MICHIGAN STATE UNIVERSITY

The Soil Fertility and Drainage Indexes:

taxonomically based, ordinal estimates of relative soil properties

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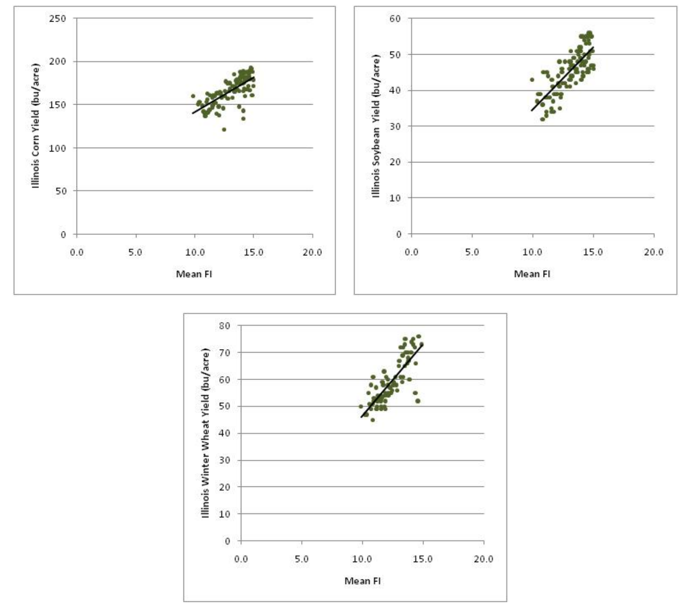
Validation of the Soil Fertility Index

Among other validation approaches with different data sets, 2009 crop yield data for 11 Midwestern states were used to evaluate the FI. In a GIS, we determined the soils and crops in particular fields, and thus were able to ascertain the mean FI value per soil, per crop, per county. These crop specific, mean, county level FI values were then compared with the county yield values reported by USDA-NASS. Statewide summaries of these data produced correlations among yields of specific crops and FI values that were all positive. Below are selected examples.

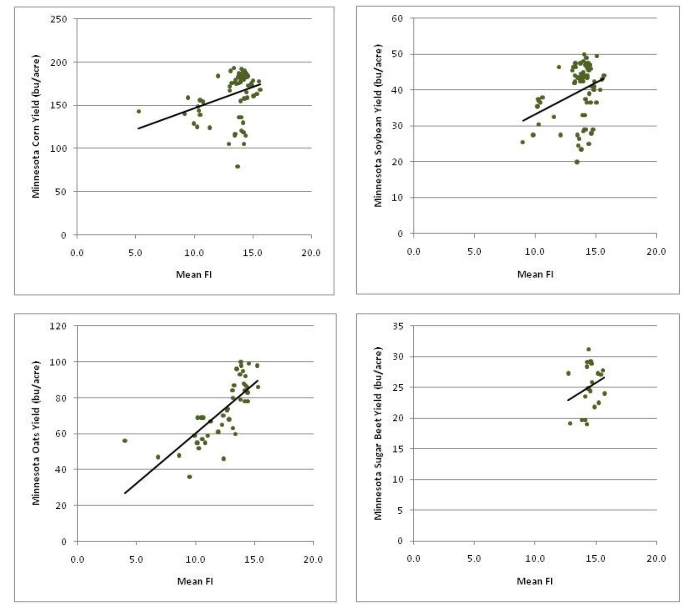
Illinois

Crop	R_s value
Corn	0.73
Soybeans	0.75
Winter Wheat	0.78



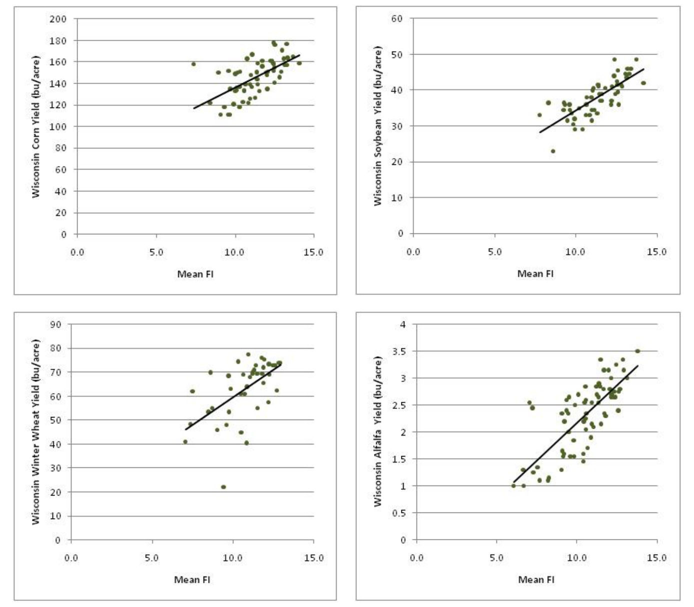
Minnesota

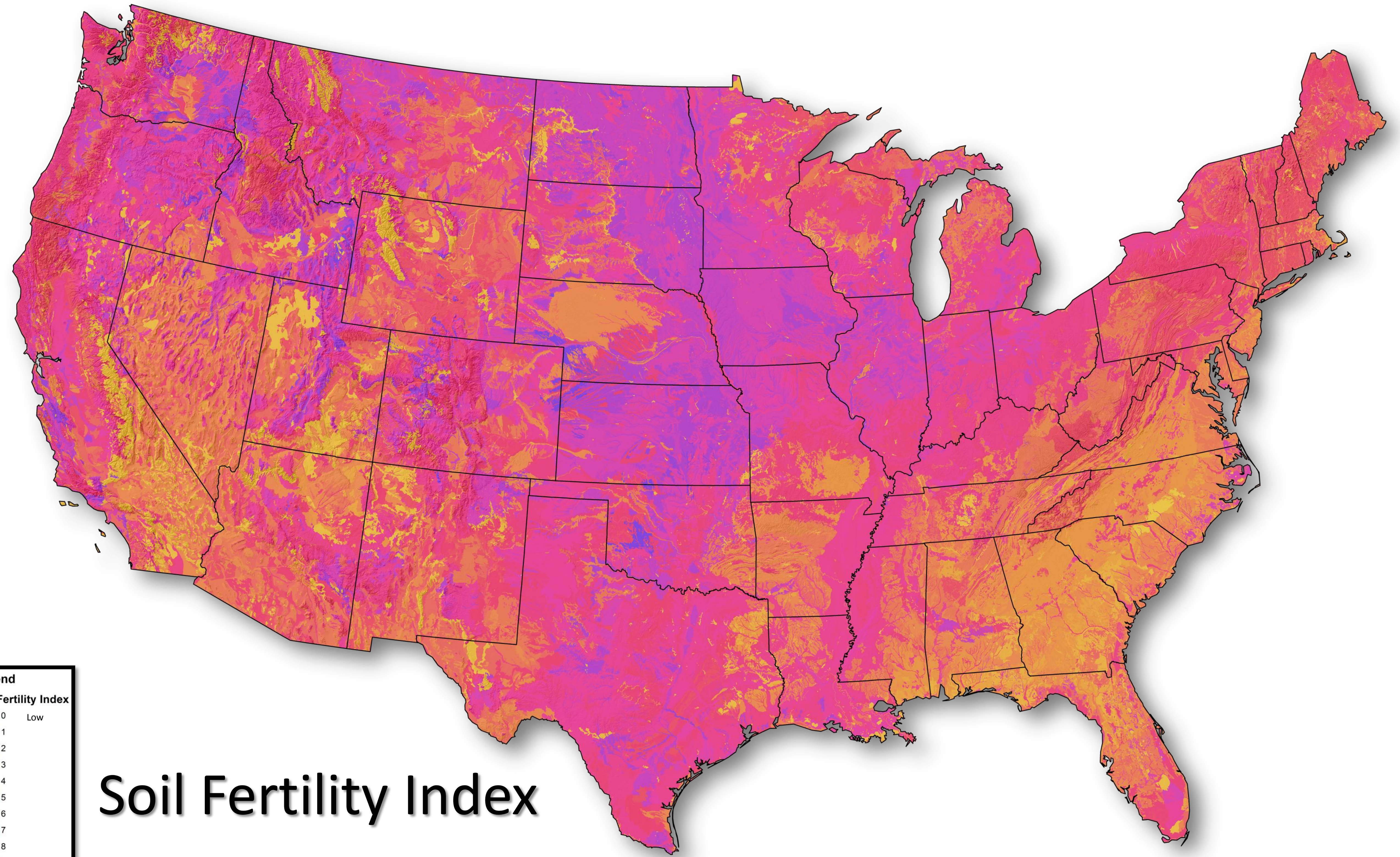
Crop	R_s value
Corn	0.29
Soybeans	0.23
Oats	0.80
Sugar Beets	0.24

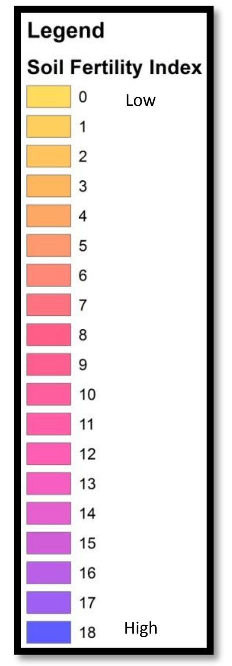


Wisconsin

Crop	R_s value
Corn	0.55
Soybeans	0.78
Winter Wheat	0.60
Alfalfa	0.68





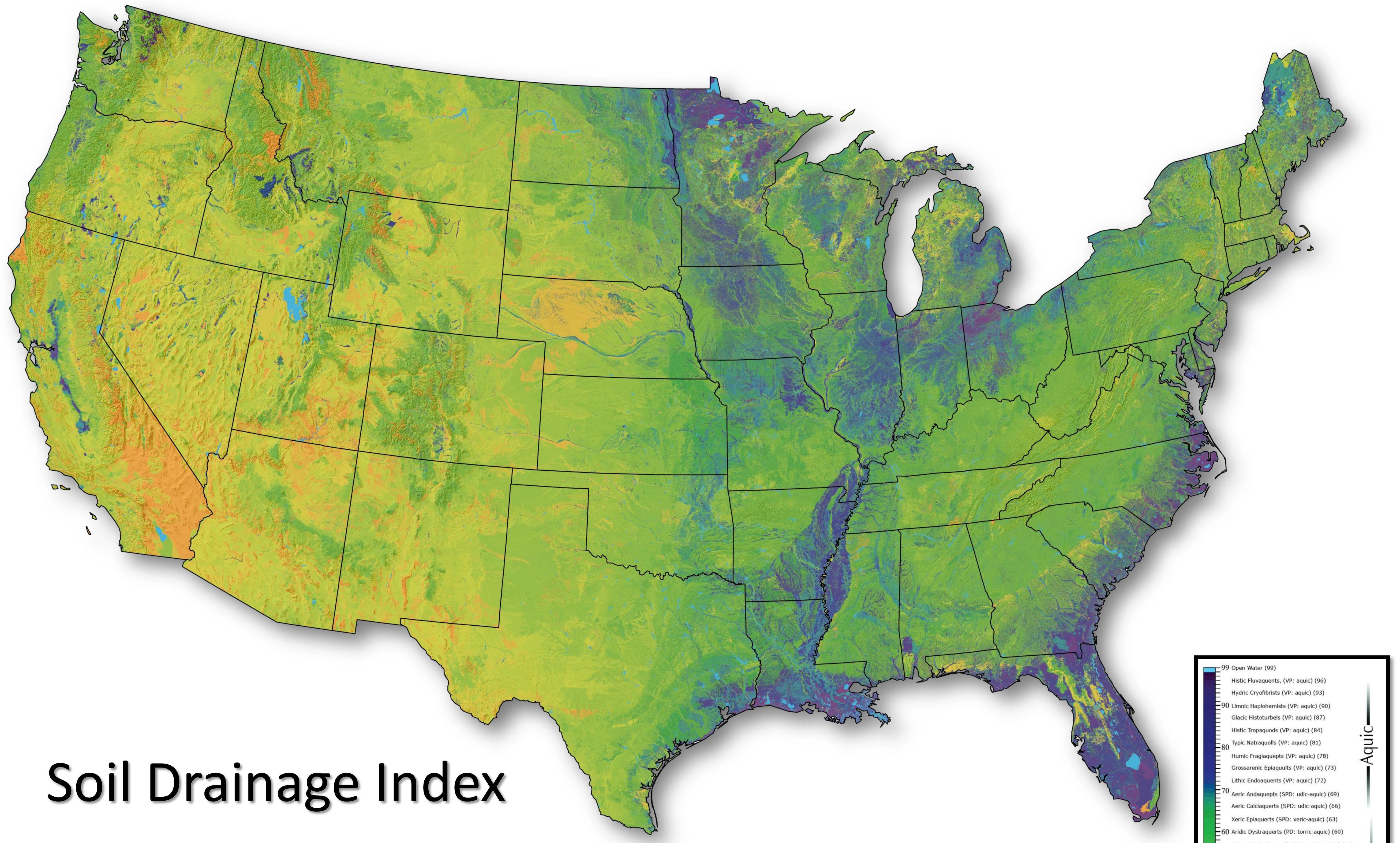


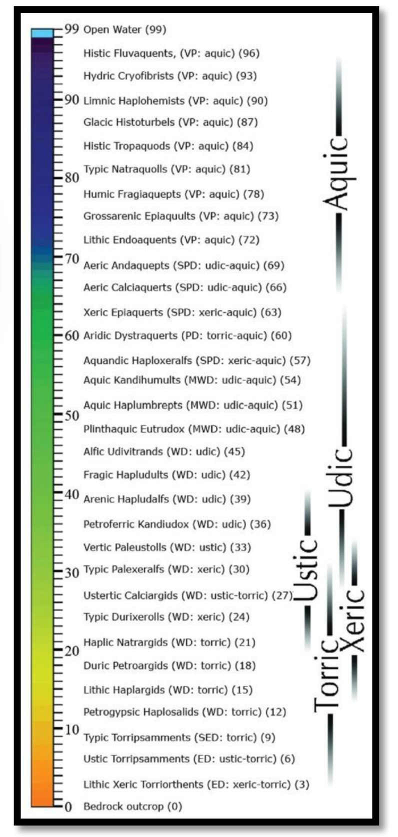
Soil Fertility Index

This poster introduces a new, ordinally based, Soil Fertility Index (FI). The above map shows the FI for the lower 48 states. The FI uses family-level Soil Taxonomy information, i.e., interpretations of taxonomic features or properties that tend to be associated with natural low or high soil fertility, to rank soils from 0 (least fertile) to 19 (most fertile). The index has wide application, because, unlike competing indexes, it does not require copious amounts of soil data, e.g., pH, organic matter, or CEC, in its derivation. To calculate the FI the following variables were used to guide initial assessments of fertility among the 12 soil orders: (1) organic matter content, (2) CEC, and (3) clay mineralogy, as well as our knowledge of general land use on each of the orders. Next, modifier values were assigned to each suborder, Great Group and subgroup, when these entries implied changes (more, or less) in overall fertility, relative to the base value. Lastly, the FI was modified by adjusting for texture, based on texture family classification. FI values for all soils currently classified by the NRCS can be accessed from the web site: http://www.drainageindex.msu.edu.

This map shows 48 statewide soil grids, each created by downloading county-scale SSURGO files from the NRCS soil data mart, seaming them together into a statewide mosaic, and then resampling them, to create a statewide grid file. FI values (downloadable from the web site) were then joined to each state-wide SSURGO soil grid in a GIS. We next applied our own color ramp symbology to the FI values and overlaid them onto a 240-m hillshaded DEM, using 30% transparency.

Citation: Schaetzl, R.J., Krist, F.J. Jr., and B.A. Miller. Introducing the Soil Fertility Index: A taxonomically based, ordinal estimate of soil fertility. Soil Science: Under Review.





Soil Drainage Index

The map above shows the natural, inherent, soil wetness of the lower 48 states, as determined by the ordinally based Natural Soil Drainage Index (DI). The DI is intended to reflect the amount of water that a soil can supply to growing plants under natural conditions. It ranges from 0 for the very driest soils and exposed bedrock, to 99 for areas of open water. Its derivation is based on soil taxonomic information, normally available in soil digital datasets created by the USDA-Natural Resources Conservation Service (NRCS), and available for download at the NRCS's Soil Data Mart web site (http://soildatamart.nrcs.usda.gov/). The DI can be calculated for any soil by knowing it's taxonomic subgroup and, in GIS applications, map unit slope. The index has many applications in the geosciences, forestry, ecology, geography, and environmental modeling, especially when examined spatially. DI values for all soils currently classified by the NRCS can be accessed from the DI web site: http://www.drainageindex.msu.edu. Validation data for the DI are not presented here as it has been already published.

This map shows 48 statewide soil grids, each created by downloading county-scale SSURGO files from the NRCS soil data mart, seaming them together into a statewide mosaic, and then resampling them, to create a statewide grid file. DI values (downloadable from the web site) were then joined to each state-wide SSURGO soil grid in a GIS. We next applied our own color ramp symbology to the DI values and overlaid them onto a 240-m hillshaded DEM, using 30% transparency.

Citation: Schaetzl, R.J., Krist, F.J. Jr., Stanley, K.E., and C.M. Hupy. 2009. The Natural Soil Drainage Index: An Ordinal Estimate of Long Term, Soil Wetness. Physical Geography 30:383-409.