2. Modeling wetland type: can we predict moisture-relevant wetland types?

Background, Data and Methods

Wetland boundaries are necessary for predicting methane emissions, a warming climate, and carbon storage. Predictive models require wetland boundaries to be defined at a scale relevant to methane emissions, but challenges exist at high latitude. High latitude wetlands are complex and have a large range of wetness conditions. Two methods were compared:

- **Overlay**: Overlay of geophysical variables (vegetation and soil properties) with spatial data (vegetation and soil types). This method includes both spatial and environmental variables.
- **Cluster**: Cluster analysis of vegetation data and permafrost type. This method includes only vegetation data.

Observed wetland types (Fig. 6) that occur >50˚N (Matthews and Fung)*

- **Cluster A**: cold deciduous forest
- **Cluster B**: temperate/subpolar wooded forest
- **Cluster C**: evergreen needleleaf forest
- **Cluster D**: subpolar shrubland
- **Cluster E**: tundra/bog/forb
- **Cluster F**: forested bog

Table 1. Percent of Total Wetland Cell Grades in Clusters

<table>
<thead>
<tr>
<th>Type</th>
<th>Cluster A</th>
<th>Cluster B</th>
<th>Cluster C</th>
<th>Cluster D</th>
<th>Cluster E</th>
<th>Cluster F</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Cells</td>
<td>537</td>
<td>638</td>
<td>637</td>
<td>418</td>
<td>38</td>
<td>58</td>
</tr>
<tr>
<td>Type score</td>
<td>3.3</td>
<td>3.0</td>
<td>3.2</td>
<td>3.1</td>
<td>3.0</td>
<td>3.2</td>
</tr>
<tr>
<td>Soil carbon</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Installation</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>52.4</td>
<td>52.0</td>
<td>52.0</td>
<td>40.0</td>
<td>40.0</td>
<td>40.0</td>
</tr>
<tr>
<td>NFB: tundra/bog/forb</td>
<td>52.3</td>
<td>40.0</td>
<td>40.0</td>
<td>40.0</td>
<td>40.0</td>
<td>40.0</td>
</tr>
<tr>
<td>NFB: forested bog</td>
<td>40.0</td>
<td>52.3</td>
<td>52.3</td>
<td>52.3</td>
<td>52.3</td>
<td>52.3</td>
</tr>
<tr>
<td>NFB: nonforest</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Conclusions

- Wetland distribution has been simulated with two methods using simple variables
- Overlay method better reproduces location and fractional coverage of wetlands
- Clustering performs poorly for predicting wetland location because it overestimates water table depth
- All wetland types are associated with multiple clusters
- Clustering controlled primarily by temperature and permafrost
- Lesser contributions to clustering from inundation variables and soil carbon
- Cluster results provide information that may help refine methane-relevant type classification

Next steps:

- Include fractional tree cover to help separate types based on vegetation
- Use permafrost data with better spatial variability within permafrost type
- Inundation data contains small lakes, use inundation of wetlands only
- Define inundation metrics such as inundation fraction during three seasons
- Repeat clustering, assess role of individual variables, iterate...

References