Spatial Disaggregation
Techniques for Visualizing and Evaluating Map Unit Composition

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Agenda

• What is Spatial Disaggregation?
• Premise and Purpose
• Case Studies
  – Berkeley County, WV (Proof of Concept)
  – Denali National Park and Preserve, AK
• Conclusions
Spatial Disaggregation

• The process of separating an entity into component parts based on implicit spatial relationships or patterns
Premise

- Soil map units can be disaggregated into individual components based on soil-landscape relationships documented in existing soil surveys
  - Soil-landscape models are commonly embedded in soil map unit descriptions in soil survey reports or stored as a series of values within the aggregate database
  - These values can be extracted and used to develop quantitative representations of soil-landscape models
  - The resulting models can be extrapolated (e.g., mapped) using any number of ancillary data layers and GIS and/or remote sensing methods
Purpose

• To model distribution of individual components within a map unit in order to:
  – Visualize and evaluate soil-landscape relationships documented in our aggregate data
  – Enable more precise estimation of component or map unit properties
  – Assist with correlation across multiple survey areas within an MLRA
  – Provide support component-level interpretations (e.g., ecological site maps)
Berkeley County, WV

Soil Survey of Berkeley County, West Virginia
Soil Map Units

• BpE – Blackthorn-Pecktonville very gravelly loams, 15-45 % slopes, extremely stony
  – (50% Blackthorn, 40% Pecktonville, 10% dissimilar inclusions)

• BpF – Blackthorn-Pecktonville very gravelly loams, 35-45 % slopes, extremely stony
  – (60% Blackthorn, 30% Pecktonville, 10% dissimilar inclusions)
Simple Landscape Model

• Blackthorn soils are primarily found in concave landscape positions
• Pecktonville soils are primarily found in convex landscape positions
• **Blue (100)** – converging flow areas:
  Blackthorn soils
• **Orange (500)** – diverging flow areas:
  Pecktonville soils
• **Transparent (300)** – linear flow areas:
  Unknown soils

<table>
<thead>
<tr>
<th></th>
<th>Converging (Blackthorn)</th>
<th>Diverging (Pecktonville)</th>
<th>Linear (Other)</th>
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</thead>
<tbody>
<tr>
<td><strong>BpE</strong></td>
<td>2150 ha (36%)</td>
<td>3060 ha (51%)</td>
<td>770 ha (13%)</td>
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<tr>
<td><strong>BpF</strong></td>
<td>625 ha (42%)</td>
<td>820 ha (55%)</td>
<td>45 ha (3%)</td>
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</tbody>
</table>
Denali National Park, AK

Soil Survey of Denali National Park Area, Alaska
Map Unit Selection Criteria

- Have well-documented soil-landscape relationships;
- Have appropriate geospatial data layers available; and
- Have soil-landscape relationships that can be adequately characterized by available geospatial data.
Selected Soil Map Units

- 7MS1D – Alpine Dark Sedimentary Mountains
- 7MSHD – Alpine Dark Sedimentary Mountains, High Elevation
- 7V1 – Alpine Lower Mountain Slopes and Fans with Discontinuous Permafrost
- 7V11 – Alpine Fans
Soil Landscape Model Development

- Identified NASIS data elements that might contain useful information about the soil forming environment
  - Slope gradient, Elevation, Aspect, Mean Annual Precipitation, Potential Vegetation, Geomorphic Description (Feature Type and Feature Name), Hillslope Profile, Slope Shape Across, Slope Shape Up/Down, Parent Material Group
  - Recorded values for selected data elements by map unit and component (major and minor)
Soil Landscape Model Development

• Reviewed NASIS data and looked for unique values that could be used to model individual components in a map unit
  – For instance, if a map unit consists of two components and the first is found predominantly on north-facing slopes and the second on south-facing slopes, aspect can be used to predict the distribution of these soils within the map unit

• Selected (or created) GIS data layers to represent key landscape characteristics
Soil Landscape Model Development

• Developed quantitative rules for each map unit and implemented them in a GIS
  – 7MS1D: Alpine-scrub dark gravelly colluvial slopes = < 3700 ft elevation and linear
    planfrom curvature OR linear profile curvature

• Reviewed maps, and edited rules based on comments from the MO 17 Senior Regional
  Soil Scientist
Key GIS Data Layers

- 60 m DEM
- Slope Gradient
- Slope Aspect
- Planform/Profile Curvature
- Fuzzy Backslope
- Wetness Index
Key GIS Data Layers

- Landsat Scene, 15 class landcover map
Soil Components

- Subalpine-scrub-meadow mosaic dark gravelly swales
- Alpine-dwarf scrub dark gravelly colluvial slopes
- Alpine-riparian scrub gravelly flood plains
- Alpine-scrub gravelly colluvial slopes
- Alpine-scrub gravelly terraces
- Alpine-scrub-meadow mosaic gravelly swales
- Alpine-scrub-sedge gravelly till slopes
- Alpine-scrub-sedge loamy terraces
- Alpine-sedge-dwarf scrub gravelly swales
- Subalpine-scrub-meadow mosaic dark gravelly swales
- Nonvegetated alluvium
- Interior-nonvegetated rock outcrop
### 7MSHD – Alpine Dark Sedimentary Mountains, High Elevation

<table>
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<th>Component</th>
<th>% Composition NASIS</th>
<th>% Composition Component Map</th>
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</thead>
<tbody>
<tr>
<td>Interior-nonvegetated rock outcrop, ice, talus, and/or drift</td>
<td>25 – 60</td>
<td>16</td>
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<tr>
<td>Alpine-dwarf scrub dark gravelly colluvial slopes</td>
<td>15 – 40</td>
<td>30</td>
</tr>
<tr>
<td>Alpine-dwarf scrub dark gravelly colluvial slopes - moist</td>
<td>15 – 30</td>
<td>29</td>
</tr>
<tr>
<td>(minor) Alpine-scrub-meadow mosaic gravelly swales</td>
<td>5 – 15</td>
<td>21</td>
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<tr>
<td>(minor) Alpine-sedge-dwarf scrub gravelly swales, frozen</td>
<td>0 – 5</td>
<td>4</td>
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<tr>
<td>Other</td>
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<td>0</td>
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# 7V11 – Alpine Fans

<table>
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<tr>
<th>Component</th>
<th>% Composition NASIS</th>
<th>% Composition Component Map</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpine-riparian scrub gravelly flood plains</td>
<td>20 – 55</td>
<td>48</td>
</tr>
<tr>
<td>Alpine-scrub gravelly terraces</td>
<td>15 – 40</td>
<td>29</td>
</tr>
<tr>
<td>Nonvegetated alluvium, riverwash</td>
<td>10 – 40</td>
<td>14</td>
</tr>
<tr>
<td>(minor) Alpine-riparian scrub gravelly flood plains, moderately wet</td>
<td>10 – 35</td>
<td>Not Modeled</td>
</tr>
<tr>
<td>(minor) Alpine-riparian scrub loamy flood plains</td>
<td>5 – 15</td>
<td>Not Modeled</td>
</tr>
<tr>
<td>(minor) Alpine-dwarf scrub gravelly fan terraces</td>
<td>5 – 15</td>
<td>Not Modeled</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>
Ecological Sites

- Alluvium, Nonvegetated
- Gravelly and Sandy Terraces, High Elevation
- Gravelly Flood Plains, Cool
- Gravelly Frozen Slopes
- Gravelly Frozen Slopes, Cold
- Gravelly Mountains, High Elevation
- Gravelly Mountains, Moist
- Gravelly Slopes
- Rock and Ice, Nonvegetated
- Swales
- Swales, High Elevation
Parent Material

- gravelly colluvium and/or silty eolian deposits over gravelly colluvium derived from shale
- mossy organic material and/or woody organic material over silty eolian deposits over gravelly colluvium
- organic material over loamy alluvium over sandy and gravelly alluvium and/or loamy alluvium
- rockfall deposits and/or scree and/or talus
- sandy and gravelly alluvium and/or sandy and silty alluvium
- sandy and silty alluvium and/or sandy and gravelly alluvium
- sandy and silty alluvium over sandy and gravelly alluvium
- silty eolian deposits over gravelly colluvium derived from shale
- silty eolian deposits over sandy and gravelly alluvium
- woody organic material and/or grassy organic material over silty eolian deposits over gravelly till
Issues with Landscape Model Development from NASIS Data

• NASIS data for a particular component may not be fully populated
• Quality of NASIS data may be unknown, or errors may exist in the NASIS database
• Slope, aspect, elevation, and other values may be populated for an entire map unit rather than individual components
• The scales at which slope shape and other morphometric properties are estimated and populated are unknown, and can be variable
Conclusions

• Development of soil component maps from SSURGO and NASIS data allows one to
  – visualize the distribution of soil components on the landscape and within a map unit
  – visualize component-level properties
  – see a spatial representation of soil-landscape information stored in the NASIS aggregate data
Conclusions

• Ability to develop reasonable soil-landscape models from NASIS aggregate data depends on the completeness and accuracy of data in the database

• Expert knowledge is required to resolve errors or conflicts
Acknowledgements

- Mark Clark, Senior Regional Soil Scientist, MO-17
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Questions?