Considerations for applying digital soil mapping to ecological sites

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Ecological sites

• ES are useful delineations of the landscape relevant for addressing management decisions

• ES are applicable to all lands (Caudle, et al., 2013)
  – Rangeland, forest, cropland, pasture, etc.
Delineation of ES

• “factors include observable landscape features such as soil morphology, texture and drainage class, indicator plant communities, landform position, slope, aspect, or elevation,...” – Caudle et al., 2013

• Applying environmental systematics

Required ES characteristics
representative soil features,
climatic features,
ecological dynamics,
animal production,
physiographic features,
influencing water features,
etc.

DSM framework
$S_c = f(s,c,o,r,p,a,n)$
Soil, climate, organisms, relief, parent material, age, space
Spatial representation

**Soil properties**
- Point observations
- Environmental maps
- Polygons hand digitized
- Spatial model/geostatistics
- Uncertainty maps
- Continuous properties

**Ecological sites**
- Correlate ES to soil component/mu
- Link to SSURGO or TEUI
- 1:1 maps to component
- Uncertainty maps
- Quantitative soil-landscape attributes

CSM

DSM
Ecological sites

Other eco-classification

Map courtesy of Curtis Talbot
• “Digital soil map*”: 331
  - DSM-“ecological site”: 3
  - DSM-“ecolog*”: 17

• “Predictive soil map*”: 16
  - PSM- “ecological site”: 0
  - PSM-“ecolog*”: 2

• “Pedometrics”: 65
  - PSM- “ecological site”: 0
  - PSM-“ecolog*”: 1

• “Ecological site*”: 225
  - “soil map*”: 3
  - “soil”: 95
What is the difference between these two ESs?

- Same precipitation zone, soil texture, depth, rock fragments, etc.
- Even correlated to some of the same soil series!
- But, the reference plant communities and STMs are different
Updating ES concepts

What is the difference between these two ESs?

Max Sand %

Site 215  Site 216

Max Clay %

Site 215  Site 216

Soil Depth

Site 215  Site 216
Updating ES concepts
ES State Maps
Benefits of DSM-ES integration

- Simultaneous digital mapping of soil and ES may improve both products
- Improved spatial resolution
- Ability to scale nested information
- Produce ES maps independent of SSURGO/TEUI
- Better quantify/test ES concepts (minimize bias)
Thank You!
Hand digitizing ecological states

Example from rangeland in southeastern Arizona
~15,000 acres

SSURGO

Ecological State Map

Data courtesy of Eldon Ayers
DSM to map ES

• If ESD is available/acceptable
  – Identify soil, landscape, climate criteria
  – Produce raster maps of relevant properties
  – Apply key of ES to raster maps

• No ESD available
  – Predict soil, landscape, climate variables
  – Connect field observations of vegetation communities with covariates
  – Organize/classify landscape units
Data delivery

• Multi-tier structure
• 3 types of users
  – Basic
    • (Landowners/land managers)
  – Intermediate
    • (Interpreter, agency field staff)
  – Technical
    • (Developer, researchers)
Summary

• Predicting detailed ecological units is very similar to DSM (MacMillan et al. 2007)

• Using DSM approaches can help
  – reduce bias
  – standardize methodologies for developing nested ecological mapping units.
Depth to paralithic in southern Indiana

SSURGO Rep. Value

<table>
<thead>
<tr>
<th>Slope Position</th>
<th>Measured vs SSURGO_RV</th>
<th>Measured vs DSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toeslope</td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Summit-Shoulder</td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Backslope</td>
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<td>a</td>
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