

University of Wisconsin – Madison Project Description

SoLIM (Soil Land Inference Model) is a new technology for mapping soil resources based on recent developments in geographic information science (GIScience), artificial intelligence (AI), and information representation theory. SoLIM was designed to overcome the limitations of existing soil survey methods and to improve the accuracy and efficiency in conducting survey of nation's soil resources.

The current method of conducting soil surveys is very inefficient (costly, time-consuming) and the products are of low quality due to the limitations of polygonal representation scheme, the manual mapping process and the lack of knowledge documentation strategy. With 0.9 billion hectares of land in the United States and a current rate of soil survey updating at approximately 4 million hectares per year, it will take 220 years to update all of the soil surveys in the U.S. If the effort is doubled as more staff are shifted from initial soil surveys to updates, survey updates will still occur on a 100-year cycle, requiring at least three generations of soil scientists. This rate of soil information production certainly cannot meet the needs of Information Age land resource management and other geographical analysis. A radical change is needed to move soil resources survey to a more acceptable update rate and to a product that can be continually updated efficiently and accurately.

The SoLIM approach overcomes the limitations of the existing soil survey methods: 1) by replacing the polygonal representation scheme with a fuzzy logic-based raster representation scheme; 2) by using a computerized inference process in the place of manual mapping; 3) and by explicitly documenting knowledge on soil-landscape relationships through the use of artificial intelligence techniques. As a result, the spatial gradation of soil resources can be more accurately represented and the spatial details of soil sources can be captured. The computerized inference process not only relieves the labor intensive and time-consuming manual mapping tasks but also dramatically increases the speed of mapping soil resources. The documentation of local soil scientists' expertise not only makes the initial investment reusable and reduces cost for conducting soil resources inventory, but also allows the product to be continually and efficiently updated.

Cases studies in Wisconsin have shown that the SoLIM approach is about 10 times faster than the conventional approach and the products are about 20-30% more accurate than those produced using the conventional methods. In addition, the SoLIM approach can generate a range of products not available using the traditional approach. Agriculture Secretary Ann N Veneman has praised the SoLIM approach. The approach is in the process being adopted by Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture in its effort to modernize its way of surveying of nation's natural resources.

Lead Presenter: A-Xing Zhu

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