Soil and Water Science
Research Brief
University of Florida Institute of Food and Agricultural Sciences

SOIL LANDSCAPE MODELING

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Many pedologists stress the close relationship between soil, landform (topography) and hydrology. Small variations in local topography can cause large responses in vegetation type creating a mosaic of different vegetation complexes. In Florida, soils, topography, hydro-patterns and vegetation-patterns are closely interrelated where the subtropical climate boasts unique and fragile ecosystems that are not found elsewhere in North America (e.g. freshwater marshes, tropical hardwood hammocks, mangrove swamps, and pinelands).

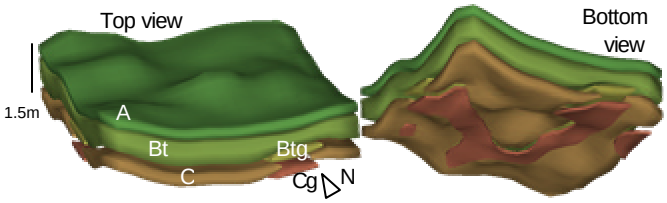

Fig. 1. 3-D soil layer model representing a 1 sq mile area in southern WI. Soils on upslope areas were classified as fine silty, mixed mesic Typic Argiudolls and on lower elevated areas as fine silty, mixed mesic Aquic Hapludolls and Typic Hapaquolls.

Soil-landscapes are complex and diverse due to pedo-geomorphological and hydrological processes acting over hundreds and thousands of years. These soil-forming and –destroying processes proceed simultaneously in soils and the resulting profile reflects the balance of these processes - present and past. Since soil features are invisible from the surface and observations are often limited, gaining insight into the spatial distribution of soils is a challenging task.

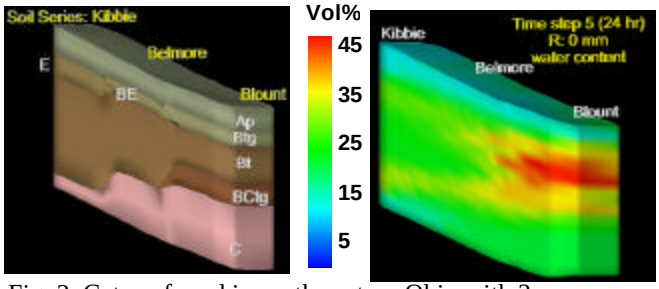

Fig. 2. Catena found in northwestern Ohio with 3 different Soil Series. A process-based model (SWAT) was used to simulate hydrologic processes.

Soil-landscape models describe and explain the spatial and temporal distribution of soil and landscape properties and patterns at landscape-scale. Three exclusive soil-landscape modeling philosophies exist: (1) *Empiric, factorial models* use factors such as climate, organism, topography, parent material, and time to explain and predict the spatial and temporal distribution of soils, (2) *Spatial models* utilize geostatistical methods to predict soil and landscape properties at previously unsampled locations within a specified domain, and (3) *Deterministic, pedo-dynamic (process-based) models* integrate algorithms to describe pedo-geomorphological processes forming soils.

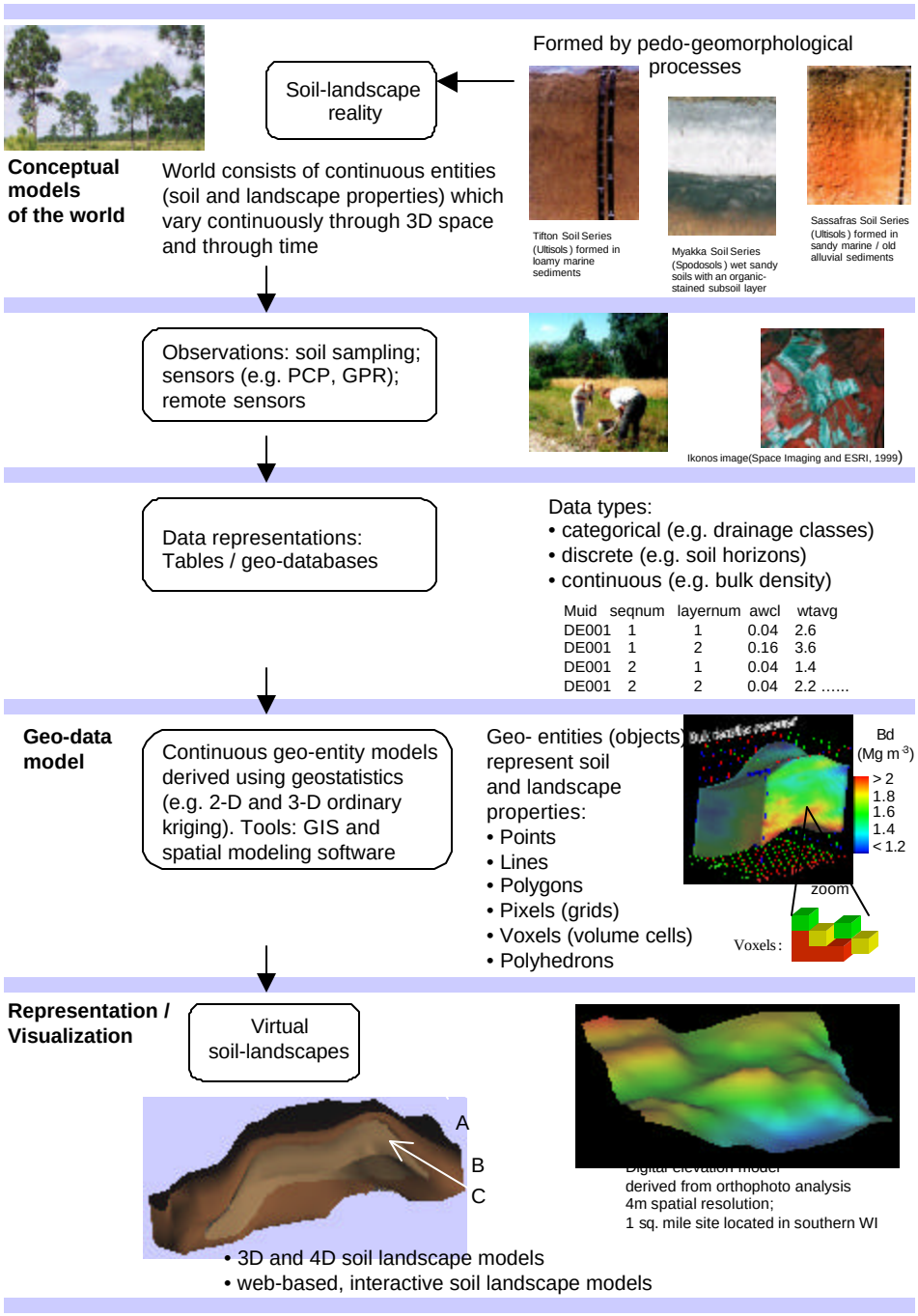

Fig.3. Steps in the process from observation of real world phenomena to the creation of virtual soil- landscape models (highest abstraction level).

Reconstruction and Visualization of Soil-Landscapes: The objectives were to abstract real soil-landscapes and create continuous, multi-dimensional, virtual soil-landscape models. Models were created using a reconstruction technique based on 2-D and 3-D ordinary kriging, respectively. Geo-data modeling and visualization was implemented in Virtual Reality Modeling Language (VRML).

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