td>Malvaceae</td>
<td>Forb</td>
</tr>
</tbody>
</table>
Species distribution models
aka SDMs
disturbance and predictors of restoration need

- Colorado Plateau boundary
- BLM oil and gas leases in UT, CO, AZ, NM
- USGS Land Treatment Digital Library (LTDL) Seeding treatments
- Landfire vegetation disturbance
- which species have the highest probability of occurrence over the largest area?
- which species are relatively more probable in the area of interest?
\[ P_{sp\ i} = \text{median(Prob}_{sp\ i} \) } \]
\[ A_{sp\ i} = \frac{\text{area of species range}}{\text{area of interest}} \]
\[ P_{sp\ i} \times A_{sp\ i} \rightarrow 0-1 \text{ index of suitability} \]
• Relative probability

\[ \text{RP}_{sp\ i} = \text{mean} \left( \frac{\text{Prob}_{sp\ i}}{\text{mean}(\text{Prob}_{sp\ i}, \text{Prob}_{sp\ n})} \right) \]
Suitability index

\[ = P_{sp_i} \times A_{sp_i} \times R_{sp_i} \]
• which species have the **highest probability** of occurrence over the **largest area**?
• which species are **relatively more probable** in the area of interest?
flexible framework can be applied to varied groups of species or areas of interest

provides a quantitative metric for selecting species for restoration use on a broad ecological scale
similar framework can be applied to **climate clusters** in order to select accessions of species for restoration use

Doherty et al. 2016, in review
similar framework can be applied to climate clusters in order to select accessions of species for restoration use
climate clusters x disturbance for all species, in the Colorado Plateau
Thank you!

- Troy Wood
- Kyle Doherty
- Brad Butterfield
- Mitch Power
- Simon Brewer
- Zach Lundeen
- Adrienne Pilmanis
- Justin Welty
- Chris Calvo

Utah Bureau of Land Management and Colorado Plateau Native Plant Program

University of Utah Rio Mesa Center

National History Museum of Utah

University of Utah's Garrett Herbarium

U.S. Geological Survey

Northern Arizona University

Great Basin Institute
climate clusters x disturbance for all species, all areas of disturbance