

# Down to Earth: Historians and the Historiography of Soil Knowledge (1975–2011)

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At the end of the nineteenth century, the scientific discipline of soil science originated from two independent natural sciences: agricultural chemistry and geology. From the 1930s onward, the field of soil science grew strongly. Various subfields, such as soil fertility research, soil mapping and soil classification, advanced greatly after World War II. As of 1900, the first histories of the discipline began to appear. Soil scientists with an interest in history, described the emergence and development of soil science to legitimize and promote their field. Only from the 1970s onward, professional historians took an interest in agricultural science and subsequently in soil science. Science and agricultural historians pioneered in this historiography, but soon environmental historians joined them and finally different interdisciplinary works were completed.

This paper aims to study the way professional historians have dealt with the history of soil knowledge. It gives an overview of the development of soil knowledge historiography through a critical discussion of the English language literature. The following questions will be answered: Who took an interest in this subject and why? Who are the most prominent historians in the field? How do historians approach the subject? What questions, problems and hypotheses do they present, and what is their goal? The answers to these questions may lead to new research venues.

**Keywords:** Historiography, Soil Science, Twentieth Century, Agricultural History, Environmental History

## Introduction

Scientists justly state that the history of soil research has largely been one of soil use related to agriculture. Indeed, soil fertility and the food production associated with it are of major importance to human survival. However, soil has evidently had an impact on non-agricultural subjects as well. As Eric Brevik and Alfred Hartemink wrote:

“Soil serves as the basis of construction works, it is closely tied to worldwide climate change, it is an inherent component of our planet’s environment and it supplies raw materials. The history of soil science is not only related to agriculture, but also to the economy, politics, scientific developments and to environmentalism.” (Brevik, Hartemink, 2010).

Although people strongly depend on soils, as most of our food comes from plants grown in it, it took a relatively long time before the scientific discipline of soil science was established. Its origin and development lie in the nineteenth century but it was only founded by the beginning of the twentieth century. As of then, soil scientists began writing the history of their discipline. Historians, on the other hand, only began to show an interest in history of soil knowledge by the mid-1970s. This development was also fairly common in other scientific disciplines: first came specialization and later historians started to take an interest. Moreover, the delayed interest from historians can also be due to the difficulty of the subject: most historians are not familiar

with soil science and are not aware of how soil scientists work. Richard W. Unger, a historian at the University of British Columbia, reports in a HPSSS<sup>1</sup> Newsletter:

“For historians, there is a fear that the history produced by scientists, and that would include soil scientists, will be condescending or patronizing. [...] On the other hand for soil scientists the history of science done by historians can appear to be naïve and even inaccurate because of a lack of knowledge of the science” (Unger, 2007, p. 2).

Better collaboration between historians and soil scientists may be the answer to this divided approach.

This paper studies the historiography of soil science, including the history of soil science subfields, soil knowledge in general and the relation between soils and society, written by professional historians. Although various soil scientists have written the history of their discipline, this paper only discusses the historiography made by historians, because it aims to examine the way historians in particular deal with the subject of soils and soil knowledge. Moreover, this article is limited to papers and books specifically about the history of soil science and soil knowledge. General agricultural science histories will not be discussed, unless they especially focus on soil research. This for example, is the case of Margaret Rossiter’s *Emergence of Agricultural Science* (Rossiter, 1975). In this work, she includes the emergence and downfall of soil analysis between 1840 and 1880.

This article aims to give an overview of the developments in soil science historiography, by giving a critical discussion of the available English<sup>2</sup> language literature. Although this discussion includes important and well-known English language works on the subject, it does not claim to provide an exhaustive list of all historical works on the subject matter. It must be mentioned that the article does not include the vast stratum of Russian and German language literature. A similar study with focus on these languages would be an important complement to this article.

The English works included here have been selected, on the basis of the information they can provide on the way historians report on soil knowledge history. Issues that need to be addressed in this analysis involve the beginning, development and reasons for soil science history, identification of the historians working in this discipline, their approach, research questions, hypotheses and goals they focus on.

This analysis provides trends in soil knowledge history, it may expose current weaknesses in soil science historiography and it seeks to identify new venues for research for both historians and soil scientists.

The first part gives a general history of soil science, linked with the emergence of soil science history as written by soil scientists themselves. This account is divided in two time periods, before and after World War Two. In the second part, the historiographical works on the subject, written by historians, are discussed. This section is divided into three parts: the initiative of the agricultural historians in the 1970s and 1980s, the turn of the environmental historians in the 1990s, and the emergence of the interdisciplinary collaborations at the turn of the century. Finally, concluding remarks are given on the current ‘state of the art’ in soil knowledge history and new venues for research are offered.

<sup>1</sup> History, Philosophy and Sociology of Soil Science Newsletter of the Commission on the History, Philosophy and Sociology of Soil Science (International Union of Soil Sciences).

<sup>2</sup> I chose to examine only the English language papers, as English is one of the principal languages of international communication and these works are widely available.

## History of Soil Science and the Emergence of its Historiography conducted by Soil Scientists (19<sup>th</sup> and 20<sup>th</sup> century)

### *Before 1945: Institutionalization of Soil Science and its Early Historiography*

Most nineteenth-century agricultural chemists studying soils related their research to soil fertility and agricultural production. They were inspired by the ideas of Justus von Liebig on soil fertility and crop production as proposed in his *Die Organische Chemie in ihrer Anwendung auf Agrikultur und Physiologie* (Liebig, 1840). Another group of scientists, geologists, studied soils as natural bodies worthy of study as such. Some geologists, referred to as 'agrogeologists', linked their field to the agricultural potential of soils just as the agricultural chemists did. In the U.S., Eugene Hilgard contributed the concept of dynamic soils with his *Report on the Geology and Agriculture of the State of Mississippi* (Hilgard 1860). Russian early soil scientists, led by Vasilii V. Dokuchaev in the 1870s and 1880s, recognized that each soil was a natural body with its own morphology. In this period, educational and governmental agricultural experiment stations were founded all over the western world to support soil fertility research, soil mapping, and soil classification.

At the end of the nineteenth century, soil science as an independent scientific discipline and the concept of soil as an independent natural body was born in Russia and the U.S.A. In Western Europe, soil was mostly studied in function of plant growth and soil fertility. The land area was used for agricultural benefits and farmers had learned much about their soils by trial and error over several centuries (Kellogg, 1974, p. 348). The United States and the Russian Empire had large areas of soils that could be used for agricultural expansion. Questions were centered on finding out what soils they had, how to select those responsive to management and how to avoid waste of effort in farm development (Kellogg, 1974, p. 348). Hence there was a need for soil mapping and a better understanding of the soil concepts (Van Baren et al, 2000, p. 3). European scientists followed suit, and by the beginning of the early twentieth century soil science was fully established and institutionalized. The first successful attempt to uniformity came in 1909 when the First International Conference of Agrogeology was held in Budapest. The Hungarian Geological Institute invited soil and agricultural experts to an international conference on the occasion of its fortieth anniversary. The scientists discussed the contemporary various systems of nomenclature, classification, and cartography of soils. Nine nations (Germany, Austria, Belgium, Hungary, Italy, Norway, Russia, Sweden and the United States) were represented. Thus, deliberation on soil science started. The goal of these conferences was to exchange soil knowledge and ideas. This was further extended through the newly established journal *Internationale Mitteilungen für Bodenkunde*, the second soil science journal. In 1899, the Russians pioneered: the first journal for soil science was *Pochvovedenie* (*Почвоведение, Soil Science*). In 1916 the Americans offered a third journal, named *Soil Science*.

Fifteen years after the first Agrogeology Conference was held a new society of soil scientists emerged in Rome at the fourth conference of Agrogeology (1924): The International Society of Soil Science (ISSS), which became the official organization for the promotion of soil science and a symbol of international cooperation.

At the end of the nineteenth century, soil scientists began writing down the history of their discipline. Thus, from the very beginning of the existence of soil science, Russian soil scientists started to publish soil science histories in the journal 'Pochvovedenie'. European and American soil scientists soon followed. They were evidently interested in the development of their own, relatively new scientific branch and a proper history of the discipline may well have been considered as further legitimization for their newly created science.

Before World War Two, two German scientists took it on themselves to write the history of soil science up to 1900. In 1914, O. Neuss published an article in the fourth volume of the journal *Mitteilungen der Bodenkunde* (Neuss, 1914). For the first time in history, attention was given to the general, international historical development and history of soil science. In 1929 the German soil scientist Edwin Blanck edited *Handbuch der Bodenlehre* (Blanck, 1929), a textbook in which a chapter was devoted to a historical overview of soil science, from ancient times to 1900 (Giesecke, 1929). The author of this chapter was the agricultural chemist and soil scientist, Fritz Giesecke. His title seems to suggest that he was inspired by the Neuss' earlier publication.

The urge of soil scientists to legitimize the field of their study might explain why they went as far back in time as ancient Greece (776 B.C. — 323 B.C.) in describing the history of soil science, despite the discipline's young age. They wanted to prove that their field of study was worthwhile and timeless. Furthermore, soil scientists paid much attention to biographical material. They devoted many articles and papers to the 'heroes' of their own scientific discipline (such as Eugene Hilgard, Vasili Dokuchaev, Curtis Marbut and Justus von Liebig). Historiographically, this can be seen as a result of the 'Great Man Approach', which was fashionable in nineteenth-century historiography and philosophy.

As for historical notes on soil science and its subfields, it is striking that there is a difference between Europe on the one hand and the USSR and the US on the other. European soil scientists were mostly from the agricultural chemistry branch, which meant they tended to write more on fertilizers, soil chemistry and soil fertility. In the other continents soil scientists undertook more research on soil physics, soil classification and soil mapping. This does not mean, however, that European scientists were not occupied with soil classification and soil mapping.

Especially after 1930, soil research has gained considerable momentum worldwide. The Great Depression and the U.S. Dustbowl stimulated demand for soil information in general. Moreover, due to the strongly growing fertilizer industry, the need for information and advice from farmers and land managers was stimulated by agronomists. Subsequently, soil science and its subfields (such as soil physics, soil fertility, soil microbiology, plant nutrition, soil mapping) gained increasing relevance (Miller, 2002, p. 654). In this period, soil science institutions sprung up like mushrooms in various countries. Unfortunately, the Second World War interrupted the first growth spurt of the discipline.

### ***After 1945: The Flourishing of Soil Science and the Environmental Turn***

After World War II, soil science flourished and began to be more fragmented and multi-disciplinary. National and International Conferences on the subject matter were held, scientific societies were formed and more and more institutional organizations were founded.

By 1950, the major paradigms of soil science had been established. The foundation of pedogenesis concepts by Dokuchaev and Hilgard, the chemical basis of plant nutrition by Sprengel and von Liebig, the theoretical basis of soil physics, the characterization of soil mineralogy and the basis of soil microbiology were established. After 1930, the first Journals of soil science<sup>3</sup> were supplemented by a variety of scientific journals<sup>4</sup>. Altogether, there was a clear need for soil science after World War II: the number of text books and scientific articles boomed. Both agriculture

<sup>3</sup> Pochvovedenie(1899), *Mitteilungen der Bodenkunde* (1909), *Soil Science* (1916).

<sup>4</sup> Such as: *Soil Science Society of America Journal* (1936), *Journal of Soil and Water Conservation* (1946), *Plant and Soil* (1948), *European Journal of Soil Science* (1949), *Soil Science and Plant Nutrition* (1955), *Canadian Journal of Soil Science* (1957), *Soil Survey Horizons* (1960), *Geoderma* (1963), *Soil Biology and Biochemistry* (1967), *Communication in Soil Science and Plant Analysis* (1969),

and science came out of the war with a higher status than they had before (Tinker, 1985, p. 2). Agricultural production increased and optimism and positivism characterized the 1950s. Most soil research still occurred in function of increasing crop yields. Advances in technology, such as isotopic tracers, satellites, fractal mathematics, geo-statistics, biotechnology, computers and sophisticated software became powerful tools for soil scientists. During the 1950s and 1960s soil science peaked, the number of soil scientists increased strongly. They received extensive research funding and published ample papers and articles in a multitude of new soil science journals.

As a reaction to the environmental movement of the 1960s, and the 1970s, soil scientists began to develop soil research for other purposes as well, such as soil conservation, environmental protection, recreation, construction, engineering and wildlife. In the 1980s, the study of soils became more and more interdisciplinary and increased attention to environmental issues allowed soil scientists to reinvent themselves and to embrace a broader array of concerns (Helms, 2000a, p. 535).

In this period, the western world witnessed a clear growth in the publication of historical soil science papers as well. Significant in this development was the publication in 1981 of the monograph on soil science history of the Russian soil scientist Igor Krupenikov (Крупенников, 1981; Krupenikov, 1992). His overview emphasized Russian scientists and the evolution of soil knowledge from ancient civilizations (Greece and Rome, the Orient) to the modern times of Western Europe and the former USSR. He studied the history of ideas on soils in 19<sup>th</sup> century Europe and in Russia and he dealt separately with the beginning of soil genesis research. A discussion was provided on the different trends in soil science over the centuries. In 1989, Krupenikov's French colleague, Jean Boulaïne, published a similar textbook entitled *Histoires des pédologues et de la science des sols* (Boulaïne, 1989). Russian soil scientists have a remarkable tradition of writing large historical contributions on soil science history. In 1999 Sergey V. Zonn published a book on the history of soil science in Russia in the 20<sup>th</sup> century (Зонн, 1999), and in 2003 Igor V. Ivanov published his book on the history of national soil science (Иванов, 2003).

Earlier, soil scientist Dan H. Yaalon discussed (Yaalon, 1964) local and national differences in soil research. He can be considered as an international researcher, reaching beyond the European, Russian and American borders. Yaalon was born in former Czechoslovakia in 1924 and studied in Copenhagen. In 1948, he became a citizen of the new state of Israel, where he obtained his PhD in Soil Science. Subsequently, he was a postdoctoral fellow at the Rothamsted Experimental Station in England and a UNESCO fellow in Tashkent in the former USSR. He became professor at the Hebrew University in Jerusalem and he also lectured at several universities all over the world (Gabriels, 2000, p. 143). Who would be better placed to write about 'national characteristics'? However, it is not his 1964 article that gave him place in the historiography of soil science, but his long-term interest and activities in the field and, more particular, its history (Gabriels, 2000, p. 143). Moreover, in 1982, he founded the *Committee on the History, Philosophy and Sociology of Soil Science* within the International Society of Soil Science (ISSS). This working group shows that from the 1980s onwards, soil science history was 'proto-institutionalized'. Only in 1997 did a real institution emerge, when the 'Committee' became an official *Commission on the History, Philosophy and Sociology of Soil Science* within the Division of History of Science of the International Union of the History and Philosophy of Science (IUHPS). This promotion too was an achievement of Professor Dan H. Yaalon.

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Catena (1970), Fertilizer Research / Nutrient Cycling in Agroecosystems (1980), Soil and Tillage Research (1980) and Biology and Fertility of Soils (1980).

## Historians and Soil Knowledge Historiography (1975–2011)

### *The Initiative of Agricultural Historians (1970s and 1980s)*

As of the 1970s 'agricultural science histories' started to appear in America. These historiographies can be useful to study the history of soil science. Especially Margaret Rossiter's *The Emergence of Agricultural Science: Justus Liebig and the Americans, 1840-1880* (Rossiter, 1975) and Rachel Laudans *From Mineralogy to geology: the foundations of a science* (Laudan, 1987) may serve as models for the earlier history of (agricultural) science.

The first association of agricultural historians was founded in 1919 in Washington near the U.S. Department of Agriculture. The fact that the U.S. were the first in this respect was probably due to the major role agriculture had played from the very beginning of colonization (Van Molle, Thoen, 2006, p. 15). In 1927, *Agricultural History* was launched, a multidisciplinary journal at first but dominated by historians after the Second World War (Hurt, 2004, p. 3).

Agricultural and science historians were the first to enter the field of soil science history. In their study of agriculture and agricultural science they gradually included research on soils, soil fertility and soil science.

In Europe, the organization of agricultural history studies began in earnest after the Second World War. The Netherlands took the lead in 1939 with the establishment of a private 'Study circle for the history of agriculture'. In the 1950s, such societies arose in Great Britain and Germany as well (Van Molle, Thoen, 2006, p. 15). Further proof of non-historians writing agrarian history is provided by two books on the history of agricultural science by the British scientists Sir John Russel and G.W. Cooke (Russel, 1966; Cooke, 1981). The book of the latter includes papers on plant breeding, crop production, horticulture, soils and fertilizers, and others aspects of agricultural science. Both books are of great use for soil science historians.

Especially Margaret Rossiter's *The Emergence of Agricultural Science: Justus Liebig and the Americans, 1840–1880* (Rossiter, 1975) inspired other historians to undertake studies of agricultural chemistry. Rossiter argued that the history of applied sciences had been neglected, although, in her opinion, such a study reveals far more of a society's attitude toward science than the study of the more abstract pure sciences does. Furthermore, she states that the study of agricultural chemistry is of great interest, as it encompasses both pure and applied science.

The picture that emerges in Rossiter's monograph (1975, p. XI) shows science's role in the mid-nineteenth century U.S. to be strongly penetrating and active, but also very complicated and uncertain. She focuses on three events in the history of science in America: the reception of the works on agricultural chemistry by the German scientists Justus von Liebig during the 1840s, the sudden craze over soil analysis and subsequent reaction against it, and the importation of the first chemical research laboratories and agricultural research stations from Germany into the United States (Rossiter, 1975, p. XII). The story involves aspects of social, agricultural, educational and science history, which provides a broad picture of the greatly expanding role of science in America between 1840 and 1880, against the background of the overall decline of agriculture in the eastern US after 1830. Poor soil and Western competition caused continuing problems for Eastern farmers in this period, despite their adjustment efforts. If they wanted to be market proof, they would have to specialize in certain crops and adopt new techniques, such as the use of chemical fertilizers. Her account also shows that scientists, who were seen as forces of progress and who criticized farmers for failing to adopt the latest ideas, were confronted with the limits of what was possible and were even forced to revise their earlier optimism. After 1855, they began to stress the need for long term experimentation as the only hope for improvement. The continuing problem for agricultural scientists was reconciling the complexities of agricul-

tural science with the public demand for practical benefits. In the 1870s and 1880s, this was institutionalized in agricultural experiment stations, which became a source of fruitful agricultural innovation. According to Rossiter, agricultural chemistry showed its most important and long-lasting influence in this period of institutionalization (Rossiter, 1975, p. XIII).

Rossiter examined the literature on the German influence on American universities and found it to be quite general. She also argued that it failed to consider the important financial side of the growth of laboratories and universities in the nineteenth century (Rossiter 1975, p. XIII). Finally, she showed that only three men were active in the agricultural chemistry movement in nineteenth-century America: Eben Northon Horsford, John Pitkin Norton and Samuel W. Johnson. She studied their different experiences to learn something on the difficulties that they faced, when they tried to import foreign ideas and institutions into the VS between 1840 and 1880. She concludes that the nineteenth century was formative for agricultural science. New fields emerged, old fields were transformed and new institutions were established. Justus von Liebig attracted great attention to chemistry and agriculture and stimulated lasting changes (Rossiter, 1975, p. 172). This resulted in American farmers turning to agricultural chemistry. The establishment of an institution network became the pride of twentieth-century American science. Although Rossiter did not examine the history of soils or soil science as such, she contributed a basic work on pre-soil science developments in agricultural chemistry and on soil analysis evolution in the nineteenth century.

From 1975 onwards, a few articles on the same subject were published. In 1987 Alan I. Marcus, professor in history of science, technology and agriculture published an article on nineteenth century U.S. state regulation of fertilizers by chemists in the journal *Agricultural History* (Marcus, 1987). The paper discusses the never-erring science idea of the 1870s. With the emergence of agricultural chemistry in agriculture, character or reputation began to be replaced by expertise (Marcus, 1987, p. 48). Chemists came to evaluate fertilizer effectiveness. Marcus argues that while the artificial fertilizer industry assumed importance in the 1850s, a crusade of agricultural chemists had begun. Those agricultural chemists fought commercial fertilizer manufacturers, accusing them of selling adulterated products. They claimed that a fertilizer's potential worth could only be determined by chemical means. From this discussion the function of state chemists was created. The establishment of 'state chemist bureaus', later followed by state-funded experiment stations, marked the scientists formal entry into agriculture (Marcus, 1987, p. 51). By reaction, the fertilizer companies employed their own chemists. The result was that in 1884, state chemists created a national organization (the Association of Official Agricultural Chemists) with the aim to set uniform standards for fertilizer control to convince the public of their reliability. In the following years they even went further and wanted to control all agricultural industries and all farm products. Marcus concludes that state chemists laid the foundation for the more familiar regulatory American agencies of the twentieth century (Marcus, 1987, p. 73).

A second article was written in 1988 by historian M.R. Finlay and this seems to be an answer to the previous article and the work of Rossiter. It is entitled *The German agricultural experiment stations and the beginning of American Agricultural research* (Finlay, 1988). The article discusses the creation of the first German agricultural experiment stations (1850s), originating from the wish to increase yields through comparative investigations. The German model of experiment stations became the standard for the American model. Finlay first describes the establishment of German experiment stations, where researches performed soil studies. He also mentions that Samuel W. Johnson, the foremost American proponent of experiment stations, reported from Germany to an American journal that the station workers were conducting basic

scientific research. He did not mention research addressing farmers' specific questions about crops and fertilizers. The author states Johnson's message would not have appealed to German founders of the experiment stations because they wanted chemistry to be useful to farmers. It was only after the 1850s that the chemists' questions replaced those of the farmers because more funds were provided then for scientific research (Finlay, 1988, p. 50).

The history of soil survey, soil conservation, and soil erosion has been studied extensively by agricultural historians, especially in the United States. In 1991, agricultural historian Douglas Helms wrote an article entitled *Eroding the color line: The Soil Conservation Service and the Civil Rights Act of 1964* (Helms, 1991). It is an institutional history of the Soil Conservation Service of the U.S., focusing on the career of John Maynard Jones, the first African American soil conservationist. He describes the first black professionals working in the Soil Conservation Service. He also examines the efforts in response to the Civil Rights Act of 1964 to expand equal opportunities for employment and equal access to government programmes. In another article, Helms discussed the position of the women working at the Soil Conservation Service (SCS) (Helms, 1992), providing a very general description of the first women's work for SCS in the United States and of the evolution of their number and their functions.

Anne Efland, also an American agricultural historian, published a paper on the U.S. Soil Survey Program in *Agricultural History* (Efland, 1992). More specifically, she reports on soil geomorphologic studies describing soil types and land use recommendations. To obtain scientific knowledge on soil formation, the Soil Survey supported a research programme in conjunction with its mapping activities. Soil geomorphology examines the relation of soils with the geomorphology of an area. Pedologists and geologists conducted this type of research in the field by mapping land surface and its underlying geology. This subdiscipline only appeared in the 1930s. Efland describes the origins of interest in soil geomorphology and then follows the fortunes of this line of research in the soil survey program from its early accomplishments in the 1930s to the 1990s. She comments on the significance of the research for improved land use and for the development of a more precise soil classification system. She also describes the changes in soil geomorphology and in the Soil Survey Program of the Department of Agriculture over all these years.

In the same issue of *Agricultural History* another article was published on soil conservation: *Twentieth-century tenancy and soil conservation: some comparisons and questions* (Harbough, 1992). William Harbough also examined the link between farm tenancy and soil erosion in the US however in an international context. In general, he argues that tenants only occasionally 'paid any attention' to maintaining fertility. He states that only around 1930 did concerns about soil erosion begin to surface. He compares owner-operated and tenant-operated land. Tenants depleted the soil more rapidly, according to commentators, and lacked capital to diversify crops. Land prices reinforced these attitudes, due to one year leases. The key question Harbough asks is who invested in conservation measures. He concludes that the primary cause of erosive soil loss was row crops and small grains on erosion-susceptible land, no matter by whom it was cultivated, and that compensation for improvements would not have changed matters.

A third article in *Agricultural History* on soil protection was from the English historian C.A.M. Duncan, who wrote about legal protection for the soil of England in the nineteenth century (Duncan, 1992). In his opinion, very little attention has been paid to the details of English agriculture's remarkable socio-legal arrangements. His paper proposes a new overall context in which to review much of the historiography so far as well as to discuss the absence of relevant source material on attitudes to environmental aspects of socio-legal arrangements. First, he describes the theoretical vantage-points from which this absence of data was detected. Duncan criticized the methods of agricultural history, stating that in a general agricultural history the institutional context in



which agronomic decisions are taken should be characterized first. According to him it tends to be treated as an optional extra piece of information. The situation in the 1930s is a good example of this institutional context. Due to the Depression agriculture was driven out of the market system in the 1930s and was hooked up on state life-support systems in every single corner of the world. He believes the English agricultural law arrangements worked in a way that favored the long-term health of the soil through catering to the long-term interests of the landowning class. Hence, he concludes that the law aimed to protect the land on behalf of its owners and their heirs. He studied the English legal system for any changes at the end of the 19<sup>th</sup> century, and in what way these changes had an effect on agriculture. In his view, the casualty of socio-legal changes was the category of explicit land-protective institutions. He finally concludes that the eighteenth-century approach to farming was what should have been preserved. Its agronomy was sounder and its socio-legal institutions were more reasonable because of legal land protection, a project that was abandoned at the end of the nineteenth century.

A few American agricultural historians also contributed summary reviews on soil science history in science encyclopedias. These encyclopedic contributions are worth considering because only they discuss the historiography of soil science conducted by historians, albeit in a very limited way.

Douglas Helms contributed a paper on American soil science in *The History of Science in the United States, an Encyclopedia* (Helms, 2000b). For the same encyclopedia, historian Mark Finlay wrote a piece on 'Agricultural Chemistry' (Finlay, 2000). He notices that "historians of agricultural chemistry have generally focused on the emergence of the subdiscipline, which illustrates well the process of professionalization in the nineteenth-century history of American Science. Others have examined the ideas, including religious ones, that convinced some Americans to study agricultural chemistry in the nineteenth century" (Finlay, 2000, p. 14). In his view, "more recent developments have received less attention, though, largely because the notion that chemistry provides firm answers to agricultural questions has been replaced by more holistic analyses of agricultural phenomena" (Finlay, 2000, p. 14).

Agricultural historian Anne Effland published a contribution on 'soil science history' to *Sciences of the earth. An Encyclopedia of Events, People and Phenomena*. (Effland, 1998). She states that "few historians have written about history of soil science and much historical work remains to be done on the field of soil science. Historians might fruitfully pursue such foundation work as biographical studies of individual scientists and historical research on the theoretical and institutional development of the discipline and its subfields". In her opinion, "there is a need to pull together work on the different subfields and place them in the context of the larger scientific, social, economic, and political developments of the nineteenth and twentieth century" (Effland, 1998, p. 771). Because there are but few examples for the twentieth century history, she concludes that "historical study of soil science remains a wide open field" (Effland, 1998, p. 771).

### ***Environmental Historians and their Focus on 'Soils and Societies' from the 1990s onward***

In the 1980s, some American historians were pioneers of a relatively new historical sub-field: environmental history. It was a product of the environmental movement of the 1960s and 1970s and emerged during an era of heightened concern over the quality of the environment and threats to nature and human health (White 1985). It took a while before these environmental historians began studying the history of soils and soil research. Only at the end of the nineties and mostly after the start of the new millennium the number of environmental historians studying this subject increased. They especially focused on the relation between humans and soils.

John McNeill and Verena Winiwarter, eminent environmental historians, argue that "historians (even environmental historians) have scarcely recognized that all over the world, long term eco-

conomic trajectories, the ebb and flow of political power, the waxing and waning of populations, rested on the successful management of soil nutrients" (McNeill, Winiwarter, 2006, p. 2). Some historically-minded soil scientists did investigate human-soil relations before environmental historians took their stance in the debate (Hyams, 1952; Lowdermilk, 1953; Hillel, 1991). According to McNeill and Winiwarter, "historians typically regard soils as fixed features of the environment and therefore background considerations to agricultural and economic history" (McNeill, Winiwarter, 2006, p. 2). Moreover, they state that the environmental historical turn reminds people that "environments are not mere backdrops to the dramas of history, but participants in their own right, interacting with all the others" (McNeill and Winiwarter, 2006, p. 2). This implies that soils have their own natural and human histories.

The book *Soils and Societies. Perspectives from Environmental History* (McNeill and Winiwarter, 2006) treats this human-soil relation from an environmental historical point of view. It draws attention to soil knowledge and its maintenance, transmission and impacts, from the ancient Roman agronomic writers to German agricultural experts. It includes studies on different time scales and different geographic locations. The authors see their work as a step towards a world environmental history of soils. The book can also be discussed in the third part of the article because it is an interdisciplinary collaboration. According to the authors "any approach to the study of humankind and soils requires the methods and insights of multiple scholarly disciplines" (McNeill and Winiwarter, 2006, p. 4). The book includes ten papers, of which two are written by historians: Verena Winiwarter and Frank Uekoetter. Uekoetter's contribution is entitled *Know your Soil: Transitions in Farmers and Scientists' Knowledge in Germany* (McNeill, Winiwarter, 2006, p. 322–340). This interesting paper discusses the agricultural knowledge system. It is an innovative soil research historiography, in which he argues that the environmental problems of industrial agriculture are intrinsically connected to a knowledge system that farmers cannot easily abandon. The key problem, according to Uekoetter, is not a lack of good intentions on the side of the farmers but a lack of knowledge systems (McNeill, Winiwarter, 2006, p. 336). In his view, a reform of the agricultural knowledge system would have to consider ways of incorporating farmers' experiences in a productive way. He questions if the rules of the knowledge society are at odds with the dynamics of nature. In his opinion, the history of agricultural knowledge in the twentieth century shows that an open discussion on the knowledge system of modern agriculture is necessary. Uekoetter also states that the agricultural knowledge society will need to turn into an agricultural learning society (McNeill, Winiwarter, 2006, p. 336). With this paper, the author is one of the first historians dealing with post-war soil knowledge exchange.

Winiwarter's paper entitled *Prolegomena to a history of Soil Knowledge in Europe* (McNeill, Winiwarter, 2006, p. 175–215) aims to introduce the history of soil knowledge as part of agricultural knowledge from antiquity to the fourteenth century. She discusses two examples of how soil knowledge has evolved over time. One is soil terminology, developed in antiquity; the other is the question of 'suitable' soil (McNeill, Winiwarter, 2006, p. 177–178). This Austrian environmental historian is an expert on soil knowledge from antiquity. Since the end of the nineties she has published several articles on this subject in German and in English (Winiwarter, 1997, 2000, 2002, 2005). Furthermore, in collaboration with John McNeill she wrote a paper, which was published in *Science*, on the relation between humanity, history and soil. In short, they discuss subjects such as soil erosion, soil management, soil knowledge and soil/plant nutrients over a broad time scale (McNeill, Winiwarter, 2004). Winiwarter also contributed two articles on the history of soil fertility management (Winiwarter, 1998; Winiwarter, Blum, 2008).

In 2002, the Swedish environmental historian E. Marald (2002) dealt with the subject of agricultural chemistry from an environmental point of view. From the late nineties, environmental history began to take second place, after agricultural history, in dealing with the history of soils and soil science. Marald analyses the arguments of recycling put forth by agricultural chemists in the mid nineteenth century. His study emphasizes how agricultural chemical theories, mainly developed by Justus von Liebig, were connected to larger issues outside the scientific domain. It also investigates how agricultural chemists argued for different kinds of recycling systems. The author concludes with some arguments for the ultimate abandonment of the recycling discourse at the end of the nineteenth century.

Science historian Lloyd T. Ackert (2004) wrote a doctoral thesis on the subject of microbiology history in the nineteenth century. In 2006 he published an article on American agricultural chemistry and organic matter in a Newsletter of the Commission for History, Philosophy and Sociology of Soil Science (Ackert, 2006). In this paper, the author describes the holistic vision of the 'cycle of life' of American agricultural chemistry students. In the mid-nineteenth century, they considered and investigated nature as a circulation of matter through the soil, plants and animals back again into the soil (Ackert, 2006, p. 12). Ackert states that American agricultural chemists subscribed to this new view to reform agriculture through science (Ackert, 2007). One year later, he also published an article in the *Journal of the History of Biology*. It related more with the subject of his PhD-dissertation: *The Cycle of life in Ecology: Sergei Winogradsky's Soil Microbiology 1885–1940*. This time, he explored a new dimension of the emergence of ecology as a discipline in the late nineteenth century. Instead of using the synthesis of Humboldtian botanical geography and Darwinian evolution, he uses Sergei Winogradsky's career and research as a point of departure. The author illustrates the manner in which microbiologists, chemists, botanists, and plant physiologists included the concept of a 'cycle of life' in their investigations. He argues that Winogradsky's personal life is an example of the interplay between Russian and Western European scientific networks and intellectual traditions. The microbiologist developed a series of research methods that translated the concept of a 'cycle of life' into an ecologically conceived soil science and microbiology in the 1920s and 1930s. These methods later captured the attention of an international network of scientists and they also appealed to practitioners at agricultural experiment stations and microbiological institutes in the United States, Western Europe, and the Soviet Union (Ackert, 2007).

Another historian worth mentioning in this overview is Gareth V. Wood from New Zealand. In 2000, he published an article on the national soil survey history (Wood, 2000). A few years later he wrote an article on soil fertility appraisal in early colonial New Zealand (Wood, 2003a). According to the eighteenth-century biometric model, where soil fertility was correlated with tree height, Wood argues that when dense forest cover was found over large areas of New Zealand this created the inaccurate perception that its soils were very rich. This was exploited by the New Zealand Company, the main agency involved in promoting the organized settlement of New Zealand. The author concludes that during the 1840s, the biometric approach to soil fertility appraisal was found to be false, and was replaced by a developing ecological one, which relied on specific plant indicators of soil fertility. In the same year, Wood wrote another article for the *New Zealand Soil News*, on soil analysis in New Zealand before 1880 (Wood, 2003b). And finally in 2004, he published an article on soil fertility management in the *Newsletter of the Commission of History, Philosophy and Sociology of Soil Science* (Wood, 2004).

Furthermore, environmental historian David Moon dedicated an article to Vasili Dokuchaev entitled *The Environmental history of the Russian steppes: Vasili Dokuchaev and the*

*harvest failure of 1891* (Moon, 2005). In his article he examines aspects of the environmental history of the Russian steppes in the long term and in a comparative framework by focusing on the work of the prominent Russian Scientist Vasilii Dokuchaev in response to the drought and harvest failure that afflicted large parts of the steppes in 1891. He considers the environmental history of the Russian steppes as part of the wider history of the interaction between humans and grasslands in temperate climates throughout the world (Moon, 2005, p. 157). He questions how much of Dokuchaev's work on the environment of the steppes has stood the test of time and the rapid progress made by environmental sciences since the 1890s (Moon, 2005, p. 172).

Finally, Anastasia Fedotova, a Russian historian of the Institute for the History of Science and Technology (St. Petersburg) deserves a place here, considering her current study on nineteenth century soil research. Fedotova published an article entitled '*The Origins of the Russian Chernozem Soil (Black Earth): Franz Joseph Ruprecht's 'Geo-Botanical Researches into the Chernozem' of 1866*' (Fedotova, 2010). This paper analyses, amongst other aspects, the controversial scientific study of the origins of the fertile Chernozem of the Russian Empire. She states that Ruprecht's work was based on field work and microscopic analysis of soil samples. He laid the basis for the later work by pioneering soil scientist Vasilii Dokuchaev. The article places Ruprecht's research in the context of contemporary social, economic, and political as well as scientific developments (Fedotova, 2010, p. 271). It shows that in the 1850s and 1860s scholars could declare that the natural sciences were very important for agriculture, although in that period Russian agriculture depended little on the successes of science. She states that the situation only changed in later decades: extensive agricultural developments had their negative consequences and thus, it became clear that agriculture could not develop successfully without the help of natural science (Fedotova, 2010, p. 286).

### ***The Emergence of Interdisciplinary Collaboration around the Year 2000***

In 1997, Dan Yaalon and his colleague S. Berckowicz edited a collection of papers entitled *History of Soil Science: Some International Perspectives* (Yaalon and Berckowicz 1997). The book, comprising a collection of twenty-two papers, presented a wide-ranging international perspective on the history of soil science (Yaalon, Berckowicz, 1997, preface). It was a novelty, because for the first time soil scientists, geologists, geographers and historians worked together on the subject of soil science history, beyond international boundaries. The work was probably the result of the 'Commission of the History, Philosophy and Sociology of Soil Science' and of the interdisciplinary turn of soil science during the eighties. Different branches of exact science and humanities had finally found each other.

In this book, historian Douglas Helms contributed a paper on Land Capability Classification (Helms, 1997). He studied the development of the Land Capability Classification (LCC) which sheds light on several issues such as the relation between the Soil Conservation Service and farmers. It also discusses the various approaches to questions in the field of soil science and soil conservation, and it tries to clarify the connection between bureaucratic politics, science and conservation efforts (Helms, 1997, p. 159). Moreover, the author proves himself as an important historian of soil science. Indeed, he has written various papers on the subject (Helms, 1999, 2000a, 2003, 2008, 2011). When discussing soil science historiography he argued that "viewing the role of soils historically, allows us to see how soil properties interact with technology, markets, and culture. For the students of agricultural history and environmental history, the knowledge provided by the relatively new field of soil science is a boon to understanding historical developments" (Helms, 2000a, p. 723).

In 2002, furthermore, he edited a book on the history of the U.S. Soil Survey: *Profiles in the History of the U.S. Soil Survey*, in cooperation with historian Anne Effland and biologist Patricia Durana (Helms, Effland, Durana, 2002). This multidisciplinary work included several papers on the subject written by geoscientists, biologists, geologists, historians, agriculturists and soil scientists. In the introduction Helms states that “few historians have turned their attention to soil science, though more may be expected in time, as the intriguing connections between soils, the environment, and human history become evident”. The volume examines the history of soil surveying, the area of soil science that focuses on mapping, analysis, and description of soils as found on the earth’s surface (Helms, Effland, Durana, 2002, p. xiv). Most chapters deal with the cooperative programme of soil surveying begun in 1899 in the USDA (United States Department of Agriculture). Other papers describe the soil survey and soil science programmes of various federal agencies and the applications of soil survey interpretations to other fields.

The first chapter in the volume is written by historians Helms, Effland and Steven Phillips, and examines the influences of key individuals and the state experiment stations in the establishment of federal support and the federal soil surveys. Douglas Helms also contributed a second chapter describing individuals and institutions that have been instrumental in the development of the soil survey. He wrote chapter six as well, commenting on the role of African-American soil scientists in the National Cooperative Soil Survey, and the critical importance of the 1890 land-grant universities in preparing students for careers in soil survey and in supporting faculty research in the field of soil science (Helms, Effland, Durana, 2002, p. xv). Finally, historian James Muhn contributed a chapter on the history of soil surveys and soil science in the Bureau of Land Management (Muhn, 2002).

More recently, in 2006, soil scientist Benno Warkentin edited another interdisciplinary work: *Footprints in the Soil. People and Ideas in Soil History*. (Warkentin, 2006). This book was a collaboration of sociologists, anthropologists, historians and soil scientist. As stated above, not only soil scientists took the initiative on this matter. In the same year, environmental historians John McNeill and Verena Winiwarer published *Soils and societies. Perspectives from Environmental History*. (McNeill, Winiwarer, 2006). This book included papers from environmental historians, anthropologists, geomorphologists, soil scientists, biologists, geographers and ecologists.

The co-editor of this publication, Verena Winiwarer, further contributed two articles on the history of soil fertility management (Winiwarer, 1998; Winiwarer, Blum, 2008). Moreover, she also participated to *Footprints in the Soil. People and Ideas in Soil History*, edited by soil scientist Benno Warkentin (Warkentin, 2006). Winiwarer studied soil scientists in ancient Rome (Winiwarer, 2006b) and together with scientist Winfried Blum, she wrote a paper on ‘*Souls and soils: a survey on worldviews*’ (Winiwarer, Blum 2006a). It is a survey of religious systems that have connected souls and soils, for example different earth goddesses who were worshipped for their (soil) fertility. They study different forms of soil worship from ancient to recent times. Thus, they argue that soil erosion and degradation have become a theme of religious considerations (variously termed environmental ethics, deep ecology or ecotheology) in the past forty years. They conclude that soil scientists cannot live without forming some view about life and the world. (Winiwarer, Blum, 2006a, p. 119–120).

In the same Book cultural historian, Catherine Evtuhov published a paper on ‘*The Roots of Dokuchaev’s Scientific Contributions: Cadastral Soil Mapping and Agro-Environmental Issues*’ (Evtuhov, 2006). In this paper Evtuhov looks behind the scenes of the emergence of the discipline of soil science in Russia. Dokuchaev’s comprehensive conception of the soil as an organic

body, in constant interaction with other aspects of the natural environment, has its roots in a very specific cultural and historical context in post 1860 Russia (Evtuhov, 2006, p. 125). The questions she answers are: how did Dokuchaev's system of soil science grow out of and interact with his practical concerns? What was the relation of his conception to those of other scientists and to the institutions with which he interacted? What does this contextualization add to our understanding of Dokuchaev's contribution to soil science? The author tries to show that the peculiar attention to the soil in its relation to a multiplicity of other factors (subsoils, climate, fauna and flora, relief, geological age) originated from the particular set of concerns that Dokuchaev sought to address within the Russian context of the end of the nineteenth century (Evtuhov, 2006, p. 145).

## Conclusions

Overall, the history of soil research and soil science was initiated in the 1970s by historians of science and agriculture. The subject was mostly treated as a backdrop of social, cultural, political and economic issues, and had not yet been studied as a historical theme as such. Topics were 'agricultural chemistry in the nineteenth century', 'soil conservation' and 'soil erosion'. The latter topics were definitely inspired by the environmental movement of the 1960s and 1970s in the Western world. By the turn of the century, the volume of soil science history from an environmental point of view clearly increased. Most of the environmental historians examined the subject in a nineteenth-century time frame. Only Verena Winiwarter and Frank Uekoetter are an exception to this rule. Winiwarter is an expert on soil knowledge in the Roman Empire and Frank Uekoetter studies soil knowledge systems and exchange in the twentieth century.

It seems that the field of 'soil history' was largely an outgrowth of the events and turmoil of its own time, rather than an evolution from the independent study of the past (Tarr, 2001). It can be considered as an answer to an area of agricultural surpluses and the decline of the public belief in agriculture and science.

This resulted in new interesting study subjects for historians, some of whom turned to agricultural and environment topics, and became experts in this area. It would not take long before these historians also focused on more specific themes such as soil research history. The subject is especially related to both agriculture and the environment. This explains the late emergence of soil knowledge history. Historians argue that through knowledge of soil (soil science), one learns more about the relation between humanity and soils.

It seems that, among others, environmental historian Verena Winiwarter and agricultural historian Douglas Helms can be considered experts in the field of soil knowledge history. Today, both agricultural and environmental history are thus represented in the history of soil knowledge. Agricultural historians pursue more institutional and theoretical developments during the nineteenth and twentieth century. In contrast, environmental historians are more interested in the relation between humans and soils. They treat soils as participants in their own right, interacting with humans, vegetation and animals. However, the primary goal of both historical branches is the same: investigation of the influence of soils, soil research and soil knowledge on human thinking and human society.

Another recent trend in soil historiography is the interdisciplinary approach. Historians are increasingly collaborating with sociologists, philosophers and natural scientists. However,

in most cases these collaborations do not result in authentic interdisciplinary work because the collaboration remains a remote one. Historical and scientific papers are published in the same books. Very few articles in these 'interdisciplinary editions' are conducted through cooperation between a historian and a natural scientist. It is remarkable that Douglas Helms and Verena Winiwarter are exceptions to this rule. Winiwarter collaborated with soil scientist Winfried Blum (Winiwarter and Blum, 2006a, 2008) and Helms cooperated with agronomists Dewayne Mays and Horace Smith (Helms, Mays, Smith, 2002) and with biologist Patricia Durana (Helms, Durana, 2002). These, in my opinion, are the first genuine interdisciplinary attempts to write soil knowledge history.

Clearly, in the last thirty years, historical work on soil science history has grown considerably. However, there still remains a lot of research to be done and a few recommendations may be in place here.

First of all, I would like to advocate a merger of the agricultural-historical approach and the environmental-historical approach. Society is gradually moving to a reconciliation of agriculture and environment, with sustainable agriculture as one example. Thus, in historiography the intriguing connections between soils, the environment, and human history should become evident. This means that historiography of soil knowledge can be pursued both from an institutional and a theoretical basis, as well as from a human-soil relationship approach.

Second, soil science historians should continue to work in an interdisciplinary context, because "any approach of the study of human kind and soils requires the methods and insights of multiple scholarly disciplines" (McNeill, Winiwarter, 2006, p. 4). I agree with Anne Effland who states that "historians should still pursue foundation work such as biographical studies of individual scientists and historical research on the theoretical and institutional development of the discipline of soil science" (Effland, 1998, p. 771). Her observation that "there is a need to pull together work on the different subfields to place them in the context of the larger scientific, social, economic and political developments of the nineteenth and especially of the twentieth century" (Effland, 1998, p. 771), is still applicable in 2011. I would like to emphasize the need for more twentieth-century, and especially post-war historiography of soil knowledge. Historians indeed have generally focused on the nineteenth century and more recent developments have received too little attention. As indicated above, it is time to consider the post-war period of soil research developments in relation to the ever changing human society. Another defect in soil science history is the lack of different national and local historiographies. Until recently, most accounts relate to the Russian and American history of the discipline. If one wishes to come to a world history of soil knowledge there is a great need for local histories.

Finally, I would like to plea for the integration of 'knowledge exchange studies' within the twentieth century history of soil knowledge. Frank Uekoetter is the first (and probably for the time being the only) historian to adopt this approach. In his study, he concluded that there is a lack of German agricultural knowledge systems. He proposes to put the current system of agricultural knowledge under scrutiny and to start an open discussion on the knowledge base of modern agriculture. "The history of agricultural knowledge in the twentieth century shows that this will demand a lot from all parties involved, but also that such a discussion may easily gain momentum once it has started" (Uekoetter, 2006, p. 336).

As he has shown, also historians can participate to this interesting contemporary debate. After all, who is better placed to contribute and continue this intriguing discussion, than the new generation of "agro-environmental historians"?

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## Назад к земле: историки и историография почвоведения (1975–2011)

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В конце XIX в. почвоведение как самостоятельная дисциплина возникло из двух независимых естественных наук: сельскохозяйственной химии и геологии. С 1930-х гг. эта область очень активно развивалась, а после Второй мировой войны в рамках почвоведения появились различные направления: исследования плодородности почв, картирование и классификация почв. Первые работы по истории этой науки появились уже в начале XX в. Работы, посвящённые возникновению и развитию почвоведения, были написаны учёными-почвоведцами для укрепления научного авторитета своей дисциплины, становления её институциональной инфраструктуры. С 1970-х гг. интерес к истории сельского хозяйства и агрономии, а затем и непосредственно к истории почвоведения стали проявлять профессиональные историки. Пионерами в этой области были историки науки и сельского хозяйства, затем к ним присоединились специалисты в области экологической истории, и наконец, в последнее время появились междисциплинарные работы.

Целью данной статьи является критический обзор англоязычной литературы и описание подходов, используемых историками, изучающими прошлое нашего знания о почве. Автора интересовали следующие вопросы: кто проявлял интерес к этой теме и почему? Кого можно считать наиболее крупными специалистами в этой области? Какие подходы используют историки, работающие в этой области? Какие они предлагают вопросы, проблемы и гипотезы и какова их цель? Ответы на эти вопросы будут полезны для постановки новых исследовательских задач.

**Ключевые слова:** историография, почвоведение, XX век, история сельского хозяйства, экологическая история