



Soil maps of Wisconsin

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ABSTRACT

Legacy soil maps are an important input in digital soil mapping. This paper traces how reconnaissance soil maps in Wisconsin evolved between the 1880s and the present with some discussion on future directions. The first soil map in the USA was made in Wisconsin by the geologist T.C. Chamberlin in 1882. The second soil map of Wisconsin was made by A.R. Whitson in 1927, and the third by F.D. Hole in 1976. Soil texture and physiography were the major diagnostic mapping criteria. As more detailed county soil surveys were completed and knowledge of the soils increased, a higher level of detail can be observed on statewide soil maps. The detailed county soil maps were digitized in the 1990s and early 2000s and have been used in a wide range of studies and applications (e.g. agriculture, forestry, landscape architecture, and human health). In the 1990s, soil scientists transitioned from mapping on paper copy aerial photos to digital procedures. This change coincided with the development of digital soil mapping, and the introduction of several new observational techniques (GPR, EMI, and cone penetrometer). These modeling and observational tools continue to be used to evaluate small areas, but have not yet become widely used for current soil mapping activities.

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1. Introduction

Mapping of soils has been one of the challenging and thought-provoking aspects of the soil science discipline. The process of developing a soil map forces one to understand the fundamentals of soils, how they were formed, occur across the landscape or the globe, and how they might respond to use and management. Soil mapping also aims to unravel deficiencies in our understanding of soil properties and processes—both in time and space. Globally, about two thirds of the countries have been mapped at a 1:1 million scale or larger, but more than two thirds of the total land area has yet to be mapped even at a 1:1 million scale (Nachtergaele and Van Ranst, 2003). Most of the existing maps were made during soil surveys conducted after the Second World War and up to the 1980s. There are great differences between countries in the status of mapped areas (extent, scale) but national coverage of exploratory soil maps (> 1:250 000) is generally higher in the richer countries (Hartemink, 2008).

From the inception of the discipline, soil science in the USA differed from soil research conducted in Russia and Europe (Hartemink, 2002). In the older and long-settled areas of Western Europe farmers had learned much about their soils by trial and error (Kellogg, 1974). Possibilities for extending the farmed areas were limited as the population was relatively dense (Bouma and Hartemink, 2002). So, in Western Europe research interests focused on how to improve the soil conditions of existing fields. In the USA and the Russian Empire, there were large areas of soils that could be used for agricultural expansion. Here the questions

centered on determining what soils were present, how to select those most responsive to management and how to develop farms to maximize soil potential (Kellogg, 1974). As a result, there was a need for detailed soil mapping and a better understanding of soil forming processes so that soil patterns and distribution could be predicted and mapped more accurately. Large contributions were made by the Russians V.V. Dokuchaev, P.A. Kostychev, N.M. Sibirtsev and by C.F. Marbut, E.W. Hilgard amongst others (Jenny, 1961; Krupenikov, 1992). That understanding formed an important base for the development of soil mapping, which was mostly developed in the USA and Russia, though along somewhat different lines (Simonson, 1989).

Agricultural and rural development in the USA was unevenly distributed, and related to the ease of settlement, abundance of natural resources and progress in development of roads and railways. The lands of the state of Wisconsin had been occupied by humans for thousands of years when the first French explorers arrived in 1634. Fur trade was the main interest of the French, and later the British colonists. Settlement was delayed by wars, but a large number of immigrants came in during the lead mining era (the “gray gold”) in the southwestern part of the state in the 1820s and 1830s (Campbell, 1906; Schafer, 1922). By the 1850s both the fur trade and lead mining declined, railroads were opened and a large number of immigrants came from the Eastern United States (New England, New York), and from Ireland, Norway, and Germany. Wheat was the primary crop grown in addition to tobacco and cranberries. Diseases and low wheat prices forced the settlers into dairy farming and Wisconsin became the leading producer of dairy products in the USA in 1915 (Whitson, 1927). Scandinavians conducted extensive logging operations in the northern part of the state in the 1870s through the 1890s. Overall, agricultural development in Wisconsin was slower

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Fig. 1. Soil map of Wisconsin compiled by Chamberlin (1882). Legend in Table 2.

compared to states to the west that had less forest (Whitson, 1927). The University of Wisconsin was established in 1848 and the school of agriculture started the first agricultural research projects that were mainly focused on dairy farming. The interest in soils initially came from

geologists and followed by F.H. King, who became the first professor of agricultural physics (Beatty, 1991).

In the 1820s government surveyors entered Wisconsin and they made the first detailed examination of the land (Schafer, 1922). They recorded

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