Proposed Design of *A Field Guide to Soil Series of the United States*

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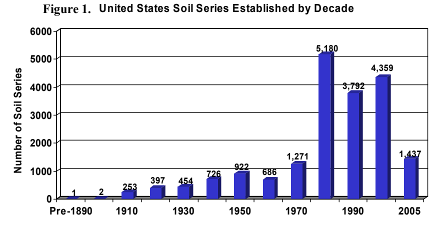
Abstract

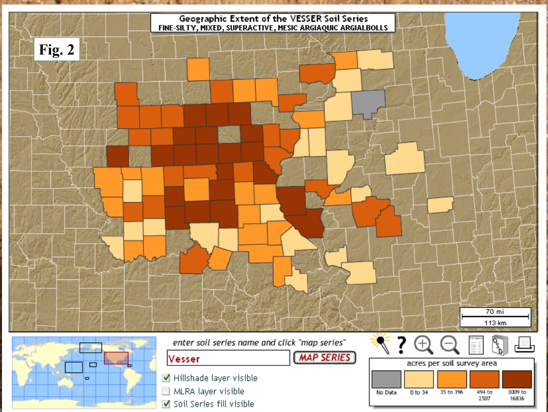
Soil Series, the most detailed category of soil classification in the USDA Soil Taxonomy, are commonly recognized and understood by agriculturalists with knowledge of their land. This poster describes the concept and proposed design of a "Field Guide to Soil Series" which will provide a customizable information source for laypersons, educators, students, and technical specialists.

Introduction

The guide emphasizes field study for identifying Soil Series and other taxa primarily from soil geographic extent and field-based soil morphological and landscape data. The concept and proposed design of a field guide is analogous in some aspects to the famous Petersons'™ Field Guides. Currently, there are more than 24,000 U.S. Soil Series with 30% (7,247) found in the Mollisols Soil Order (Table 1). Figure 1 shows the decadal distribution of Established Soil Series and the marked increase following the publication of USDA Soil Taxonomy in the 1970s.

Figure 1. United States Soil Series Established by Decade





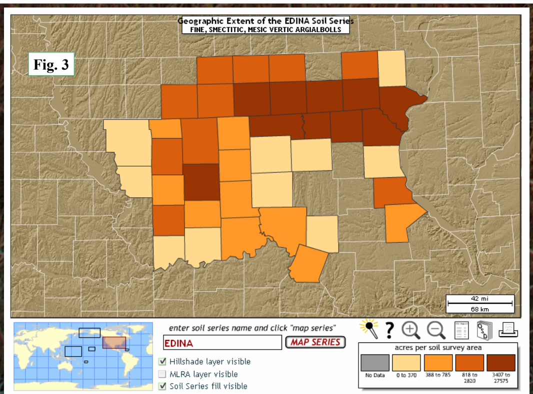
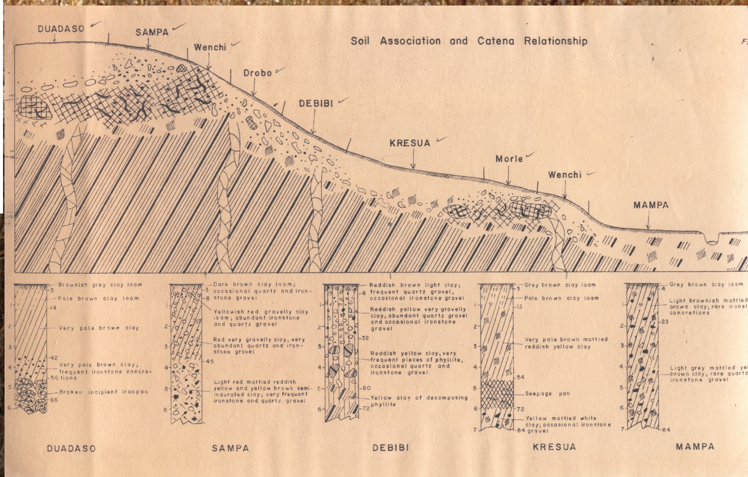


Table 1. Distribution of Soil Series by Soil Order in the On-line Database of Official Soil Series Descriptions (Accessed Sept. 12, 2007)

Soil Order	Total Number (# of OSDs)	Benchmark	Established	Tentative	Inactive
All Orders	24,105 (22,603)	1,201	20,682	2,044	1,328
Alfisols	3,885 (3,786)	251	3,558	235	92
Andisols	968 (964)	35	779	184	5
Aridisols	2,681 (2,610)	149	2,409	194	78
Entisols	2,699 (2,610)	150	2,391	249	59
Gelisols	69 (61)	10	46	16	7
Histosols	298 (284)	18	260	24	14
Inceptisols	2,886 (2,763)	163	2,567	249	70
Mollisols	7,247 (7,059)	369	6,448	681	118
Oxisols	60 (60)	8	56	4	0
Spodosols	727 (677)	31	615	66	46
Ultisols	1,305 (1,260)	111	1,178	98	29
Vertisols	469 (468)	49	426	42	1

Figure 4. Example of a Soil Association and Catena Relationship in Northwestern Ghana (Coultas, 1959)



Figures 2 and 3 (left): Soil Series Extent Maps for the Vesser and Edina Soil Series - Argialbolls

Proposed Chapters with Content and Sources

Sources of information would include the Official Soil Series Descriptions (OSDs), National Soil Classification Database, Field Book for Describing and Sampling Soils, and the Soil Series Extent Mapping Tool. Soil landscape relationships are modeled using various conceptual diagrams such as hillslope profiles, catenas, and 3-D visualization tools such as block diagrams and terrain models.

The more than 24,000 Soil Series would be grouped as chapters under Soil Order and Suborders (source: Soil Taxonomy). Four sections of each chapter would provide information on: (1) Suborder, Soil Series within each Suborder or Great Group (source: OSD) and a soil profile photograph (opposing page) by Suborder, (2) Soil landscape relationships – parent material, landform, landscape position (Wysocki et al., 2005); (3) Soil geography – extent (SEM tool), Associated soils (catenas, hillslope diagrams, 3D block diagrams, OSDs); and (4) Morphology, data analysis and visualization – pedon field morphology clues (Schoeneberger et al., 2002), lab data and statistics, i.e. correlation, depth and pedotransfer functions.

For advanced users, an optional section with multivariate graphical tools such as GGobi (Swayne et al., 2006) could be applied for exploratory spatial data analysis and multi-dimensional data visualization.

Figure 5b. Suborders with More than 100 Soil Series

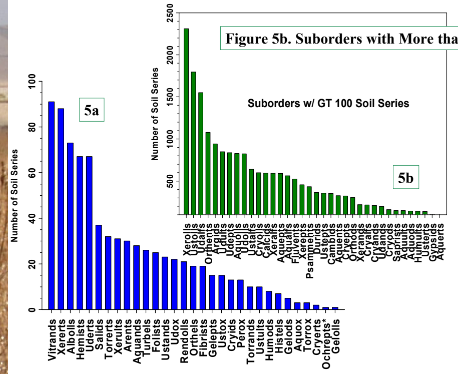


Figure 5a. Suborders with Less than 100 Soil Series

Figure 6. Vesser Soil Series – a. Soil Landscape, b. Soil Profile

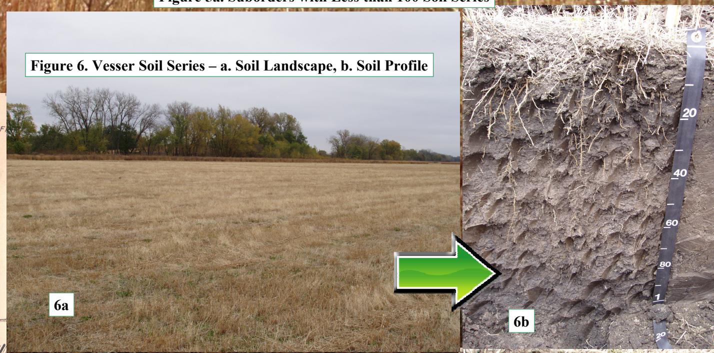
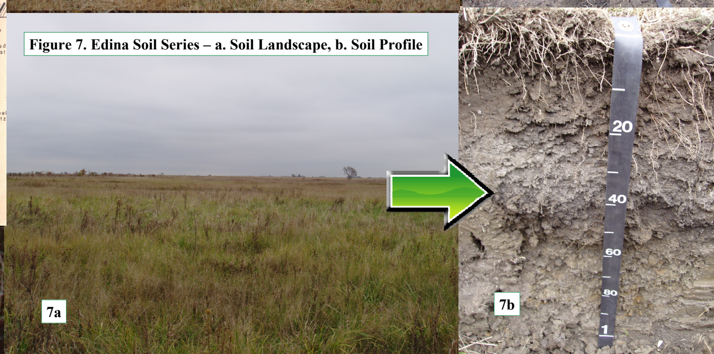
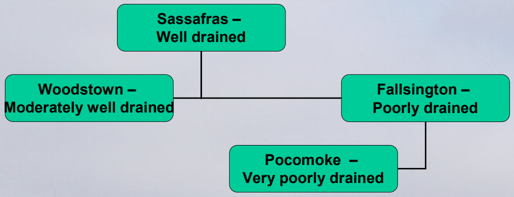


Figure 7. Edina Soil Series – a. Soil Landscape, b. Soil Profile



Geographically Associated Soils – Sassafras Drainage Catena

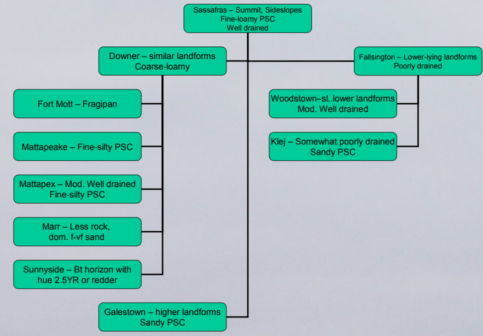
(Fanning et al., 1973)

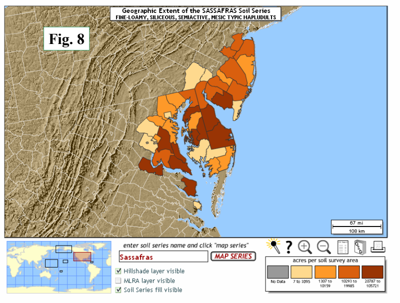


GEOGRAPHICALLY ASSOCIATED SOILS:

Downer soils--have a coarse-loamy particle-size control section, on similar landforms
Fallsington soils--poorly drained, on lower-lying landforms
Fort Mott soils--have a fragipan, on similar landforms
Galestown soils--have a sandy particle-size control section, on higher landforms
Klej soils--somewhat poorly drained and have a sandy particle-size control section, on lower-lying landforms
Marr soils--have on a weighted average, less rock fragments in the particle-size control section and the sand fraction is dominantly fine or very fine sand, on similar landforms
Matapeake soils--have a fine-silty particle-size control section, on similar landforms
Mattapex soils--moderately well drained, have a fine-silty particle-size control section, on similar landforms
Sunnyside soils--have a Bt horizon with hue of 2.5YR or redder, on similar landforms
Woodstown soils--moderately well drained, on slightly lower-lying landforms

Geographically Associated Soils – Sassafras Soil Series





GEOGRAPHIC SETTING:

Soil Series – SASSAFRAS

Landscape: Coastal Plain
Landform: Summits and side slopes
Elevation: 35 to 330 feet
Parent Material: Sandy marine and old alluvial sediments
Geographic Extent: See Figure 8

Figure 9. Block Diagram of Sassafras-Woodstown-Fallsington Soil Association

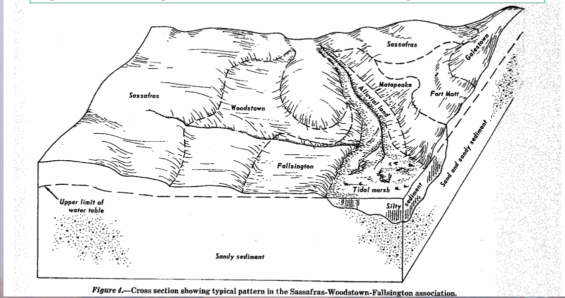


Figure 4.—Cross section showing typical pattern in the Sassafras-Woodstown-Fallsington association.

Figure 10. Pedon Concentrations of Soil Organic Carbon (SOC, kg/m³)

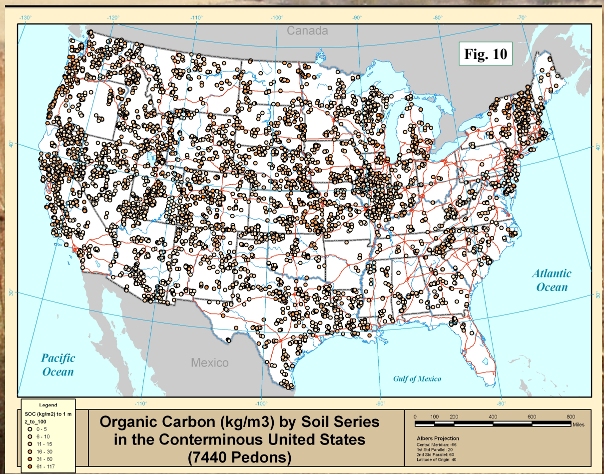
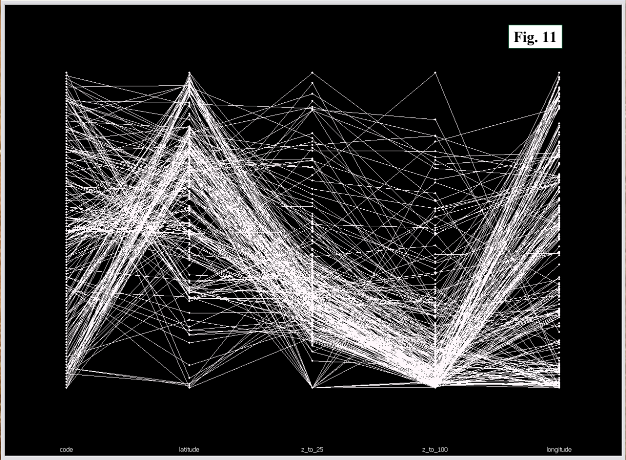


Figure 11. Parallel Coordinate Plot of SOC GT20 with latitude, longitude and depth (25 vs. 100 cm).



DISCUSSION

Photographs of representative soil profiles (where available) and associated landscapes for each Soil Series help illustrate key morphological criteria for distinguishing soils. Soil profile photographs are distributed among various Internet sites (e.g., http://soils.usda.gov; states and land grant universities; SSSA Division S-5 web page; J. Kelley's soil survey photography document, D. Crouse's soil photo library at http://photos.soil-science.info/; and others).

Soil databases linked to GIS tools provide opportunities for exploratory spatial data analysis and data visualization which may reveal unknown geographic patterns (Fig. 10) and also provide information on geospatial distribution and data analysis (Figs. 12, 13). Parallel coordinate plots (Figs. 11, 14) allow visual examination of multivariate relationships such as correlations (e.g., "flat" lines show strong correlations) and higher dimensional clustering (e.g., lines grouped at axes).

Figure 12. 266 Pedon Locations with SOC Greater Than 20 kg/m³

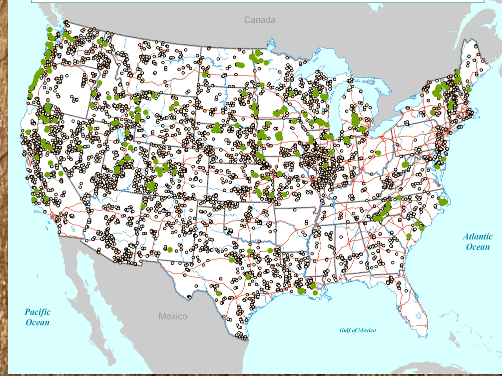


Figure 13. Scatterplot Matrix of SOC Data for 7,440 Pedons.

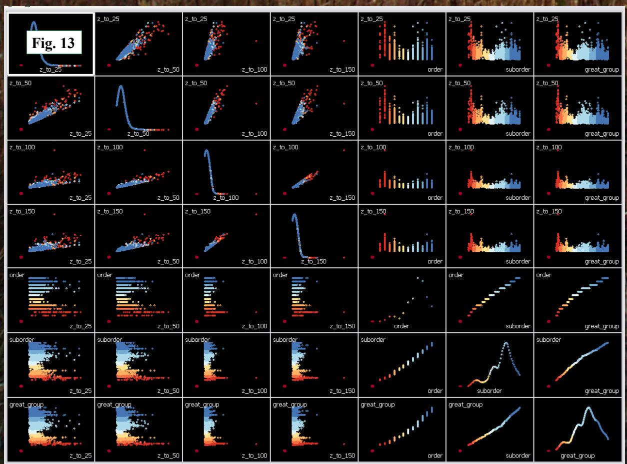
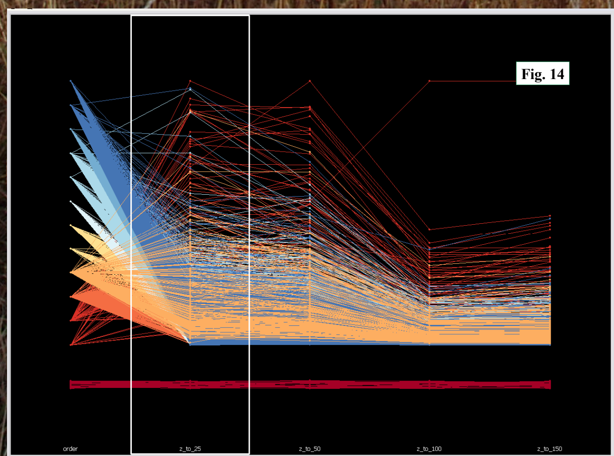


Figure 14. Parallel Coordinate Plot of SOC for 12 Soil Orders 4 depths (25, 50, 100, 150 cm).



SUMMARY

Sufficient information exists to begin development of customized field guides and, concurrently, continue work to develop the missing information such as the soil photos and landscape models databases.

A comprehensive digital library with photographs (both profile and landscape) for all Soil Series in the United States would be compiled as an educational tool and natural resource database.

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