Using the New Natural Soil Drainage Index to Highlight and Explain Soil Wetness Patterns in Michigan

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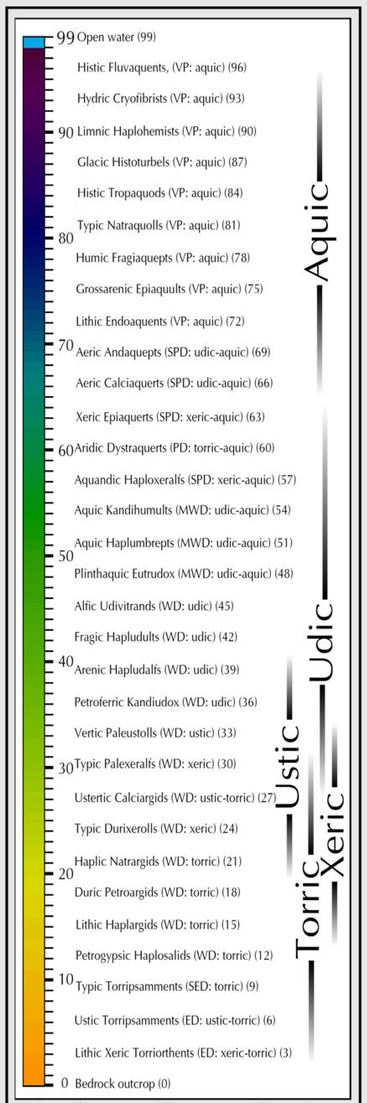
Abstract

We apply an ordinally based, natural soil drainage index (DI), intended to reflect the amount of useable water that a soil can supply to growing plants under natural conditions. The index ranges from 0 for the very driest soils, e.g., those shallow to bedrock in a desert, to 99, for areas of open water. The DI operates on the assumption that soils in drier climates and with deeper water tables have less plant-useable water; therefore, the soil's natural drainage class and soil moisture regime figure prominently in the calculation of the "base DI." The DI of each taxonomic suborder is available from pull-down menus, and for download, at www.drainageindex.msu.edu. In this poster, we present examples of how the DI, when linked to a soil map and our color ramp (see below), can provide insight into landscape wetness patterns and geomorphology.

Applications

The index has many applications in forestry, ecology, and geography, as well as in global change and environmental modeling, especially when examined spatially in a GIS. The DI can be accessed at: www.drainageindex.msu.edu



This color ramp illustrates the colors that we have assigned to the various DI values. As the DI value decreases, the colors morph to purples to blues to greens to yellows and finally to orange, designed to mimic soil wetness.

Acknowledgements

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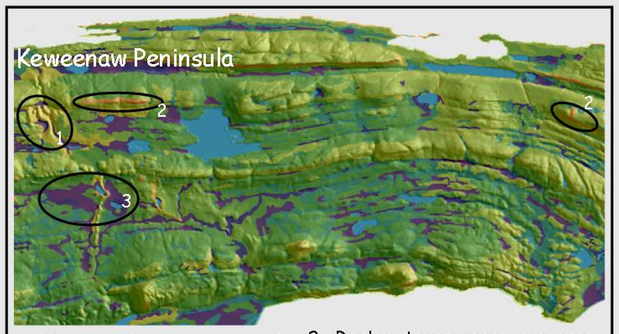
Methods

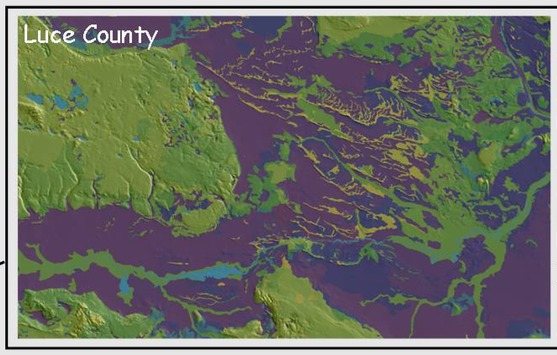
The Michigan part of the US General Soil map was joined with the DI table (accessible at www.drainageindex.msu.edu) in ArcMap. Subsequent, more detailed, pull-out figures were produced by joining the DI table to county SSURGO data in ArcMap. We adjusted the soils layer transparency in ArcMap to partially show the hillshade layer below, better illustrating how topography influences drainage.



1. Sandy soils on a dissected outwash terrace appear yellow, with DI values of 12-16.

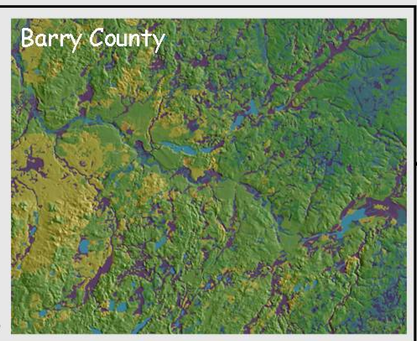
2. Rock outcrops appear orange with a DI value of 0.

3. Very poorly-drained Histosols of the Lupton-Tawas complex have DI values >88.

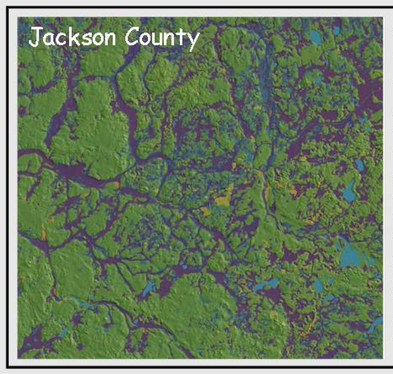


The yellow (DI=19) colors here represent excessively-drained soils on sand dunes in Luce County. These parabolic dunes are well illustrated against the purple background of Lupton, Tawas, and Carbondale mucks of the Algonquin lake plain, with DI values of 91

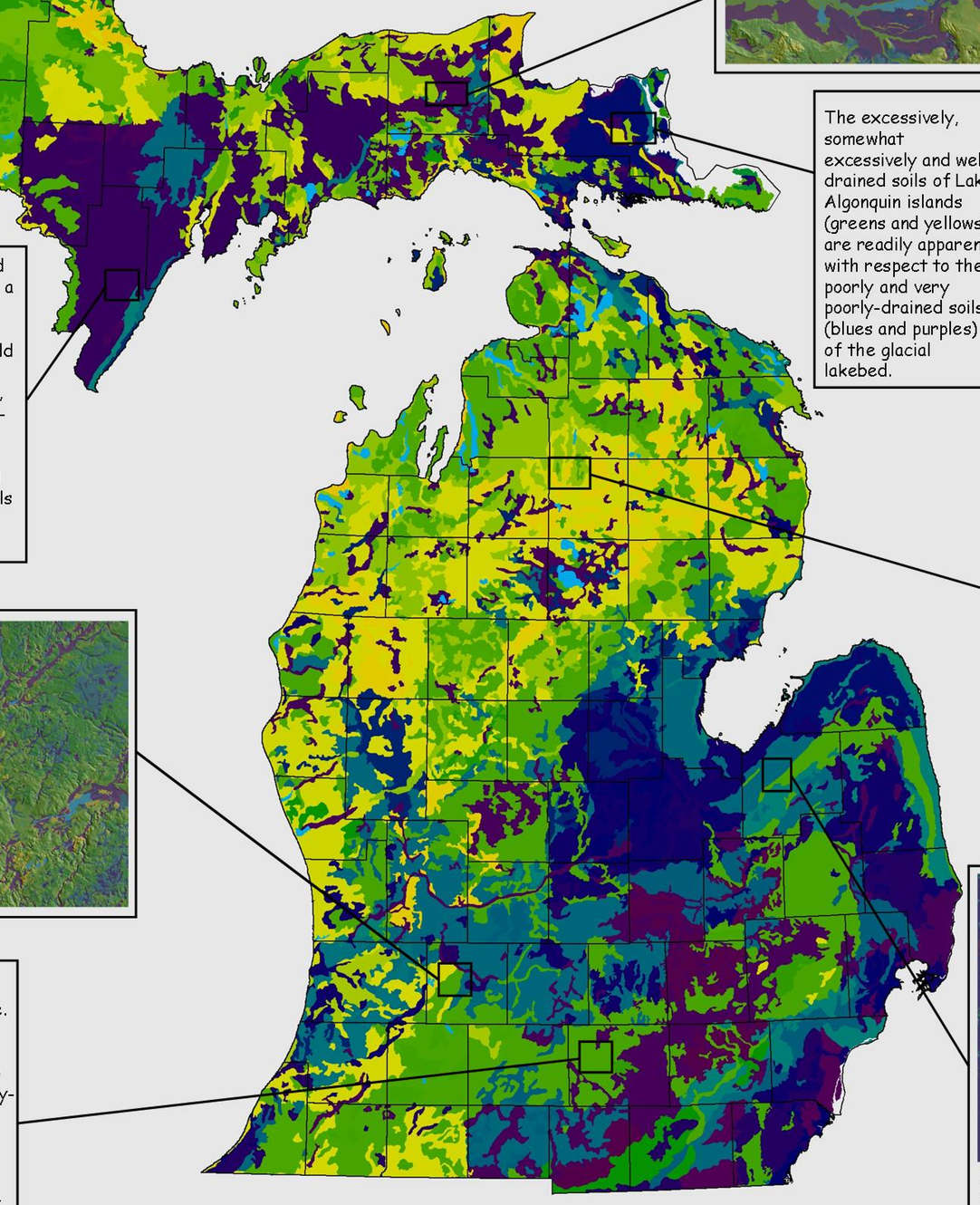
The pattern of wet and dry soils in this area is a classic indicator of a drumlin field. The Menominee drumlin field is comprised of soils formed in well-drained, loamy glacial tills. Well-drained soils on the drumlin uplands are green, while poorly and very poorly drained soils show in blues and purples.



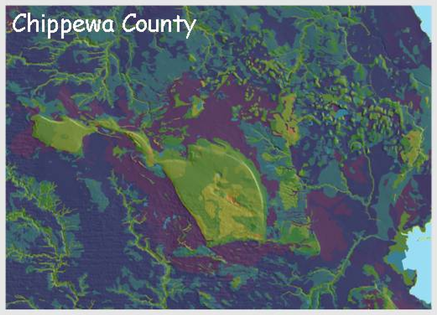
The erratic drainage patterns of the interlobate moraine in Barry County are exemplified by this image. The hummocky topography here contains very poorly-drained Histosols (purple) adjacent to excessively-drained soils in outwash sands (yellow), well-drained soils in till (green), as well as poorly-drained (dark blue) soils. The open water of kettle lakes shows as light blue.



Well-drained soils formed in sandy till, i.e. the Riddles Series, appear green with DI values ranging from 36 to 45. Somewhat poorly-drained, low areas of the landscape appear blue, with values between 64 at 70. Poorly and very poorly-drained muck soils appear purple have DI values >88.

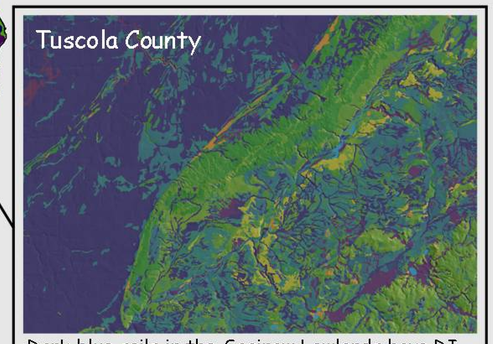


The image of Michigan above shows generalized regions of soil drainage. The blues and dark blues of the Saginaw Lowlands indicate this region is comprised of mainly somewhat poorly and poorly drained soils of former glacial lakebeds. The yellow color seen in much of northern and eastern lower Michigan are somewhat excessively and excessively-drained sandy soils. Green areas on the map show dominantly well-drained soils, much of which are tills laid down by retreating glaciers.



The excessively, somewhat excessively and well-drained soils of Lake Algonquin islands (greens and yellows) are readily apparent with respect to the poorly and very poorly-drained soils (blues and purples) of the glacial lakebed.

Uplands of the Grayling Fingers appear in greens, i.e. Feldhauser fine sandy loam, DI=43, and yellows, i.e. Rubicon Sand, DI=20. Dry channel beds between the finger uplands are mostly well-drained and excessively well-drained, although some mucks (Tawas-Lupton series) occur in the lowest areas.



Dark blue soils in the Saginaw Lowlands have DI values of 82 (Tappan-Londo loams). The Port Huron moraine is apparent from the moderately well and well-drained green hues (DI=37-53). Adjacent, lineated green landforms, highlighted by oranges (pits, DI=0), formed as relict beach ridges or sandbars from various glacial lakes.