So this talk is **not about me**?

No, listen: it’s about **finding the best approach for detecting small quantities of invasive plant species using imaging spectroscopy**!

It’s about **us**!

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Aims and scope

- Can we detect small quantities of invasive plant species?
- Which classifier performs best?

Maxent

Support Vector Machines (SVM)

Boosted regression trees (BRT)
Study area

Legend
- Study site
- Preserve boundary

Map subsets
- Centaurea solstitialis
- Phalaris aquatica
Field data - calibration

- 3 m x 3 m plots
- 66 plots Starthistle
- 33 plots Phalaris
Field data - validation

- 3 m x 3 m plots
- total of 173 plots
Hyperspectral remote sensing data

- 168 spectral bands
- 400-2500 nm
- 1 m x 1 m pixels
- 6th of May 2014
Percentage of grassland pixels with *Centaurea solstitialis*.

<table>
<thead>
<tr>
<th>Method</th>
<th>Max-ent</th>
<th>Biased SVM</th>
<th>BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>46.2</td>
<td>40.3</td>
<td>41.1</td>
</tr>
</tbody>
</table>
Phalaris aquatica

<table>
<thead>
<tr>
<th></th>
<th>Maxent</th>
<th>Biased SVM</th>
<th>BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of grassland pixels with <em>Phalaris aquatica</em></td>
<td>3.8</td>
<td>7.2</td>
<td>3.0</td>
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</tbody>
</table>
Subsets

a) Centaurea solstitialis

Maxent

biased SVM

BRT

b) Phalaris aquatica

Maxent

biased SVM

BRT
# Confusion matrices - *Centaurea solstitialis*

<table>
<thead>
<tr>
<th></th>
<th>Maxent</th>
<th>SVM</th>
<th>BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 - pred</td>
<td>1 - pred</td>
<td>0 - pred</td>
</tr>
<tr>
<td>0 - field</td>
<td>35 (TN)</td>
<td>32 (FP)</td>
<td>44</td>
</tr>
<tr>
<td>1 - field</td>
<td>11 (FN)</td>
<td>88 (TP)</td>
<td>23</td>
</tr>
<tr>
<td>Overall accuracy</td>
<td>0.74</td>
<td>0.72</td>
<td>0.73</td>
</tr>
</tbody>
</table>
## Confusion matrices - *Phalaris aquatica*

<table>
<thead>
<tr>
<th></th>
<th>Maxent</th>
<th></th>
<th>SVM</th>
<th></th>
<th>BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 - pred</td>
<td>1 - pred</td>
<td>0 - pred</td>
<td>1 - pred</td>
<td>0 - pred</td>
</tr>
<tr>
<td><strong>0 - field</strong></td>
<td>137</td>
<td>6</td>
<td>128</td>
<td>15</td>
<td>139</td>
</tr>
<tr>
<td><strong>1 - field</strong></td>
<td>15</td>
<td>15</td>
<td>14</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td><strong>Overall accuracy</strong></td>
<td>0.88</td>
<td></td>
<td>0.83</td>
<td></td>
<td>0.88</td>
</tr>
</tbody>
</table>
Band importances

a) *Centaurea solstitialis*

- **Maxent**

- **biased SVM**

- **BRT**

b) *Phalaris aquatica*

- **Maxent**

- **biased SVM**

- **BRT**
Mapping small cover fractions?

a) *Centaurea solstitialis*

- **Maxent**
  - TP rate vs. cover percentage

- **biased SVM**
  - TP rate vs. cover percentage

- **BRT**
  - TP rate vs. cover percentage

b) *Phalaris aquatica*

- **Maxent**
  - TP rate vs. cover percentage

- **biased SVM**
  - TP rate vs. cover percentage

- **BRT**
  - TP rate vs. cover percentage
Conclusions

- We can map both species, but much higher success of mapping small cover fractions for Starthistle

- Similar overall performance of different classifiers, but some differences in predictions and use of different band areas
Thanks for your attention!

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