THE NATIONAL SOIL DRAINAGE INDEX MAP

A FACTOR IN FOREST HEALTH RISK ASSESSMENT

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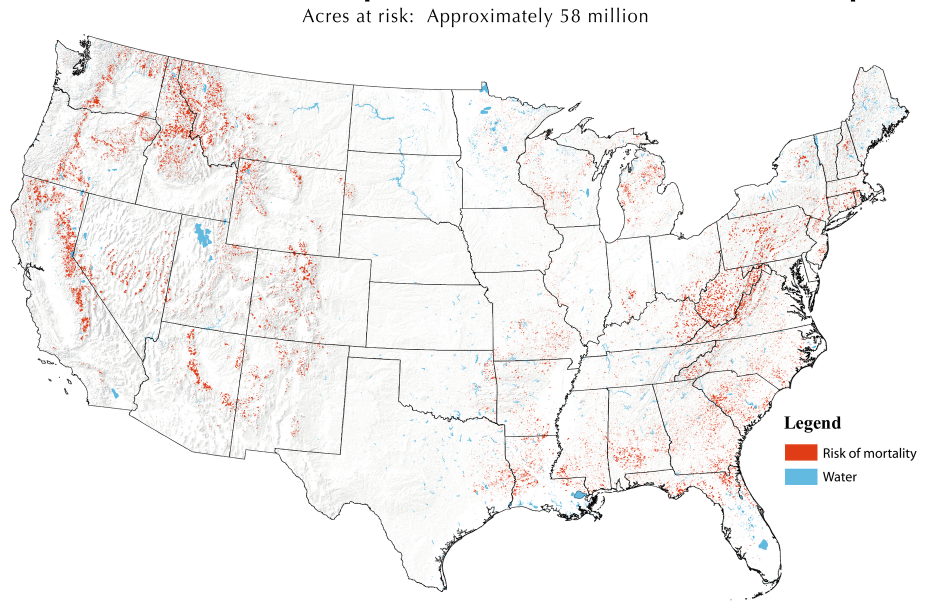
Examples of Risk Maps which include Drainage Index (DI) as factors

National 2006 Composite Insect and Disease Risk* Map

Acres at risk: Approximately 58 million

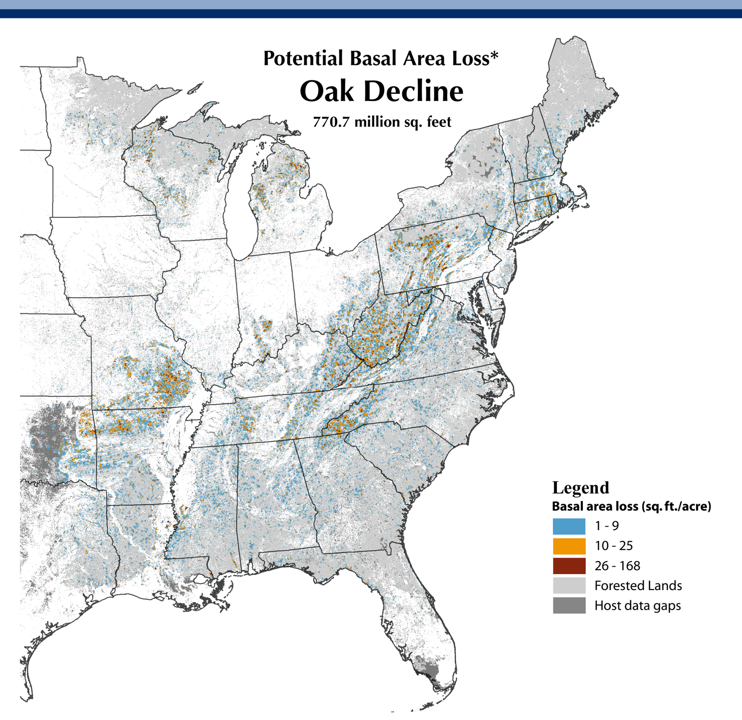


*The expectation that 25% or more of the standing live volume of trees greater than 1" in diameter will die over the next 15 years.

Potential Basal Area Loss*

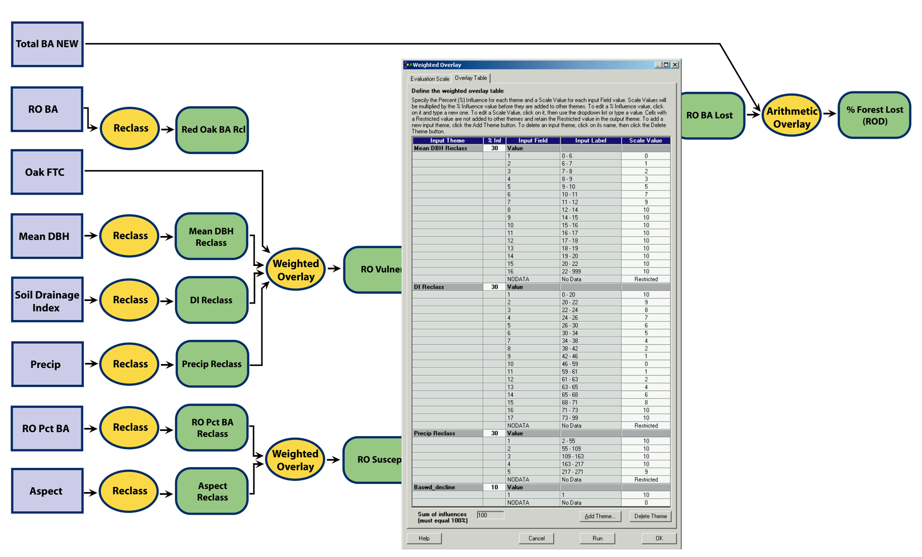
Oak Decline

770.7 million sq. feet



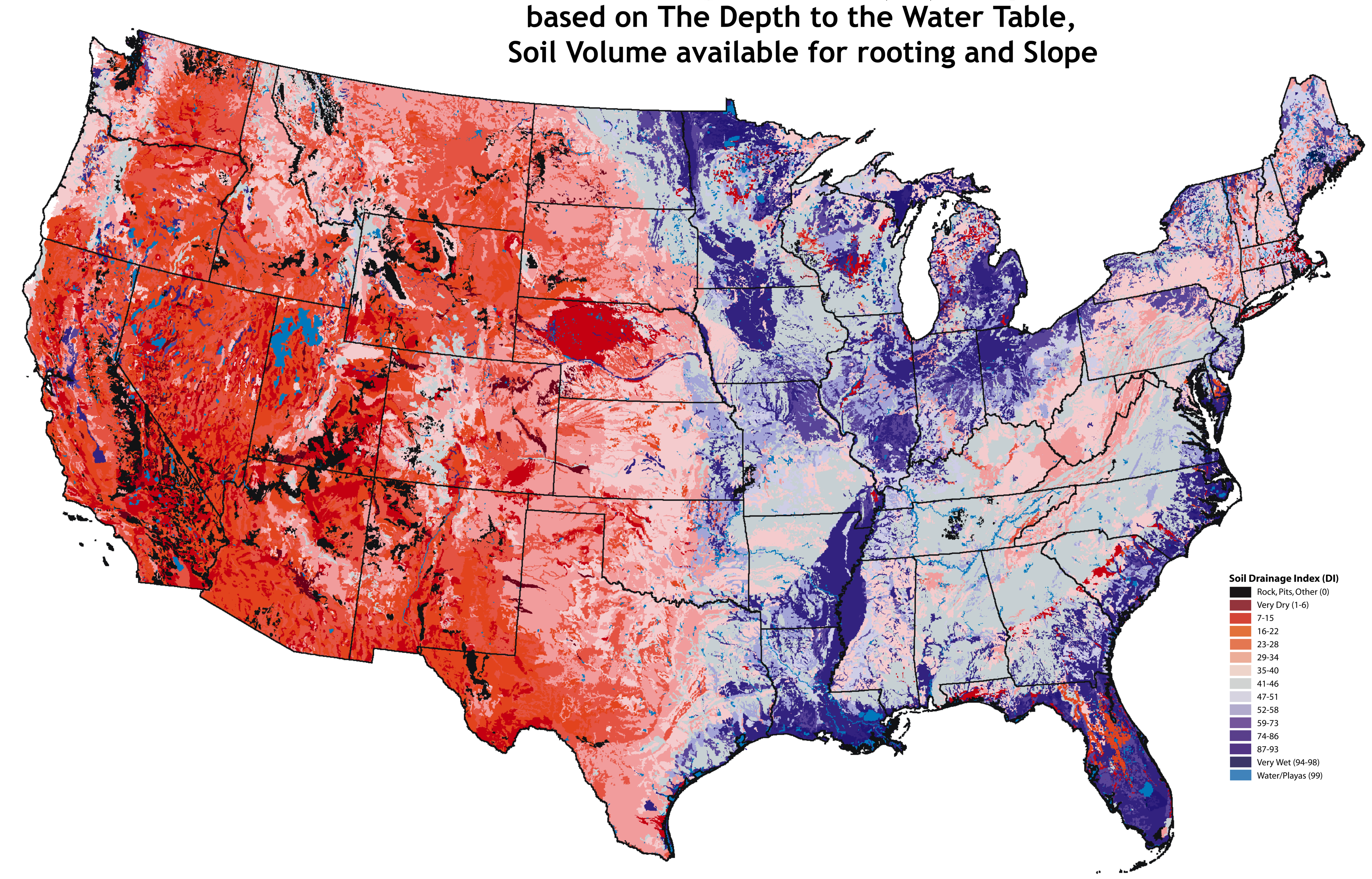
*The potential basal area loss per acre for all hosts affected by an agent.

Oak Decline Model Outline



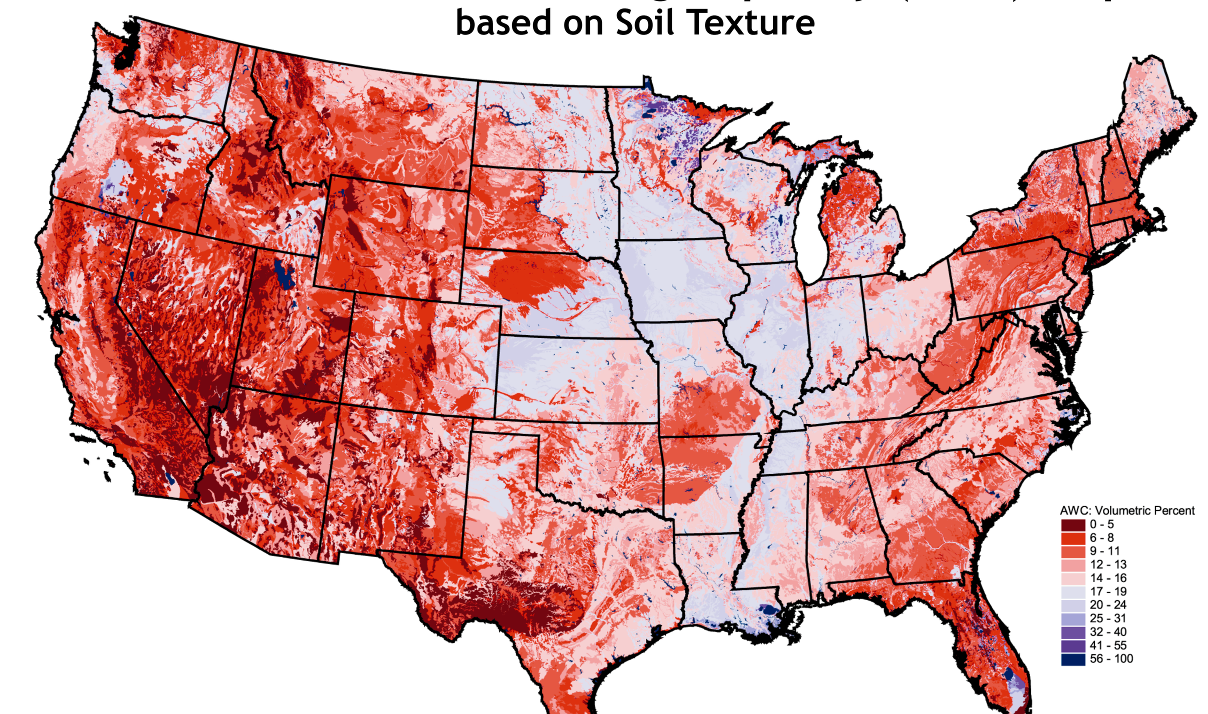
Drainage Index (DI) Map

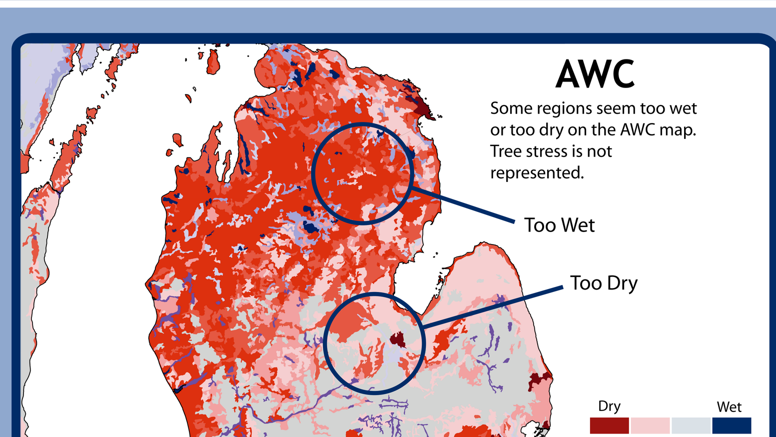
based on The Depth to the Water Table, Soil Volume available for rooting and Slope

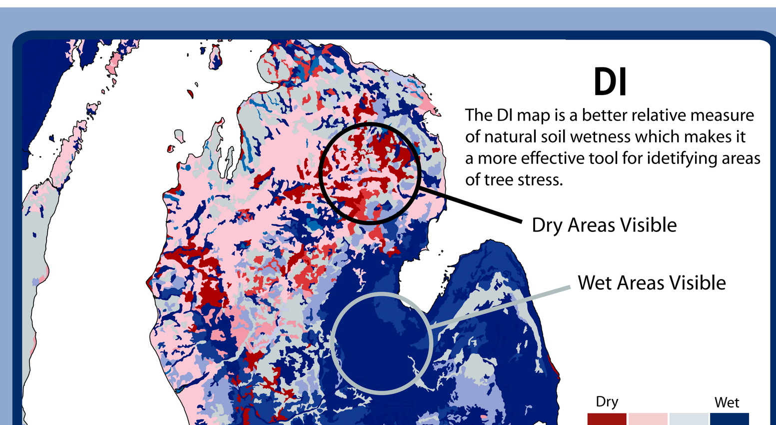


Available Water Holding Capacity (AWC) Map

based on Soil Texture







Background

With the widespread availability of published Natural Resources Conservation Service (NRCS) maps in digital format, resource managers can now begin to incorporate soilscape analysis into risk assessment exercises. Recent work, including the compilation of the National Insect and Disease Risk Map (NIDRM) by the USDA Forest Service, State and Private Forestry Area, Forest Health Protection Unit, has demonstrated the significance of soils and soil patterns in risk analysis. In particular, patterns related to soil water content, both the excess and scarcity of, are often a primary factor related to tree stress, and thus to insects and diseases (Elliot and Swank 1994, He and Richard 2000). Current measures available from the NRCS soils data, such as available water holding capacity (AWC), do not adequately describe natural soil wetness because they only reflect the soil's ability to retain and release water to plants, not the long-term mean amount of water that is actually in the soil. In order to address this data gap, a soil drainage index (DI) was used in the construction of the 2006 National Insect and Disease Risk Map (NIDRM). Of the ten primary contributors to the NIDRM oak decline, southern pine beetle, gypsy moth, IPS beetle, and hardwood decline have DI as a significant factor in their models.

What is the Drainage Index or DI?

Originally named the "natural soil wetness index" (Schaetzl 1986), the DI is a measure of the long-term wetness of a soil. It indicates the amount of water that a soil contains and makes available to plants under normal climatic conditions. It is not meant to mimic the concept of "plant available water", which is mostly dependent upon soil texture. The DI only loosely/secondarily takes soil texture into consideration. The main factors affecting DI are the depth to the water table, soil moisture regime and volume available for rooting, and (lastly) texture. Therefore, the DI is calculated from the soil's taxonomic subgroup classification in the US system of Soil Taxonomy, along with its textural family and slope class. The DI concept was first initiated by Hole (1978) and Hole and Campbell (1985), and expanded upon by Schaetzl (1986).

The DI ranges from 0 to 99. The higher the DI, the more water the soil can supply to plants. Sites with a DI of 99 are, essentially, open water. A soil with a DI of 1 is thin and dry enough to almost be bare bedrock. Because a soil's taxonomic classification is not (initially) affected by such factors as irrigation or artificial drainage, the DI does not change as soils become irrigated or drained (unless the long-term effects of this involve a change in the soil's taxonomic classification). Instead, the DI reflects the soil's NATURAL wetness condition. Each soil SERIES has, in theory, its own unique DI. Some soil series span two or more drainage classes, and thus may have more than one DI.

References:

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He, F., and D.P. Richard. 2000. Density-dependent effects on tree survival in an old-growth Douglas fir forest. Journal of Ecology 88 (4): 676-688.

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Schaetzl, R.J. 1986. A soilscape analysis of contrasting glacial terrains in Wisconsin. Annals Assoc. Am. Geogs. 76:414-425.