

ABSTRACT

The majority of soils in the Upper Midwest have developed from glacial materials deposited during the Quaternary Period. In many regions multiple advances and retreats have left a complex landscape of diverse glacial sediments and landforms. The soils that have developed on these deposits reflect the nature of the parent material.

SSURGO data were utilized to digitally map Quaternary deposits and landforms in St. Croix County, Wisconsin. Maps of ice source region, parent material, and landform were produced. Results were compared to a published Quaternary surficial geology map. Overall agreement between the published map and the maps created using soil survey information was generally greater than 60%. This project demonstrates that soil surveys can provide reliable, accurate, and high-resolution data on the Quaternary geologic history in the region. In addition this project shows the linkage and value of soil science to other disciplines such as geology.

INTRODUCTION

- Miller et al. (2008) successfully used soil surveys to map Quaternary parent materials from the Des Moines Lobe in Iowa and Minnesota.
- The Upper Midwest was glaciated several times by multiple lobes of ice from the Laurentide Ice Sheet during the Pleistocene Epoch of the Quaternary Period (1.8 million years to present) (Figure 1).
- In the Upper Midwest, material was deposited from lobes of ice from both the northeast and northwest portions of the Laurentide Ice Sheet (referred to as northeast and northwest ice source regions).
- Soil parent material characteristics are uniquely different depending on ice source region (Table 1).

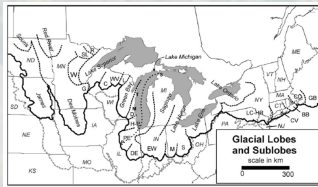


Figure 1: Glacial lobes and sublobes of the Upper Midwest (from: source Mickelson and Colgan, 2004)

Ice Source Region	Predominant Bedrock	Till Texture	Till Color	Other
Northeast	Sandstone and Basalt	Sandy Loam	Red	None
Northwest	Shale	Loam	Buff	Carbonates

Table 1: Characteristics of soil based on ice source region

OBJECTIVE

- To use soil surveys maps to map ice source regions and parent materials in St. Croix County, WI.
- St. Croix County, WI (Figure 2) was chosen for this project because it has glacial deposits two ice source regions of the Laurentide Ice Sheet.
- St. Croix County also contains a diversity of parent material and landforms.

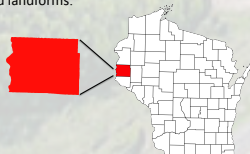


Figure 2: Location of St. Croix County, Wisconsin

METHODS

- Soil Survey Geographic Database (SSURGO) soils data was downloaded from the Natural Resource Conservation Service (NRCS).
- The lowermost horizon (generally the 'C' horizon) of a soil series was used to determine parent material and ice source region based on characteristics outlined in Table 1.
- ArcMap (ESRI) was used to create maps of ice source region and parent material using soil map data.
- The soil survey-based Quaternary map was compared to a published Preliminary Quaternary Geologic Map of St. Croix County from the Wisconsin Geological and Natural History Survey (Kostka et al., 2004).
- Percent agreement between the two maps was calculated by a polygon overlap technique, which digitally compared the areas of agreement between the two maps.

RESULTS/CONCLUSIONS

- A 56% agreement for ice source region between soil survey-based Quaternary map and published Quaternary Map (Figure 3).
- A 62% agreement for parent material between the soil survey-based Quaternary map and published Quaternary Map (Figure 4).
- A 68% agreement for parent material (till vs. outwash) for more recent glacier deposits from northeast ice source region (Figure 3). The more recent glacial deposits have more pronounced surface topography, which potentially enhanced mapping accuracy during soil survey production.
- A 78% agreement for northeast outwash between soil survey-based Quaternary map and published Quaternary map.
- A 66% agreement for northeast till between soil survey-based Quaternary map and published Quaternary map.
- A 25% agreement for northwest till between soil survey-based Quaternary map and published Quaternary map.
- The poor agreement for northwest till may be due to the age the till. This till was deposited during Pre-Illinoian glacial period (over 300,000 years before present) and has subdued surface topography, which may have impacted mapping accuracy during soil survey production.

COMPARISON OF AN ENLARGED SECTION BETWEEN MAPS

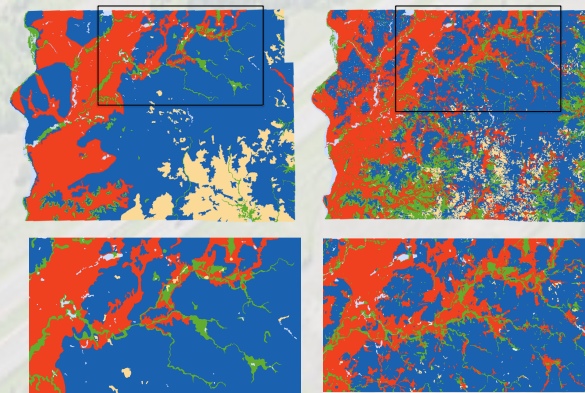


Figure 5: Enlarged map to map comparison of parent material between published Quaternary Map (left) and soil survey-based map (right)

COMPARISON OF ICE SOURCE REGION BETWEEN MAPS

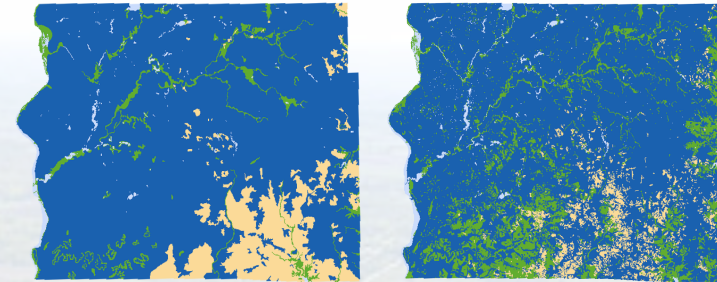


Figure 3: Comparison of ice source region between published Quaternary Map (left) and soil survey-based map (right).

COMPARISON OF RECENT PARENT MATERIAL BETWEEN MAPS

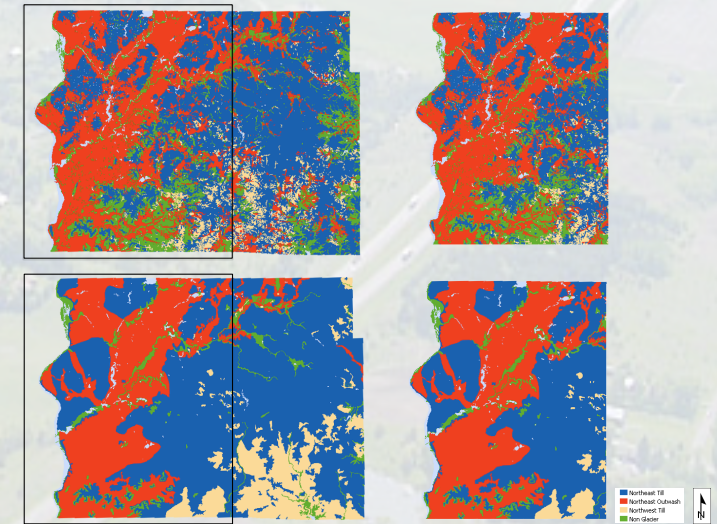


Figure 4: Comparison of parent material between published Quaternary Map (left) and soil survey-based map (right).

CONCLUSIONS

- Ice source region and parent materials were accurately mapped using soil survey information.
- Data from soil surveys could be used in the future to improve and enhance county-level Quaternary surficial mapping.
- More research is needed on the use of soil surveys to map specific landforms such as eskers, drumlins, outwash plains, etc.

REFERENCES

- Kostka, S.J., H.J. Hinkle, D.M. Mickelson, and R.W. Baker. 2004. Preliminary Quaternary Geologic Map of St. Croix County, Wisconsin. Wisconsin Geological and Natural History Survey
- Mickelson, D.M. and P.M. Colgan. 2004. The southern Laurentide ice sheet. Developments in Quaternary Science (1): 1-8.
- Miller, B.A., C.L. Burras, W.G. Crumpton. 2008. Using Soil Surveys to Map Quaternary Parent Materials and Landforms across the Des Moines Lobe of Iowa and Minnesota. Soil Survey Horizons Vol. 49 Number 4: 91-95. Winter 2008

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