

Evolution of key concepts in modern pedology with reference to Italian soil survey history



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ABSTRACT

In the second half of XIX century, early soil scientists were rooted in disciplines like agro-chemistry and geology. Their approach to soil science was consequently influenced by their cultural background. During the first half of the past century, Italian pedologists were engaged in seeking for a clear identity, consolidating the scientific status of pedology, but the elaborated concepts remained mainly within the Academia's walls. Most of the soil maps produced by academy in those years were mainly aimed at improving the knowledge of the Italian soils, their general relationships with the environmental factors and their distribution, and with few exceptions their applicability was limited. At the end of the past century, with the definition of the responsibilities of regional governments on environment, agriculture and land planning, soil survey services were set up in most of the Italian regions. Main aim of the regional soil surveys was providing information for the correct and sustainable use of soil and supporting other regional services, such as agricultural or land use planning services. This, led pedology to cope with societal and political demands, which asked for a more strict link between research and applications. Despite the lack of a clear structure in management, soil surveys were undertaken in most of the Italian regions whose coherence of approaches was guaranteed by several national scale projects in which most of the research and technical institutions were involved. At the present time, the cooperation within the whole soil science community remains an imperative necessity, for exploiting at best the existing information, focusing on priorities, with a flexible and pragmatic approach, capable to valorize local knowledge and assure consistency at National and European level.

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1. Introduction

Since the very beginning of agriculture, commonly dated 11,000 BP (Brevik and Hartemink, 2010), man had to cope with the soil qualities and limitations. Therefore, the development of a scientific approach to soil knowledge is part of the more general human soil awareness and approach to scientific thinking. Strictly rooted in basic and applied sciences, mainly geology and agronomy, soil science developed as a specific discipline in XIX century, in Italy as elsewhere.

Pedology is here defined as the study of the soils conceived as both natural bodies strongly interacting with their environment and as common goods; the term “pedology” was used as a synonym of soil science at the very beginning of the discipline. Fallou, who in 1862 introduced the word (Boulaine, 1997), distinguished the naturalistic soil science, pedology, from the agricultural soil science, agrology, that studies soils in relation to the agricultural applications (Fallou, 1862). In the scientific literature of the second half of XX century,

pedology was considered as a branch of soil science, mainly coincident with soil genesis, classification and cartography (Churchman, 2010; Ibanez and Boixadera, 2002; Bockheim et al., 2005). However, the soil concept evolves, as does the concept of pedology, all over the world and along the time (Cline, 1961; Bockheim et al., 2005), so that the terms used reflect the status of knowledge and of the theoretical evolution of the discipline, together with the general scientific culture. In Italy, the term pedology (pedologia) was introduced in a text book in 1904 (Vinassa de Regny, 1904) as synonym of soil science, and it cohabited with the terms agrology (agrologia), agro-geology (agro-geologia), agricultural geognostic (geognostica agraria), geopodology (geopedologia) used in different historical moments by differently rooted soil scientists.

In this paper we consider the evolution of the key concepts as evolved in Italian pedology during the past century, within the context of their historical development as outlined by Bockheim et al. (2005), referring to the definition of soil; soil horizons, profiles, and pedons; soil-forming factors; pedogenic processes; soil classification; soil geography and mapping, and soil–landscape relationships. We also discuss how these were influenced by the general international context and by the peculiarity of the Italian situation.

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2. Period 1900–1940

In May 1924, the International Society of Soil Science (ISSS) was founded in Rome at the end of the IV International Conference of Pedology (van Baren, 1974). It was held under the patronage of the King of Italy at International Institute of Agriculture (which would have been transformed in ISRIC after the second world war). The conference, and its preparatory meetings, represented the first opportunity for Italian soil scientists to comprehensively interact in an international milieu. Since then, the majority of Italian early soil scientists were strongly influenced by their cultural heritage, given that in Italy, as elsewhere, a solid tradition in agronomy and agro-chemistry, and geology, was present.

About a hundred Italian scientists attended the conference of Rome, and about 35 papers were presented (Calzolari, 2013). In one of his presentations, de Angelis D'Ossat, a geologist head of the local organising committee, exposed his theory about the necessity that soil classification should be based on the “lithological phase”, as the “less unstable” component of soil: “Although the changes [of the lithological phase] can be so varied and profound so that the agricultural soil may differ [...] from the parent rock, yet the course of evolution is limited [...] by the point of departure (the parent rock) and by the point of arrival (derived rock). Agricultural soil represents the distance between the two rocks” (de Angelis d'Ossat, 1924a). According to de Angelis D'Ossat, the dynamicity of soils, and the complexity of the relations with the factors of its variability were a limitation for the feasibility and utility of geo-agronomic mapping of large areas (de Angelis d'Ossat, 1924b). Instead, detailed and locally calibrated agro-geological maps were considered very useful for agriculture, provided that the information was “not superfluous” and focussed on local environmental conditions (de Angelis d'Ossat, 1924b).

During the Rome conference, the central role of soil profile in soil classification was established (agricultural soils without [a differentiated] profile; soils with a partly developed profile; and soils with fully developed profile). The edition of an agro-geological map of Europe was planned, to be presented at the First World Congress of the International Society of Soil Science, to be held in Washington in 1927. The map was eventually edited by the Rumanian Gheorghe Murgoci, and by H.E. Stremme after his death, in scale 1:10,000,000 (Fig. 1a, Stremme, 1929, 1997).

Gioacchino de Angelis D'Ossat did not attend the Congress but, unsatisfied about the over simplification of Italian pedodiversity as

represented in the map, in 1928, organised a meeting with soil scientists of the Italian Geological Society (Bollettino della Società Geologica Italiana, XLVII–1928). He was eventually tasked of preparing the first (agricultural) Soil Map of Italy in scale 1:1,000,000, then published at scale 1:2,000,000 (de Angelis d'Ossat, 1928). In drafting his map, de Angelis D'Ossat formally followed what established during the Rome conference about soil classification but, convinced that “[geology] should be taken as foundation for any classification of agricultural soils” (de Angelis d'Ossat, 1928), he based his map on the 1:1,000,000 geological map of Italy (Fig. 1b). In his map, de Angelis D'Ossat classified soils distinguishing between autochthonous and allochthonous (colluvial and alluvial soils, and glacial soils) soils. Autochthonous soils were further subdivided according to elevation (>500 m asl. and <500 m asl.) and lithology. The published soil map results in six major categories, further subdivided in mapping units differentiated by lithology (Fig. 1c).

The map did not contain the other information indicated by the soil cartography commission in the Rome congress: morphology, hydrography, climatology, vegetation and land use. These would have resulted in an “excess of details”, difficult to manage in a small-scale cartography (Mori, 1929). In effect, de Angelis d'Ossat was convinced that the farmer would have not benefited of a geo-agronomic map, as “he practices agriculture since ancient ages” (de Angelis d'Ossat, 1924b).

On agronomic side, more or less during the same period, the so-called “cattedre ambulanti di agricoltura” (literally, moving agriculture chairs) were active in most of the Italian provinces (Enciclopedia Italiana, 1931), with the aim of diffusing the technical knowledge among farmers and without specific involvement of pedology. When they were set, late in XIX century, these were mostly organised by farmers organisations and local administrations, and then they gradually passed under the full control of the Italian Ministry of Agriculture and transformed in provincial extension services.

Far from Rome and its academic circles, in Friuli region (North East Italy), under the umbrella of the Associazione Agraria Friulana (Agricultural Association of Friuli) the moving agriculture chairs, in collaboration with the Agricultural Chemistry Experimental Station of Udine, started the publication of a series of geo-agronomic maps (Del Zan and Menegon, 2003). In 1908, two geologists, Domenico and Giuseppe Feruglio, prepared the agronomic maps of the Tricesimo area (Bollettino della Associazione Agraria Friulana. Serie V, vol. 25, 1–2, 1908), based on geological surveys and accompanied by practical information, such as superficial texture, soil nutrients, and associated land use. Until the unification of Italy under the kingdom of Savoia in 1861, Friuli was part of the

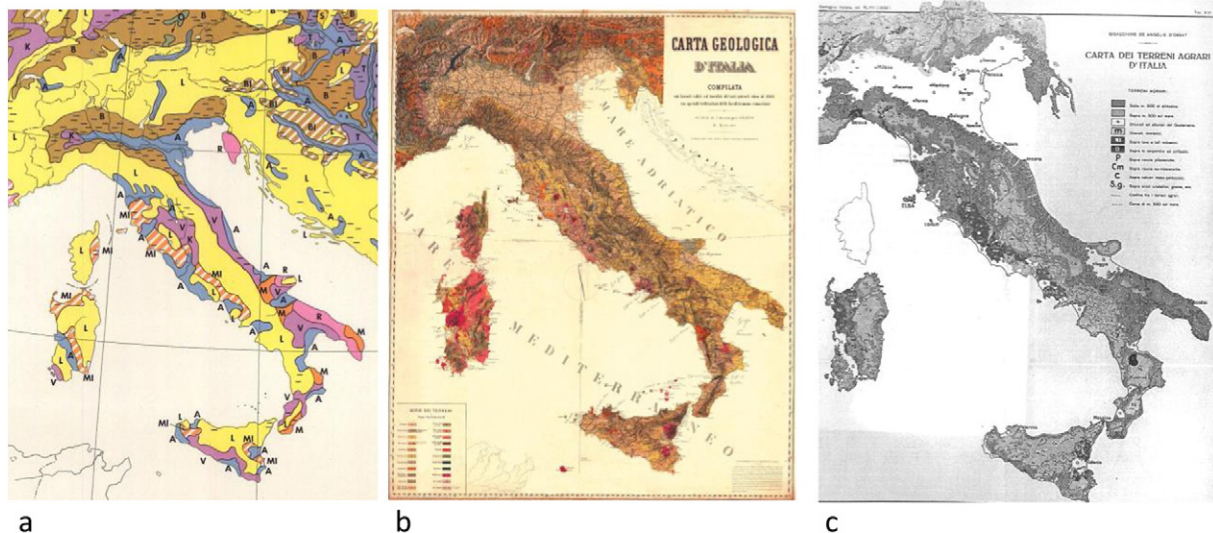


Fig. 1. a) The soil map of Europe of Stremme, original scale 1: 20 M (Stremme, 1929), particular of Italy; b) the geological map of Italy, original scale 1:1,111,111 (Regio Ufficio Geologico, 1881); c) the soil map of Italy, original scale 1:2 M (de Angelis d'Ossat, 1928).

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