Future Soil Survey Data, Users, and Producers
“Thoughts, ideas, & observations from low-relief glacial landscapes”

Mike Konen, PhD, CPSS, CPSC
Northern Illinois University
Department of Geography
mkonen@niu.edu

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Land-use Impacts on Infiltration Rate

<table>
<thead>
<tr>
<th>Land-Use</th>
<th>Infiltration (cm/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never cult</td>
<td>25</td>
</tr>
<tr>
<td>No-till</td>
<td>20</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>15</td>
</tr>
<tr>
<td>Conv-till</td>
<td>10</td>
</tr>
</tbody>
</table>

Average
As in many of the natural sciences, it is difficult to assess the problems without an initial appreciation of the available field evidence. What does one see in nature? What requires explanation? Even with a good grasp of the tools of mathematics, chemistry, physics, and botany, it is not easy to frame fundamental problems in an understandable context unless one begins with a feeling for relations as observed in the natural setting. So we begin here, not with the tools nor even with the processes, but rather with some field observations.

Two profiles separated by 2 meters on landscape – no elevation difference

Western Ohio
Human Impacts

Shoulder

Central Iowa

Footslope

Central Iowa

\( \text{Cs}^{137} \)

1870
Diamicton

Eolian sand filled ice-wedge cast
Wisconsin

Cryoturbation features
Ohio
Ice-Walled Lakes
Northern Illinois
Polygonal Patterned Ground and Beaded Thaw Lake Drainage
Western Ohio

1 mile

Piqua, OH
Data

• Societal relevance
• Useful & meaningful
• Accessible
• Scale limitations
• Human impacts
• Uncertainty
• Variability
• Geovisualization
  • “Benchmark catenas”
  • 3-d & 4-d animation
• Soil-landform
• Soil-hydrologic
• Soil-geologic
• Interactive
"Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected. NOT TRUE – conventional systems typically installed in many of these soils.
• Users see maps and ratings like this and it reduces credibility and the perceived usefulness of soil survey information.

• There are 1000’s of conventional systems functioning properly in and around this map area.

• Class rating needs to mean something.
The rating system has been improved in the past few years but is still lacking.

### Sewage Disposal

Kane County, Illinois

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

<table>
<thead>
<tr>
<th>Map symbol and soil name</th>
<th>Pct. of map unit</th>
<th>Septic tank absorption fields</th>
<th>Sewage lagoons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rate class and limiting features</td>
<td>Value</td>
</tr>
<tr>
<td>59A: Lisbon</td>
<td>92</td>
<td>Very limited</td>
<td>Depth to saturated zone</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Slow water movement</td>
</tr>
<tr>
<td>62A: Herbert</td>
<td>92</td>
<td>Very limited</td>
<td>Depth to saturated zone</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Slow water movement</td>
</tr>
</tbody>
</table>
### Loading Rates – Illinois State Code, Section 905, Appendix A

#### Section 905 Illustrations and Exhibits

#### Exhibit B: Key for Determining Sewage Loading Rates (Gallons/Square Feet/Day)

<table>
<thead>
<tr>
<th>Texture</th>
<th>Single grain, gravelly loam, gravelly sand</th>
<th>Angular and Subangular Blocky, Prismatic</th>
<th>Structureless or Massive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moist Consistency</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Font</td>
<td>l</td>
<td>d</td>
<td>f</td>
</tr>
<tr>
<td>1</td>
<td>Fragmental</td>
<td>Dr. or Very gravelly sand</td>
<td>Gravelly sand</td>
</tr>
<tr>
<td>2</td>
<td>Medium sand</td>
<td>Loamy sand</td>
<td>Loamy sand</td>
</tr>
<tr>
<td>3</td>
<td>Fine sand</td>
<td>Loamy fine sand</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Loam</td>
<td>Fine sandy loam</td>
<td>Gravelly sandy loam</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Silt loam</td>
<td>Very fine sandy loam</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>Sandy clay loam</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9</td>
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<td>10</td>
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<td>11</td>
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<td>12</td>
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<td>13</td>
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<td>14</td>
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<td>15</td>
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<td>16</td>
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<td>17</td>
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<td>18</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Footnotes:**

1. Disturbed soils are highly variable and require special on-site investigations.
2. Moderate or strong platy structure for the soil textures in Group 5 have a loading rate of 0.40 gpd/ft².
3. Platy structure having firm or very firm consistency and/or caused by mechanical compaction has a loading rate of 0.0 gpd/ft².
4. Weakly structured silt loams and loamy silt loams, which are highly permeable, are subject to high water levels.
5. This soil group is estimated to have very rapid permeability and exceeds the maximum established rate in Section 905 Illustration H, Exhibit A or this Part.
6. N/A means not applicable.

(Source: Section repealed, new Section added at 2018 Reg. 2431, effective March 15, 1996)
Quantification and Communication of Variability

1) Geologic Systems

Ice-marginal sedimentation
Quantification and Communication of Variability

2) Post depositional Modification

Periglacial processes

Western Ohio

North Slope, Alaska

Bioturbation

Mima Mounds
Northcentral Iowa
Quantification and Communication of Variability

3) Human Impacts

Central Iowa

Northern Illinois

The Tool that Changed the World

Self-scouring steel plow, 1837
Central Iowa

\[ \text{Cs}^{137} \]

1870
### Human Impacts

#### Dynamic or Anthrodynamic?

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<table>
<thead>
<tr>
<th>Type</th>
<th>Ave</th>
<th>St dev</th>
<th>n</th>
<th>% CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never cult</td>
<td>13.4 a</td>
<td>7.8</td>
<td>7</td>
<td>58.5</td>
</tr>
<tr>
<td>No-till</td>
<td>8.9 ab</td>
<td>5.2</td>
<td>7</td>
<td>58.5</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>3.3 b</td>
<td>4.0</td>
<td>7</td>
<td>123.0</td>
</tr>
<tr>
<td>Conv-till</td>
<td>1.6 b</td>
<td>2.0</td>
<td>7</td>
<td>126.0</td>
</tr>
</tbody>
</table>

Values followed by the same letter are not different at the $P = 0.05$ level.

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**Land-Use Impacts on Infiltration Rate**

Summit – Dunteman, Boerger, Konen, and Boecker sites

Kane County, IL

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**Infiltration (cm/hr)**

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**Average**
• Hooray – use of Soil Survey is increasing!
• With use comes abuse, misuse, and misunderstanding… download frenzy.
• Who are the users?
• What are they using the information for?
• Do they understand the limitations of the data?
• How do we educate users?

Data  Users  Producers

What users see.
A sliver of what the user should see
The usual suspects we see listed:

<table>
<thead>
<tr>
<th>Data</th>
<th>Users</th>
<th>Producers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planners</td>
<td>Engineers</td>
<td></td>
</tr>
<tr>
<td>Architects</td>
<td>Appraisers and assessors</td>
<td></td>
</tr>
<tr>
<td>Farmers</td>
<td>Foresters</td>
<td></td>
</tr>
<tr>
<td>Sanitarians</td>
<td>Ecologists</td>
<td></td>
</tr>
<tr>
<td>Environmentalists</td>
<td>Educators</td>
<td></td>
</tr>
<tr>
<td>Realtors</td>
<td>Developers</td>
<td></td>
</tr>
</tbody>
</table>

Do we honestly think soil survey information in its current form and scale are useful to all of these groups in a meaningful way? Much of it is but...

Have we done an adequate job of informing them of what the information means?

How do we educate these and other potential users?

How many of these users do we reach in university courses?

How can we reach them?
### Student Opportunities

- Internships
  - GIS
  - Cartography
  - Database management
  - Fieldwork
    - Mapping
    - Monitoring
    - ...
- Grants
  - USGS EDMAP model
EDMAP Projects

• USGS - “train the next generation of geoscientists”

• ISGS collaboration

• 1:24,000

• 1-2 year completion

• Competitive Grants – open to all
  • Societal relevance
  • Scientific merit
  • Graduate & undergraduate

• All phases of mapping covered
  • Preliminary lit. review
  • Field mapping
  • Laboratory analysis
  • Cartography
  • Remote sensing
  • GIS
  • Derivative/interpretive maps
Ice-marginal debris flow diamictons
Glaciofluvial inclusions abundant
BD $\sim 1.7$ g/cm³

Subglacial diamicton (till)
Glaciofluvial inclusions rare
BD $\sim 2.0$ g/cm³
Fund student research/mapping projects similarly to EDMAP program
Societal relevance
Scientific merit
Research meets mission of NCSS and State/MLRA
Collaborative with NCSS and State/MLRA
Awards used to fund student
   Assistantship
   Travel
   Field supplies
   Cartographic supplies/production
Advertised and open to all
Curriculum Issues

Much broader issue – Soil Science profession

What skills are needed?

What courses should be taken and what needs to be taught that is not?

Soil Science competency

Geoscience competency – do we understand depositional environments, landscape evolution, hydrologic processes…?

Field experience

Technology

GIS

Remote sensing

...
Posters and Presentations – “Landscape Analysis” theme

What courses would aid in doing this?

Soil Science
Pedology
Hydrology
Geomorphology
GIS
Remote Sensing
Field Methods
Soils and Land-Use Planning
Soil Geography
Spatial statistics and quantitative methods
Intro Geology or Physical Geography
...

What departments offer these courses?