SOLIM Project in Dane County

Solim-(Soil-Land Inference Model)

October 2002

Soil Factor Equation and Soil Landscape Model

- **If one knows the relationship with soil and the environment**
  - **one can assess environmental conditions to infer what soil is present**
    - **soil landscape is considered a continuum**
  - **knowledge of the relationship between the soils and the environment can be developed**
- **knowledge is documented**
- **knowledge acquisition process**
  - **Soils and GIS staff**

Soil Factor Equation and Soil Landscape Model

- Soil environmental conditions are characterized
  - GIS techniques, remote sensing
- Combine environmental conditions with relationships to produce soils map
  - tacit points
  - inference technique
- Validation of maps
- Quality check
  - field trip with Soils and GIS staff

Project Sideboards

- Fieldwork by Soil Scientists Chanc Vogel and Duane Simonson
- GIS work by Professor Axing Zhu and the Solim Group
  - Trevor Quinn
  - Feng Qi
- DEM based on 10-meter resolution TIN from UW Land Information and Computer Graphics Facility

Major Steps to Produce a Map

- **Delineate major breaks**
  - **landscapes, parent materials**
  - **consistent between soil scientists**
- **Develop a unique set of rules**
  - **relationship soil and environment**
  - **each position identified**
  - **gradient and curvature**
- **Knowledge acquisition-inference-map**

GIS Procedures

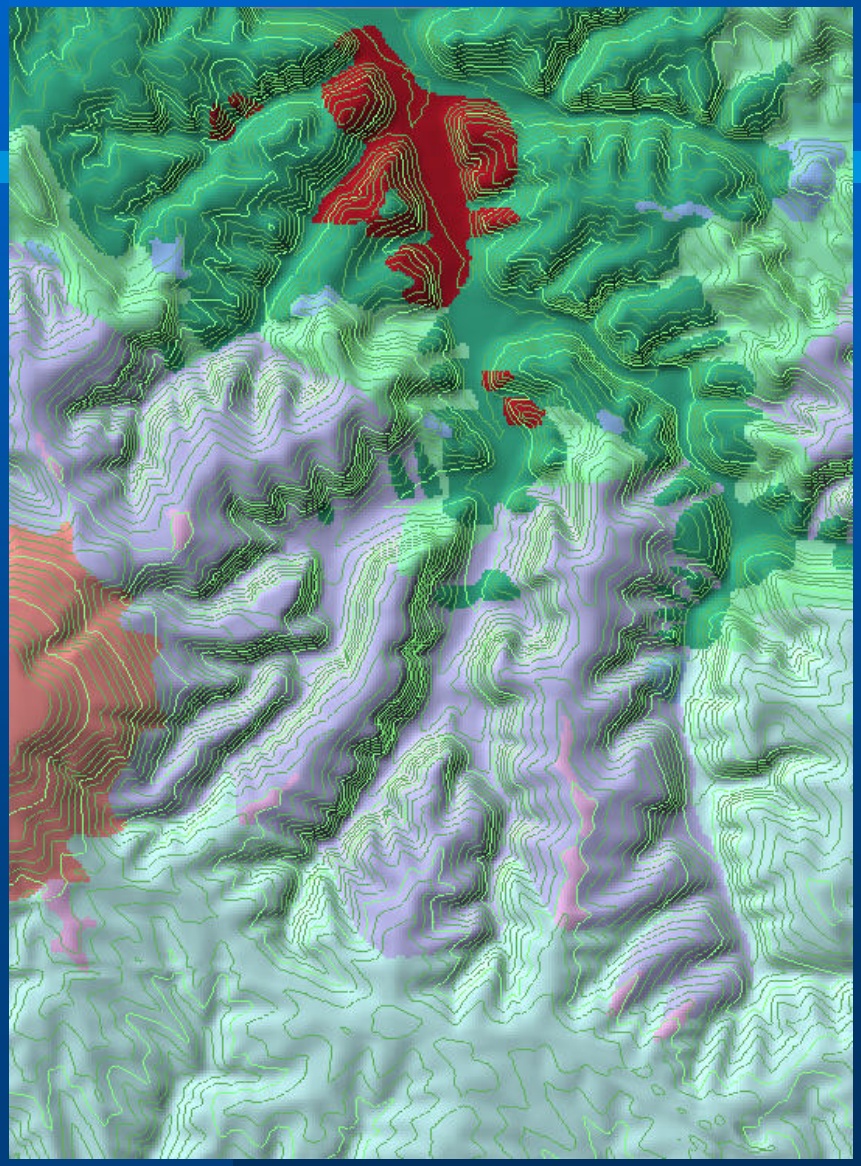
1. Establish directory structure
2. Create header files
3. Compile basic GIS database
4. Create geology layers
5. Create supplemental data layers
6. Create tacit point files
7. Create and adjust width files
8. Run the inference engine
9. Examine inference results
10. Repeat width file adjustment and inference engine operation until output matches the inference rules

Generating GIS Data Layers

The following GIS data layers can be created and used to apply the inference rules:

- Elevation
- Gradient
- Profile Curvature
- Planform Curvature
- Aspect
- Parent material (provided by soil scientist)
- Physical wetness (derived from satellite imagery)
- Topographic wetness (based on upslope drainage area)
- Ridge shapes (created using digital terrain analysis techniques and used to define gentle drumlin areas or width of summits)
- Vegetation (derived from satellite imagery)
- Existing soil survey data (cultural features)

Default breaks- BluemoundsSE, Dane



Legend

- Maquoketa
- Galena (rolling summits)
- Galena (mollisol)
- Galena (non-mollisol)
- Galena (sandy backslope)
- Oneota
- St. Peter
- Jordan

Catena sequences for BluemoundsNE (continued)

Oneota:

7Newglarus:
Bedrock: Oneota
Gradient: 0-6%
Slope position: broad, flat ridges

8Dunbarton (deep):
Bedrock: Oneota
Gradient: 0-20%
Profile: not concave
Planform: not concave
Slope position: narrow ridges and small bumps, non-concave shoulders.

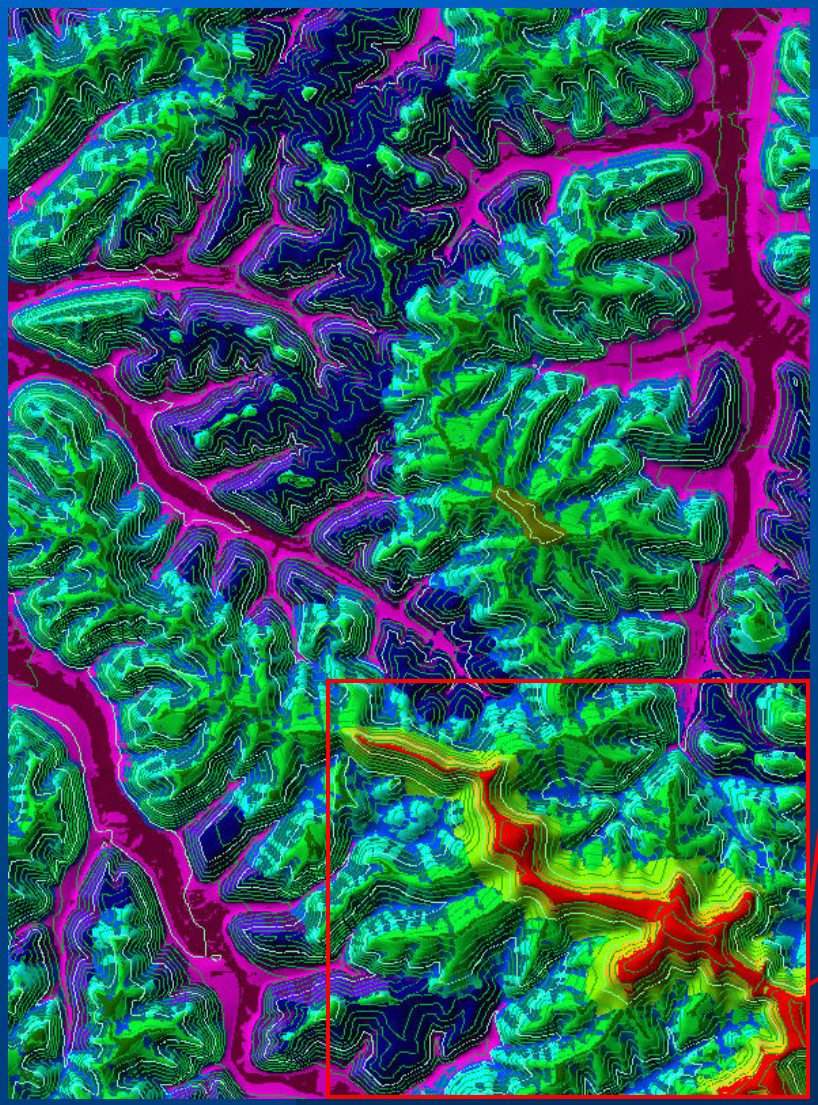
11Dorerton:
Bedrock: Oneota
Gradient: >20%
Profile: linear to convex
Planform: convex
Slope position: nose

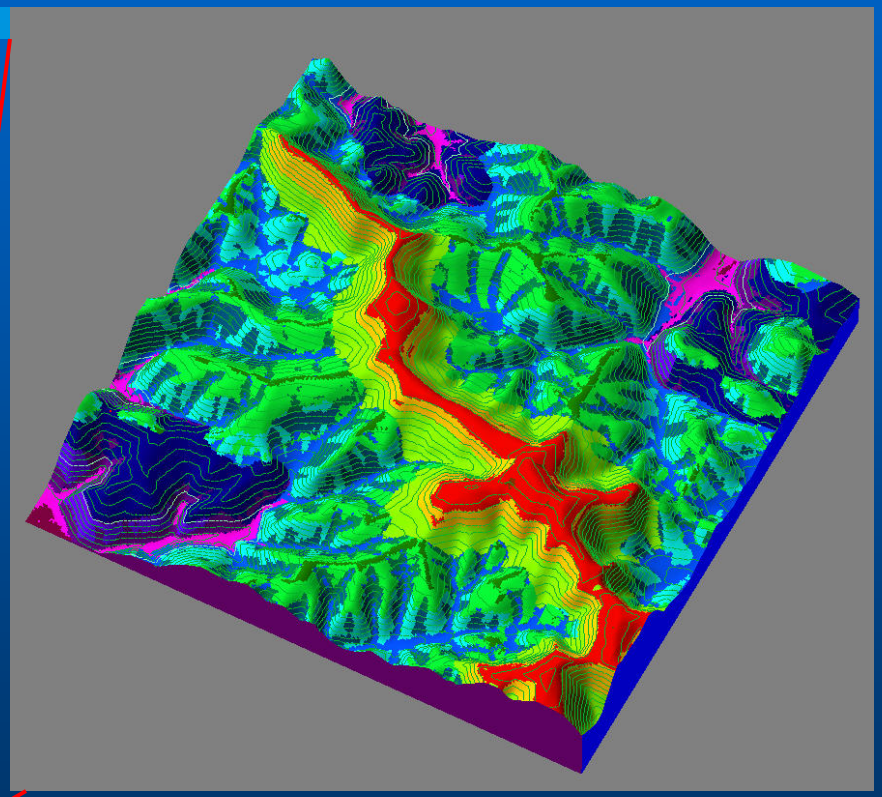
9Allamakee:
Bedrock: Oneota
Gradient: 6-20%
Profile: concave
Planform: concave
Slope position: headwater

15Churchtown:
Bedrock: Colluvium
Gradient: 6-35%
Planform: slightly convex to concave
Profile: very slightly convex to concave
Slope position: footslope

13Elbaville:
Bedrock: Oneota
Gradient: >20%
Profile: linear to slightly convex
Planform: linear to concave
Slope position: backslope

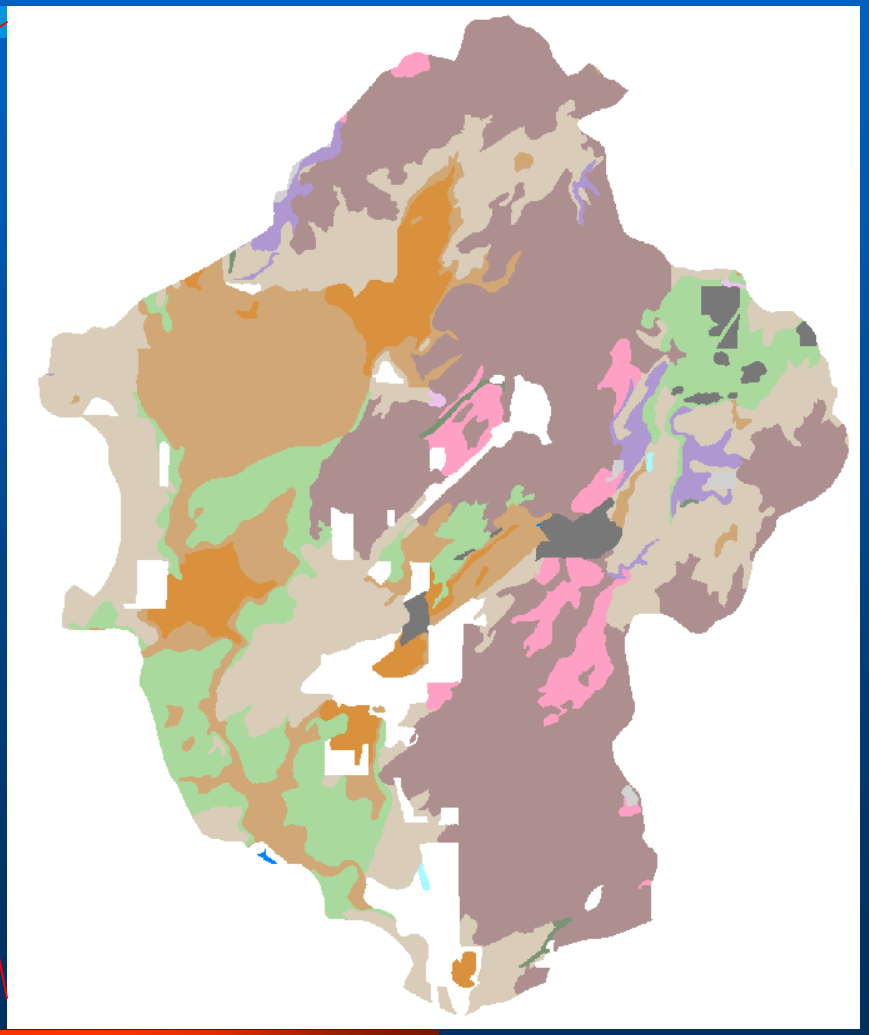
Soil inference result: BluemoundsNE, Dane





Default breaks

—Example 2: watershed34

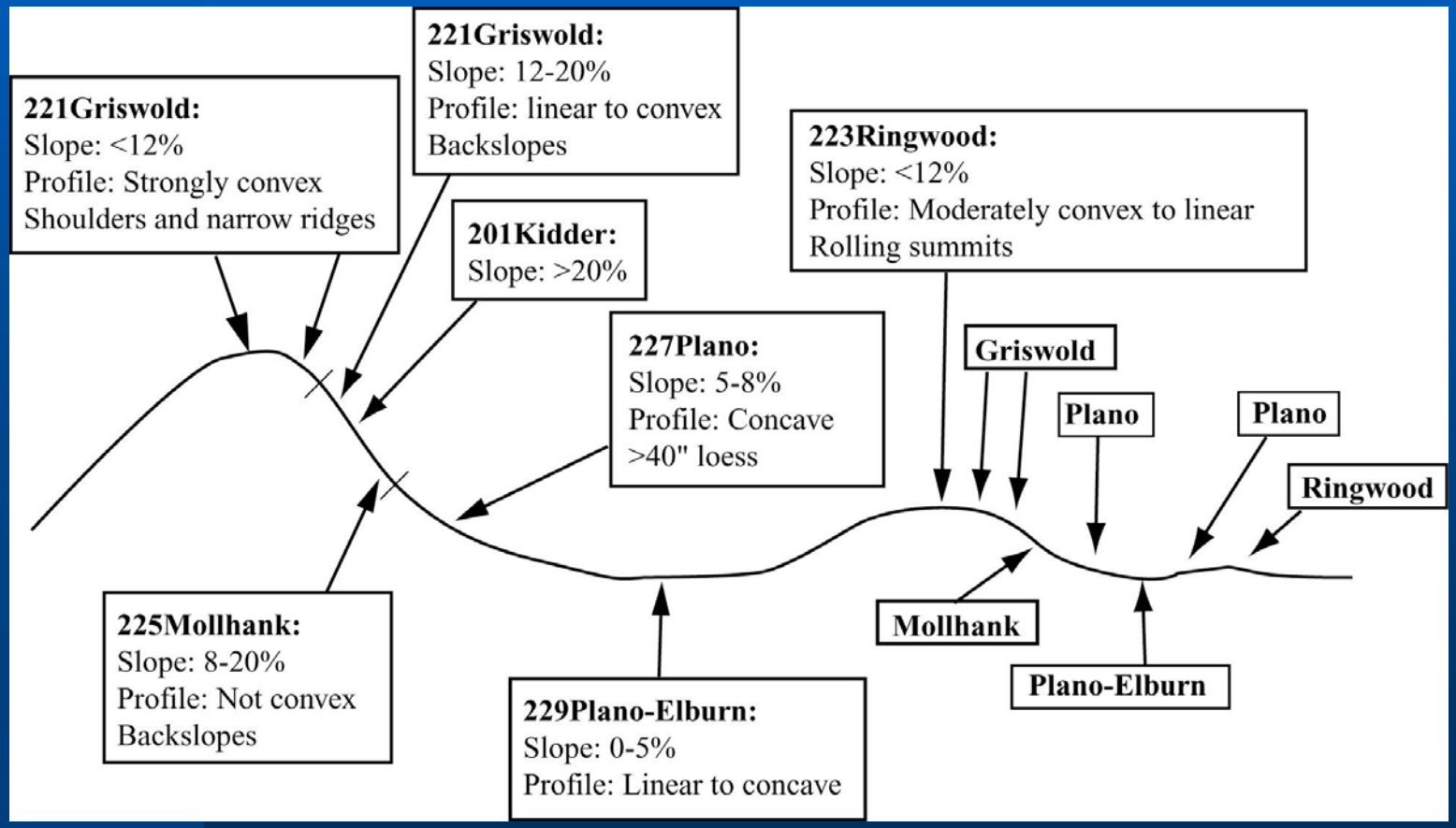


- Drumlin and Till (typic)
- Drumlin and Till (mollisol)
- Outwash (typic)
- Till over sandstone bedrock
- Till over dolostone (typic)
- Till over dolostone (mollisol)
- Lacustrine soil
- Poorly drained mineral soils
- Very poorly drained organic soils
- Floodplain
- Waterbodies
- Gravel Pits
- Quarries
- Disturbed Land

Updating rules

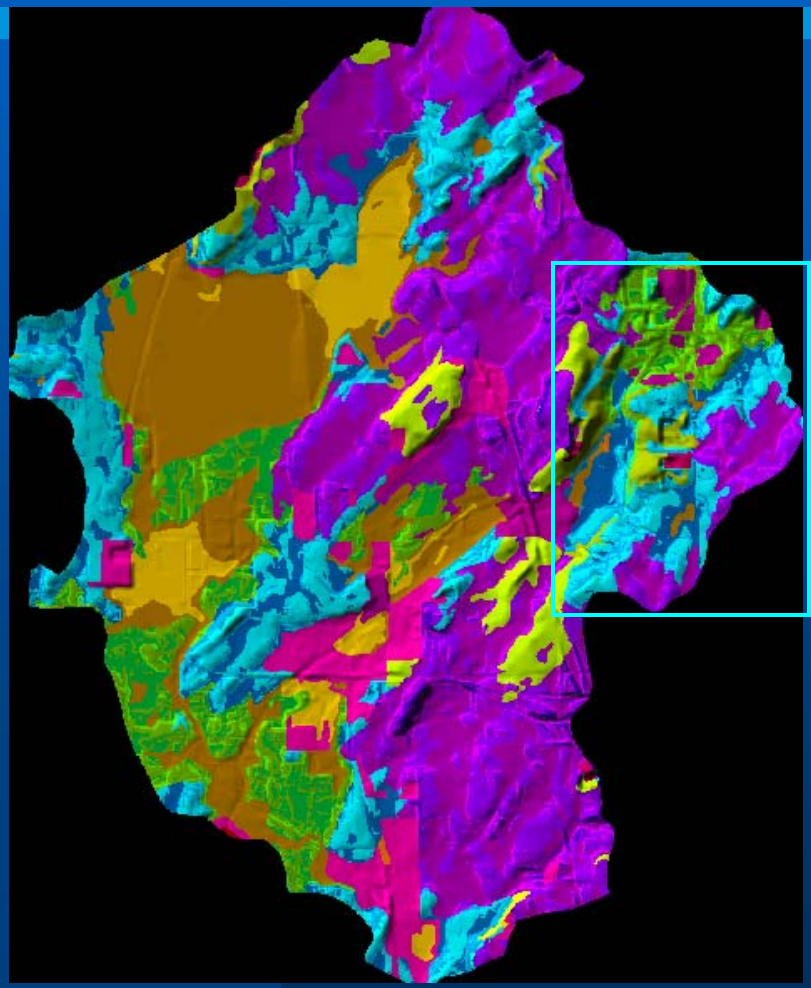
— extra catena sequences for watershede34

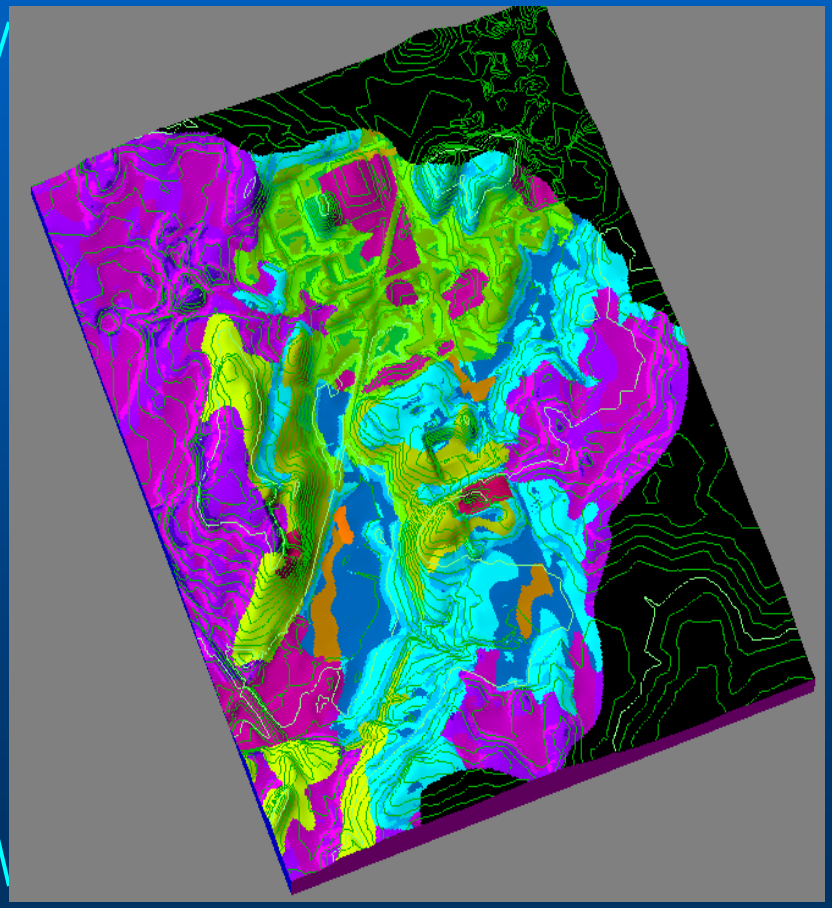
Drumlin and Till (mollisol):



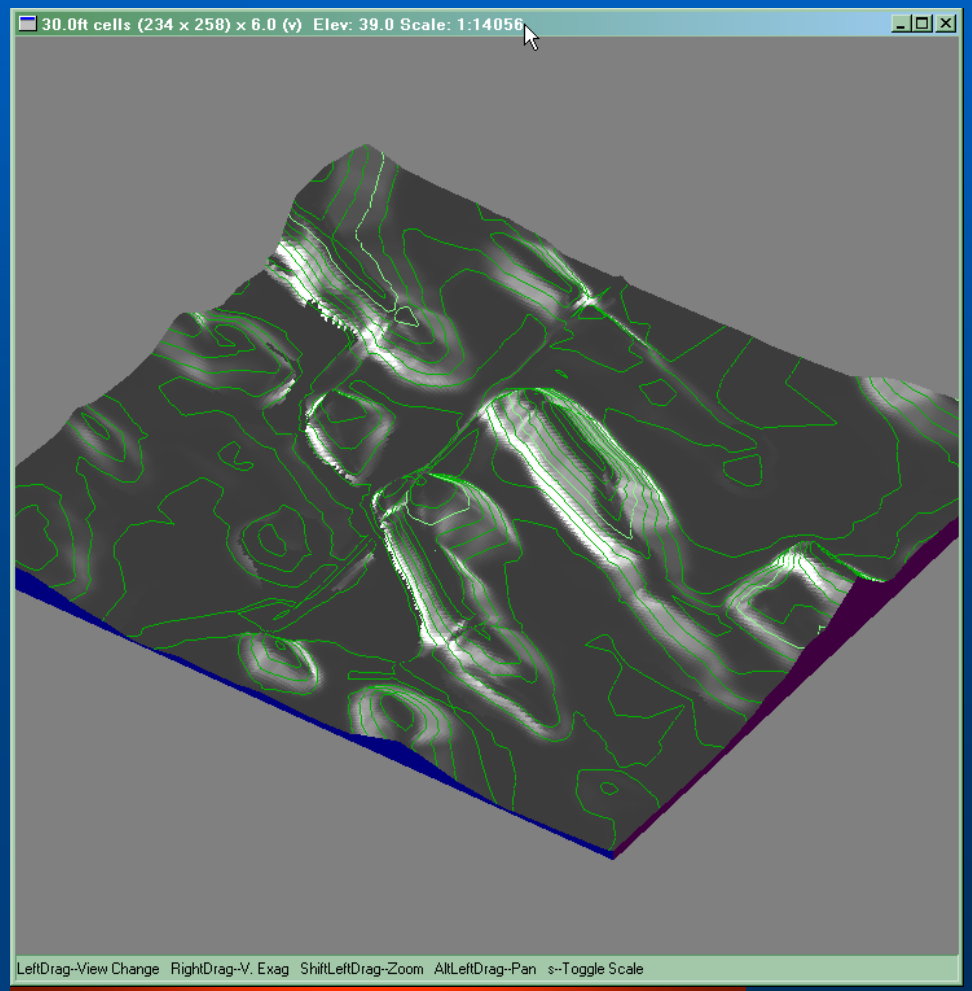
Soil inference result:

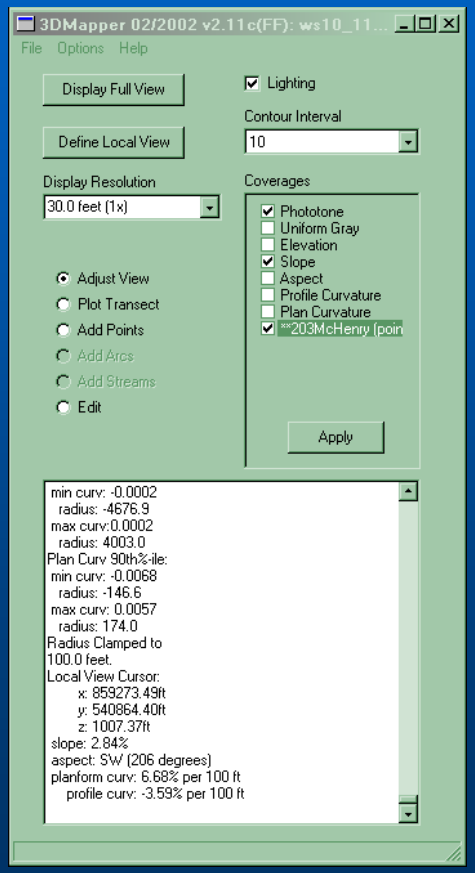
Watershed34





Fuzzy Soil Map





Analysis

- Strengths
  - quality from consistent application of rules (validation results)
    - good set of rules are essential
  - quality with more time for soil issues (database)
    - no slope checks, joins, compilation

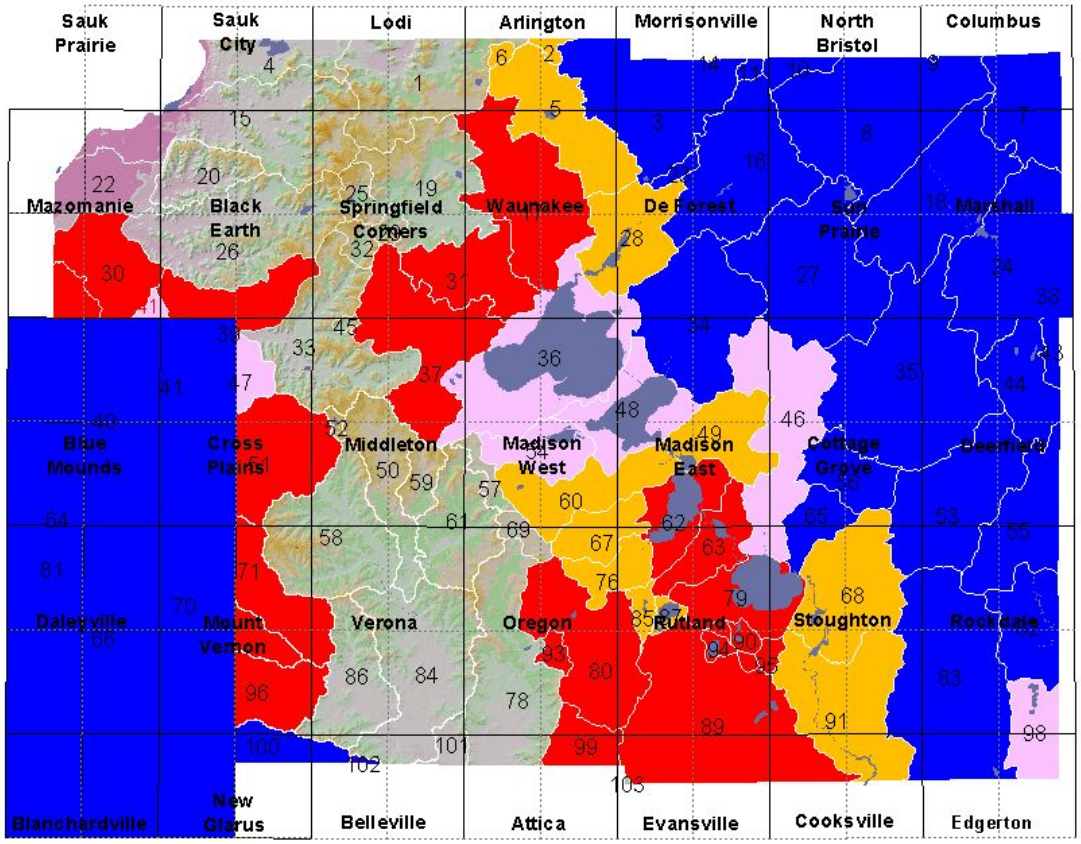
Analysis

- **Strengths**
  - **efficiency in making maps**
    - **same rules can be applied to large landscapes**
    - **future updates when DEMs or rules are improved**

Summary to success

- Good DEMs
- Ability to develop consistent major breaks
- Ability to develop a set of rules for each position within break
- Ability to apply the rules to generate fuzzy soil maps
- Ability for GIS and Soils staff to work together

Current Status Map of Dane County



Legend

- CD Burned
- Verified by soil scientist
- Inference complete
- Inference in progress
- Ready for inference
- Geology done
- Basic GIS data done