United States Department of Agriculture
Natural Resources Conservation Service

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*

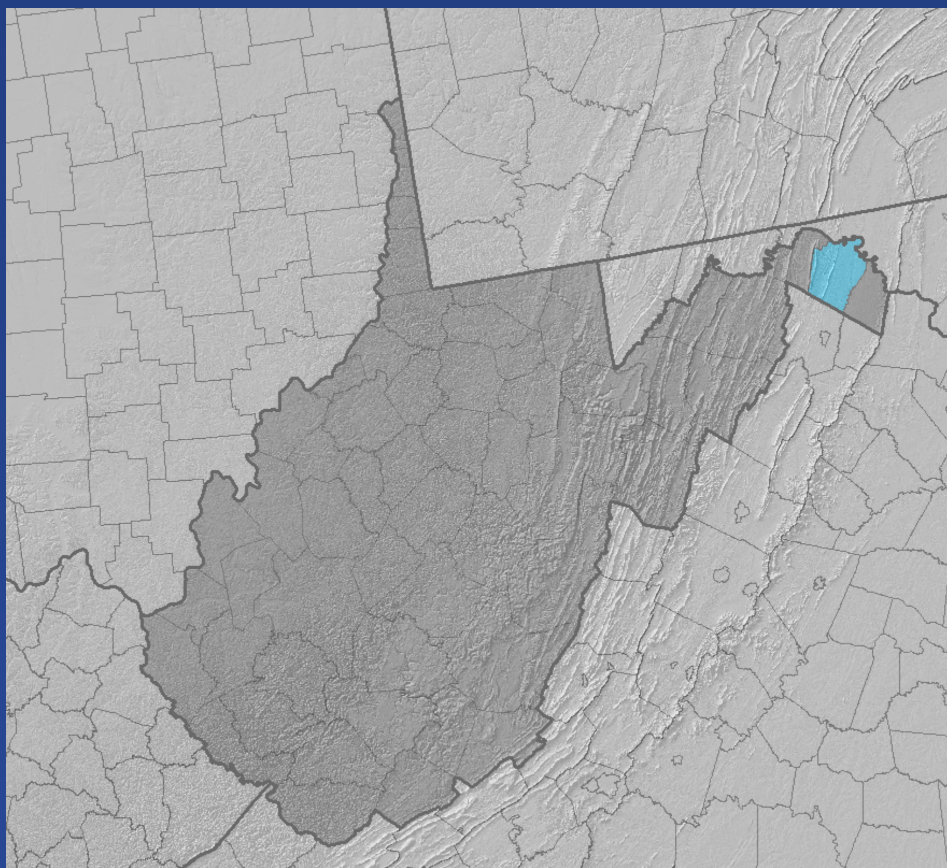
Premise

- 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



USDA United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with West Virginia Agricultural and Forestry Experiment Station

Soil Survey of Berkeley County, West Virginia

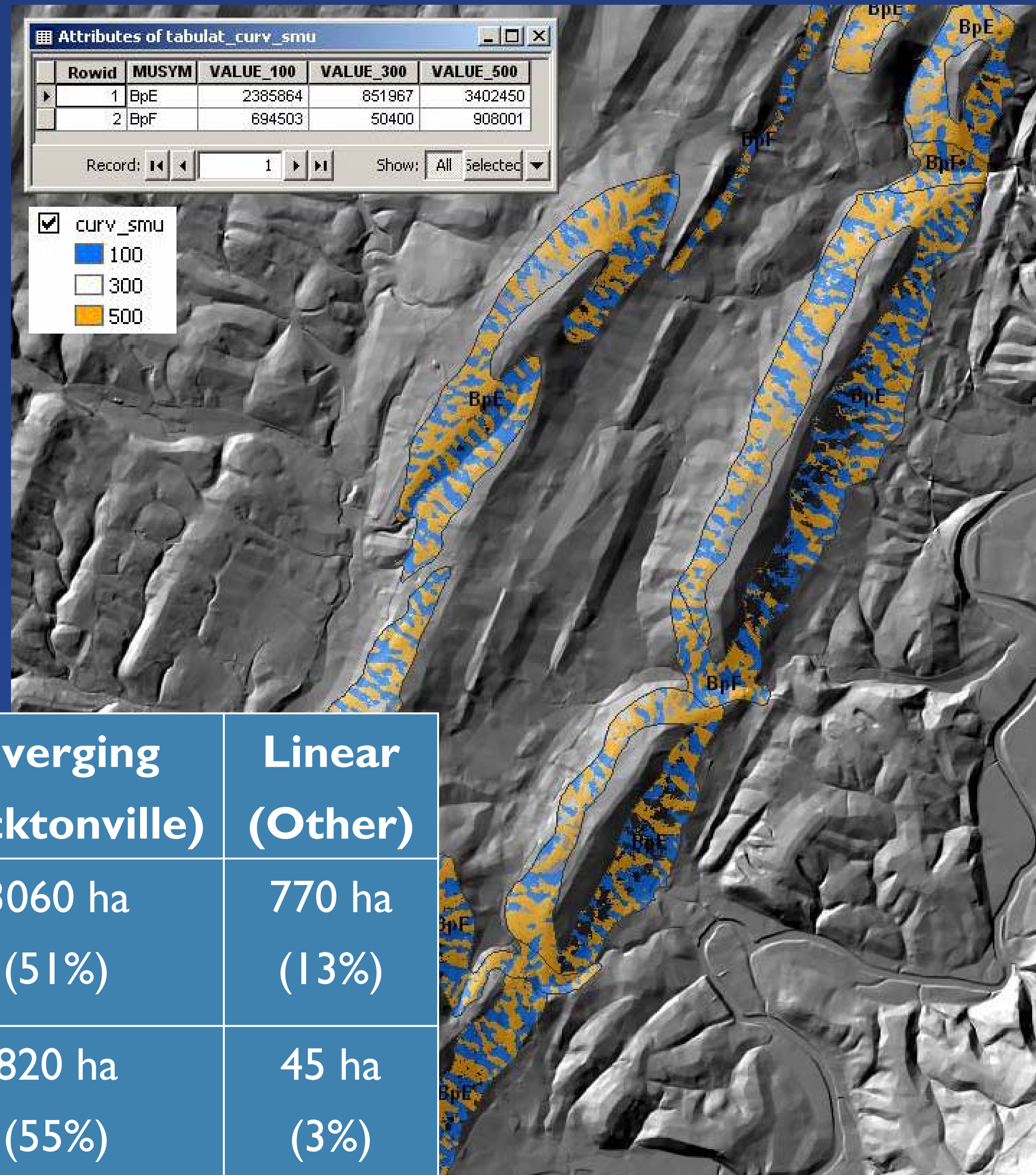
Soil Map Units

- 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

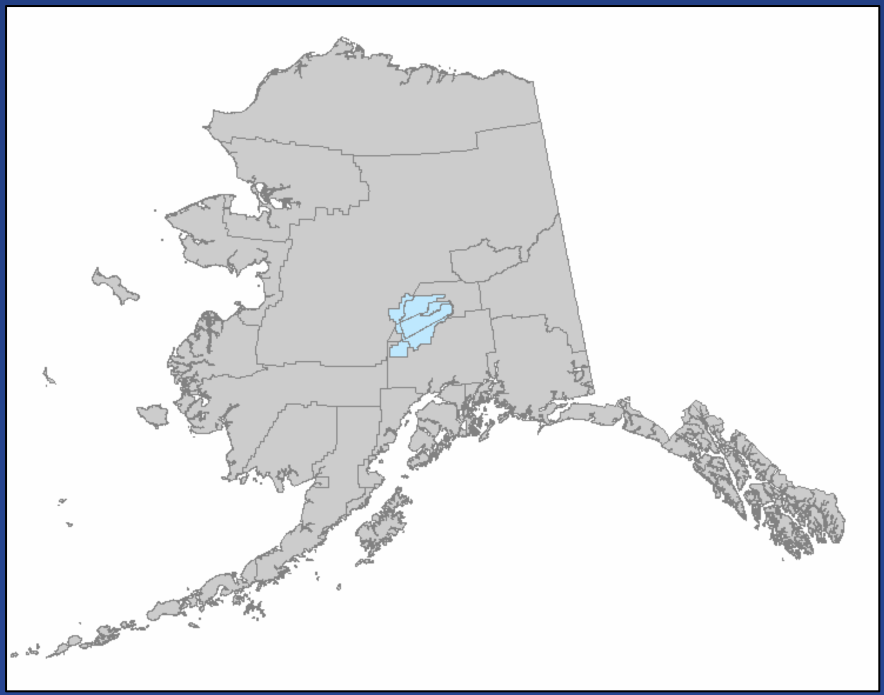
- Blackthorn soils are primarily found in concave landscape positions
- Pecktonville soils are primarily found in convex landscape positions

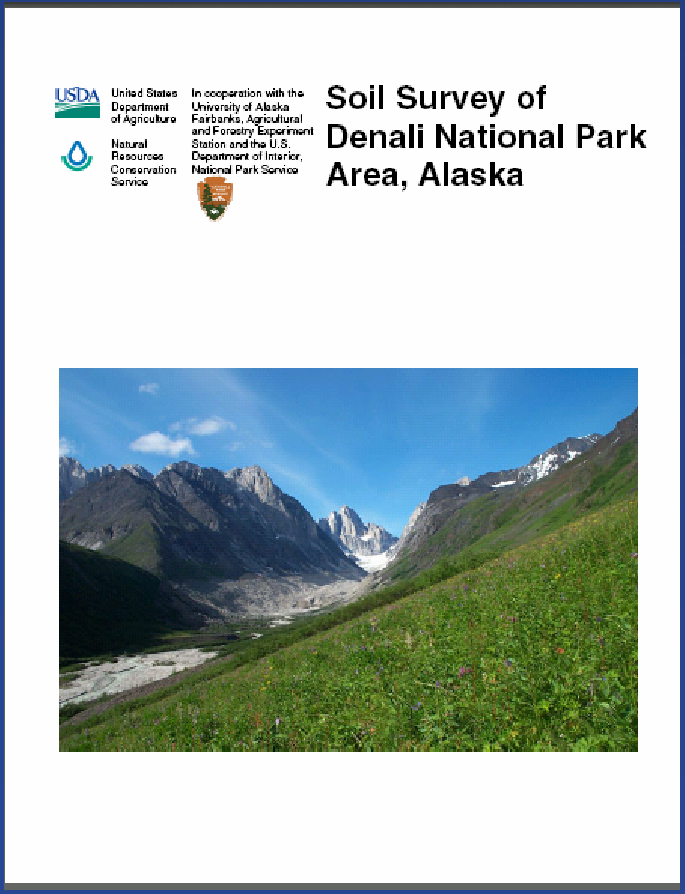
- **Blue (100) –** converging flow areas: Blackthorn soils
- **Orange (500) –** diverging flow areas: Pecktonville soils
- **Transparent (300) –** linear flow areas: Unknown soils



	Converging (Blackthorn)	Diverging (Pecktonville)	Linear (Other)
BpE	2150 ha (36%)	3060 ha (51%)	770 ha (13%)
BpF	625 ha (42%)	820 ha (55%)	45 ha (3%)

Denali National Park, AK





United States Department of Agriculture

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In cooperation with the University of Alaska Fairbanks, Agricultural and Forestry Experiment Station and the U.S. Department of Interior, National Park Service

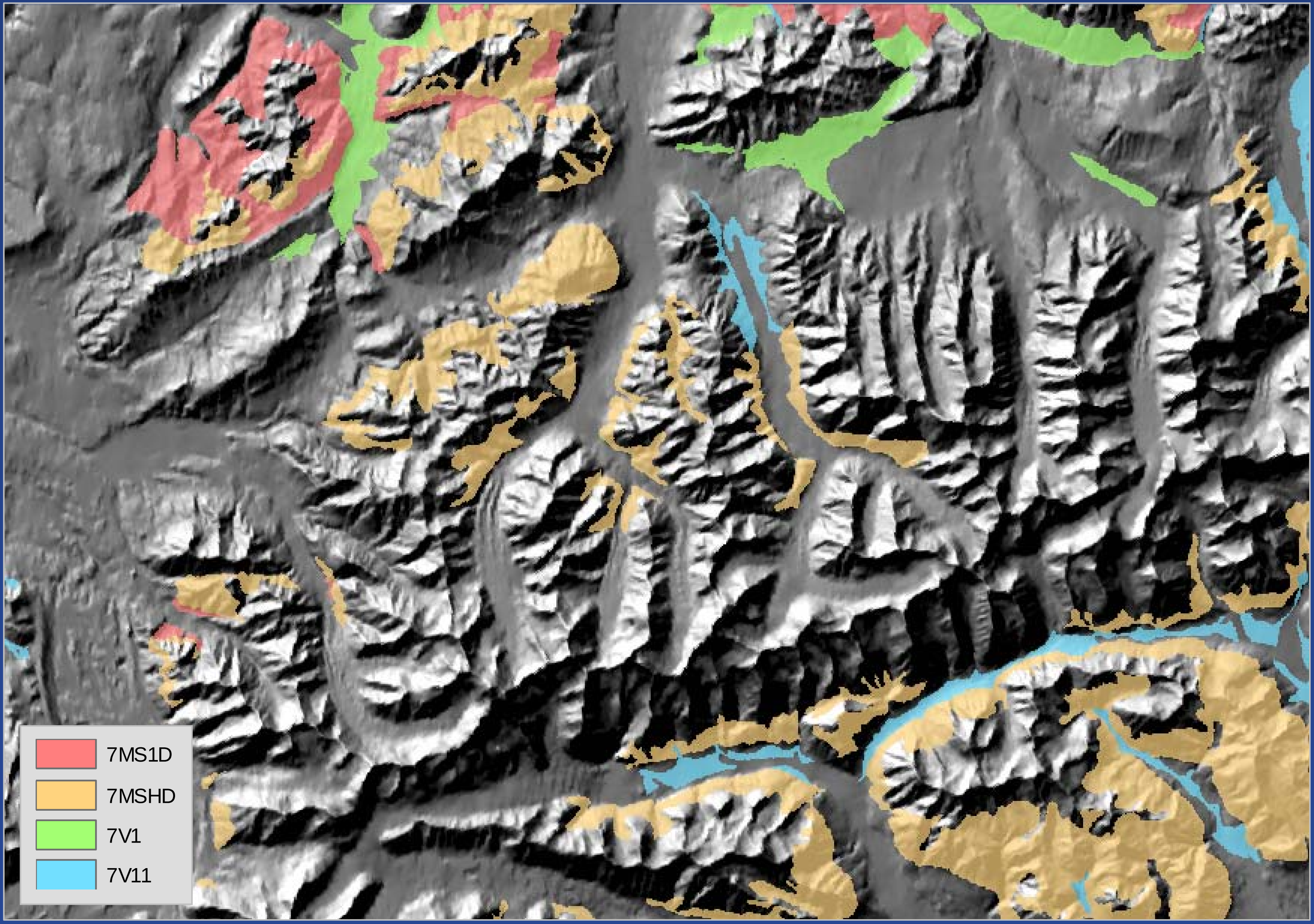
Soil Survey of Denali National Park Area, Alaska

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


7MS1D
7MSHD
7V1
7V11

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)

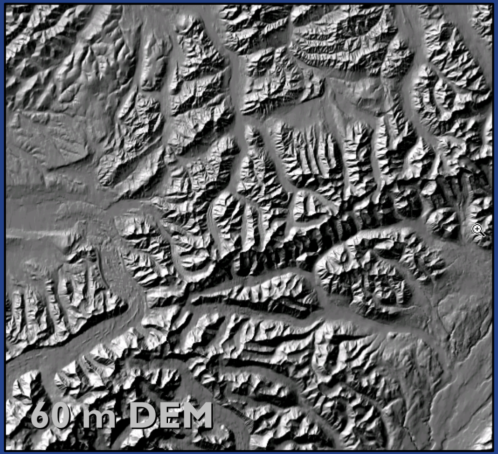
Soil Landscape Model Development

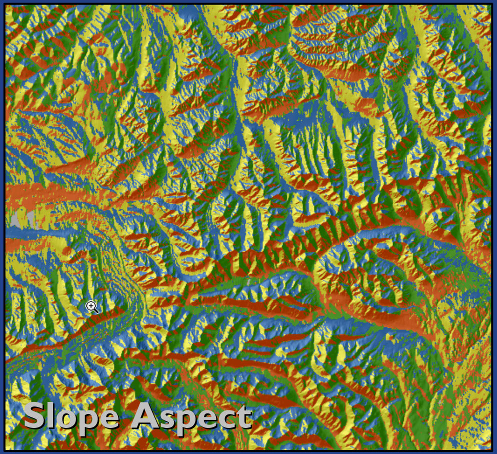
- Reviewed NASIS data and looked for unique values that could be used to model individual components in a map unit
  - For instance, if a map unit consists of two components and the first is found predominantly on north-facing slopes and the second on south-facing slopes, aspect can be used to predict the distribution of these soils within the map unit
- Selected (or created) GIS data layers to represent key landscape characteristics

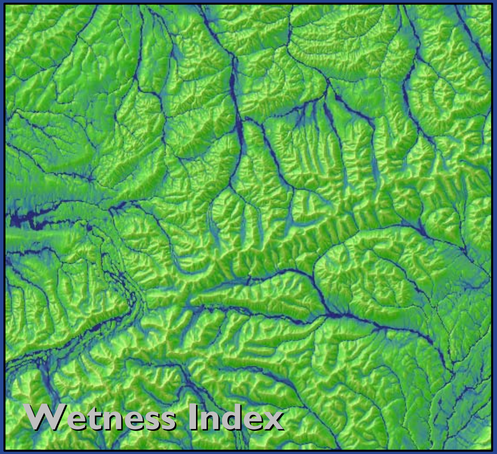
Soil Landscape Model Development

- 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

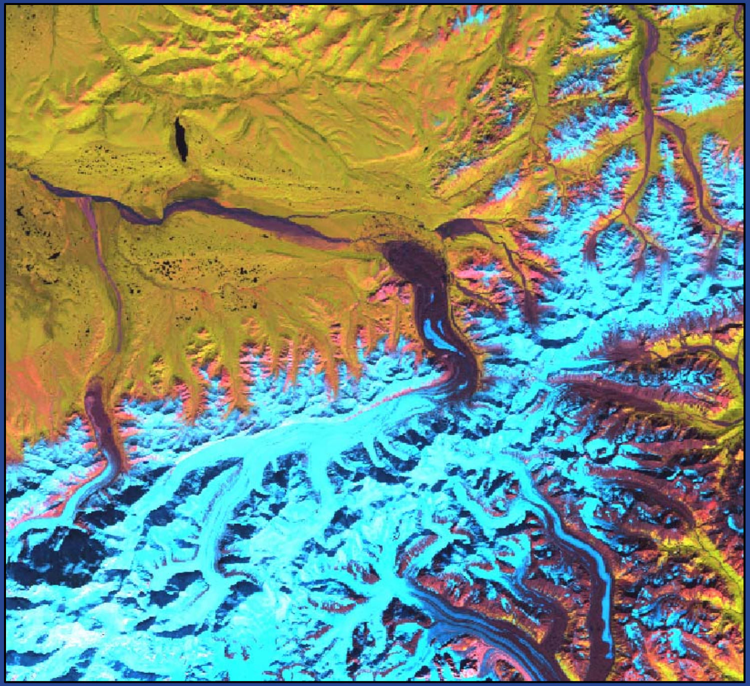


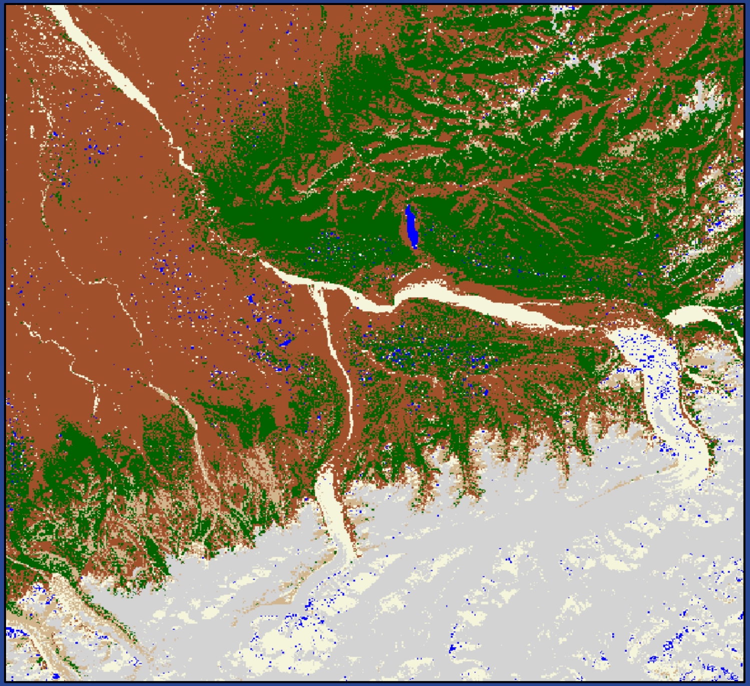




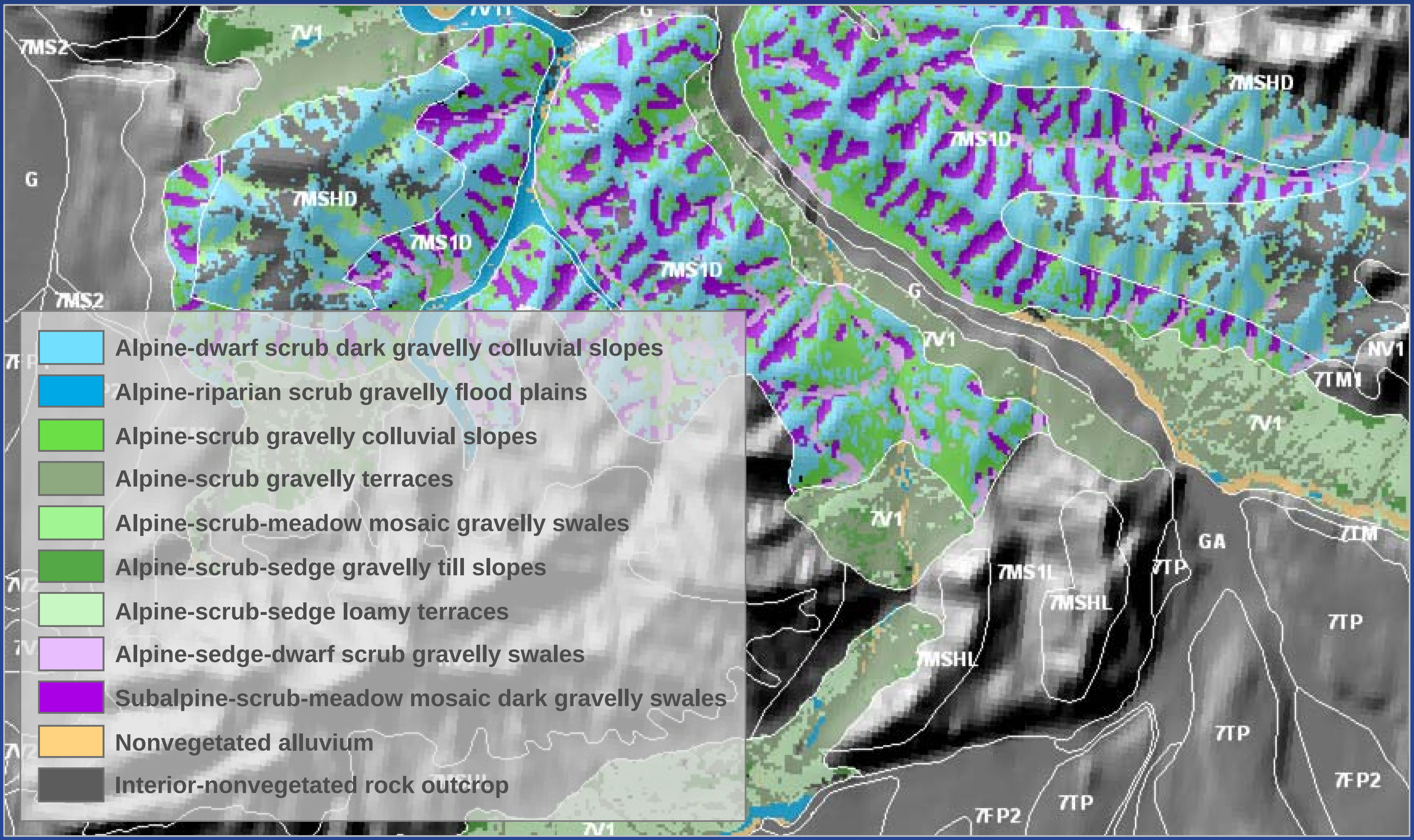
Key GIS Data Layers

- Landsat Scene, 15 class landcover map





Soil Components



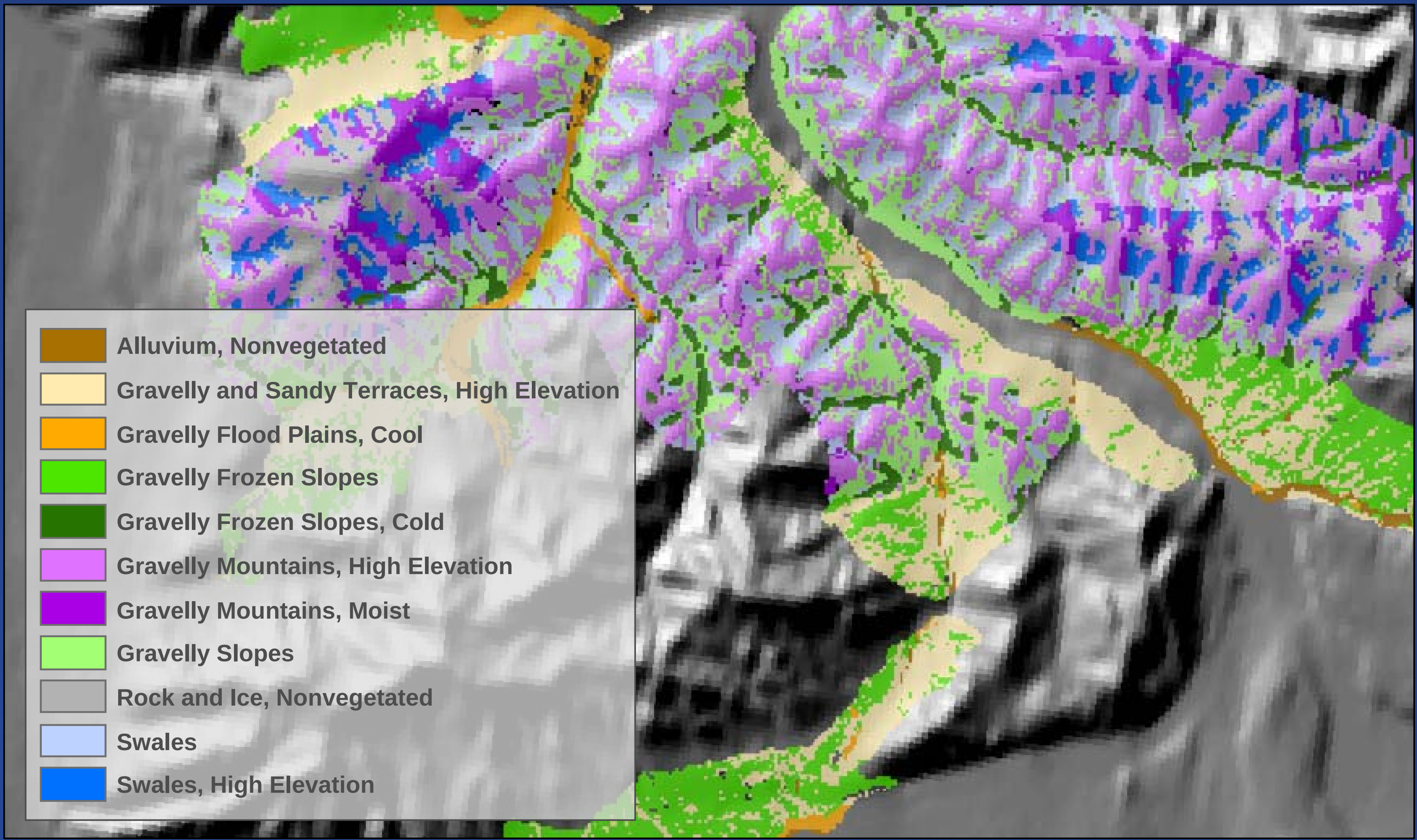
7MSHD – Alpine Dark Sedimentary Mountains, High Elevation

Component	% Composistion NASIS	% Composition Component Map
Interior-nonvegetated rock outcrop, ice, talus, and/or drift	25 – 60	16
Alpine-dwarf scrub dark gravelly colluvial slopes	15 – 40	30
Alpine-dwarf scrub dark gravelly colluvial slopes - moist	15 – 30	29
(minor) Alpine-scrub-meadow mosaic gravelly swales	5 – 15	21
(minor) Alpine-sedge-dwarf scrub gravelly swales, frozen	0 – 5	4
Other	0	0

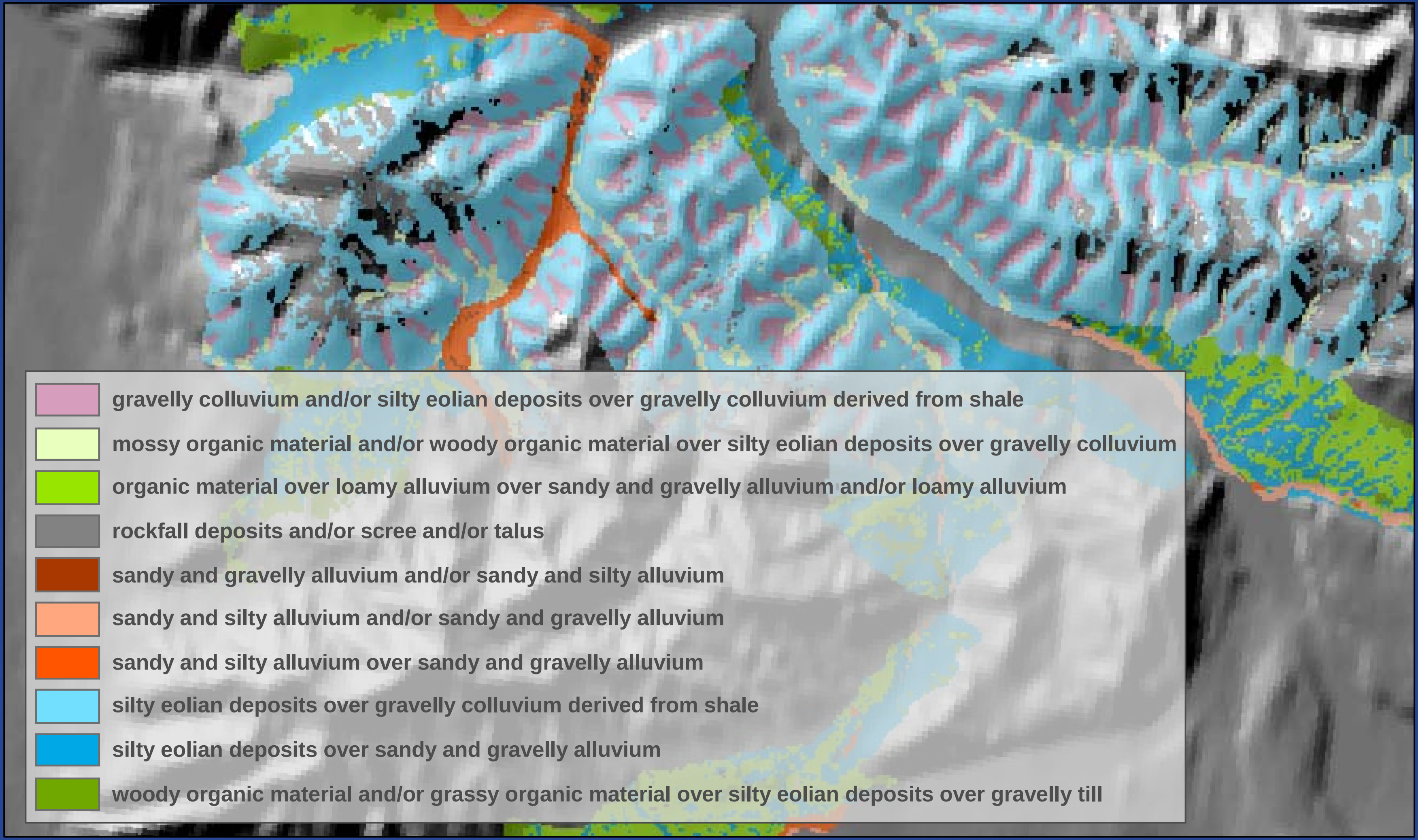
7V11 – Alpine Fans

Component	% Composistion NASIS	% Composition Component Map
Alpine-riparian scrub gravelly flood plains	20 – 55	48
Alpine-scrub gravelly terraces	15 – 40	29
Nonvegetated alluvium, riverwash	10 – 40	14
(minor) Alpine-riparian scrub gravelly flood plains, moderately wet	10 – 35	Not Modeled
(minor) Alpine-riparian scrub loamy flood plains	5 – 15	Not Modeled
(minor) Alpine-dwarf scrub gravelly fan terraces	5 – 15	Not Modeled
Other	0	9

Ecological Sites



Parent Material



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
- Darrell Kautz, Business Analyst, NGDC

Questions?