Research in Pedology: A Historical Perspective

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An Interview to Prof. Fiorenzo Mancini

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La storia siamo noi, attenzione, nessuno si senta escluso (F. De Gregori).

Biography of Fiorenzo Mancini Prof. Fiorenzo Mancini has been Director of the Institute of Geology and Mineralogy of the University of Firenze, of the Centro Studio Genesi Classificazione Cartografia del Suolo of the National Research Council (CNR), has been President of Italian Society of Soil Science, of which he was one of the founder members, President of the Italian Geological Society, President of the Accademia di Scienze Forestali, President of the Experimental Institute for Soil Study and Soil Conservation, Vice-President of the Accademia dei Georgofili. He is honorary president of the Italian Society of Soil Science and of the Italian Society of Pedology. He published more than 100 papers, and with his master, Paolo Principi, founded the pedological school of Florence. Since 2002, he is honorary member of IUSS.

1.1 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 eleventh 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, which studies soils in relation to the agricultural applications (Fallou 1862). In the scientific literature of the second half of twentieth century, pedology is 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, through 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 word pedology (*pedologia*) is introduced in a text book in 1904 (Vinassa de Regny 1904) as synonym of soil science,[1] and it cohabitates with the words agrology (*agrologia*), agro-geology (*agro-geologia*), agricultural geognostic (*geognostica agraria*), geopedology (*geo-pedologia*) used in different historical moments by differently rooted soil scientists. Moreover, in Italian, different words are used with reference to soil: *suolo, terreno, terra.* Their meaning is sometimes coincident; sometimes, and along the time, the different words have different nuances.

Similarly to other countries (Arnold 1987), in early 1980s, Italian soil scientists have lengthily disputed if soil survey could be defined as a research activity.

According to OECD (Frascati manual), "Research and Experimental Development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications" (OECD 2002). Therefore, "R&D must be distinguished from a wide range of related activities with a scientific and technological basis. These other activities are very closely linked to R&D both through flows of information and in terms of operations, institutions and personnel, but as far as possible, they should be excluded when measuring R&D" (OECD 2002).

Data collection and processing with pre-established models are excluded from the definition of research. However, since the early stages of pedology, and as far as Italy is

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[1] The first document reporting the word pedology as *pediologia* (sic) is dated 1884 (Bollettino del Regio Comitato Geologico 1884).

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concerned up until the second half of twentieth century, soil survey involved the study of the genesis of the soils and the analysis of the models that describe their distribution in space. Soil survey was an integral part of the research aimed at increasing the knowledge about the soil, the site-specific relations between soils and landscapes and the processes acting in them. In other words, quoting Richard W. Arnold, "soil survey is an example of applied research based on uncontrolled experiments with the results being the variability of soils themselves" (Arnold 1987).

Still following OECD (2002) "the basic criterion for distinguishing R&D from related activities is the presence in R&D of an appreciable element of novelty and the resolution of scientific and/or technological uncertainty".

From a historical point of view, research in pedology is therefore strictly linked with soil survey, which set the bases for any advancement in pedological concepts.

The present chapter deals with the history of research in pedology, since the early stages and up until the end of the past century, with a special emphasis on soil survey. It is based upon a series of conversations between a pedologist and researcher and the doyen of the Italian pedologists.

1.2 The Birth of Pedology in Italy (1880–1940)

Question: When is pedology born as a specific subject in Italy? What does distinguish pedology and pedologists from the other soil subjects and scientists?

Answer: Historically, and epistemologically, pedology means the study of the whole soil profile. In coherence with its definition as a natural body, soil is characterised by a succession of layers which is the result of a specific combination of the various pedogenesis factors and agents. This has been a central point in debate, e.g. with soil chemists, who were not used to study soils in the field, but instead to handle samples in laboratory. In early 1950s, this approach was quite new in Italian soil science, between geologists, who had a "lithological" approach, from one side, and soil chemists and agronomists, from the other one. The publication of the textbook "Geopedologia" by Principi, in 1953, giving a full theoretical frame to the discipline and receiving appreciation also at international level, allowed Italian pedological school to fully develop.

When early pedologists started with systematic studies of soils, their characteristics and geography, they were strongly influenced by their cultural heritage, given that in Italy, as elsewhere, a solid tradition in agronomy and agrochemistry and geology was present.

While in the second half of nineteenth century Dokuchaev in Russia and Hilgard in the United States gave their definitions of soil and pedology, early Italian soil scientists used to define soil as […] the blend of various materials, some of which very fine and not easily recognisable, some others made up by more or less coarse particles, which mostly derive […] from the rocks which are the most external part of the earth where we live […]. This very heterogeneous mixture is powdery or compact, when dry, and loose or plastic when moist […] but plants find in it both the support […] and most of nutrients they need […]

(Il terreno […] è un insieme di materie svariate, alcune minutissime e non facili a riconoscersi, altre in particelle più o meno grossolane che per la massima parte derivano, come a chiunque è agevole persuadersi, dalle rocce che costituiscono la parte più esterna del globo terracqueo su cui viviamo […] Tale congerie, assai eterogenea se asciutta è ora polverosa ora compatta; se umida è talora sciolta, talaltra pastosa. […] ma le piante trovano in essa non solo l'appoggio per stare diritte […] ma vi rinvengono soprattutto una buona parte delle sostanze nutritive […], Sestini 1899).

Soil is then characterised by its physical aspect, "mixture of more or less fragmented materials" (*congerie di materie più o meno frantumate*, Funaro 1904), and by a set of its main functions, as soil is "the ordinary site of most of the crops (and) contains in and around it all the conditions and materials that are necessary for plant life"

(Il terreno è la stazione abituale della maggior parte delle piante che forniscono i prodotti agrari [e] contiene in sé ed intorno a sé tutte le condizioni e tutti i materiali che sono necessari allo svolgimento della vita delle piante, Funaro 1904).

As far as soil formation is concerned, Vinassa de Regny in 1904 writes: "soil is a more or less weathered rock only rarely made up by solely mineral parts. In most of the cases, also life, and past natural vegetation mainly, influences soil, so that also organic compounds are present together with minerals".

It is worth to be noted that the two first definitions are given by soil chemists, Fausto Sestini (1839–1904) and by his collaborator, Angiolo Funaro. Paolo Vinassa de Regny (1871–1957), instead, was a geologist and palaeontologist. In 1904, he wrote the textbook "Elements of agricultural geology" (*Nozioni di Geologia Agraria*). He introduces the word "pedology" (*pedologia*) as synonym of "agrology" (*agrologia*), defining it as the science that "studies the composition and chemico-mechanical constitution of soil" (*studia la composizione e costituzione meccanica e chimica di un terreno*). It is part of geology, but it needs other fundamental disciplines, such as chemistry and physics and differs from geology, as it considers "soil as an active quasi-living medium, due to the continuous transformations induced by external physical and biological agents"

(il terreno attivo e quasi […] vivente, causa le continue trasformazioni che in esso inducono gli agenti esterni fisici e biologici., Vinassa de Regny 1904).

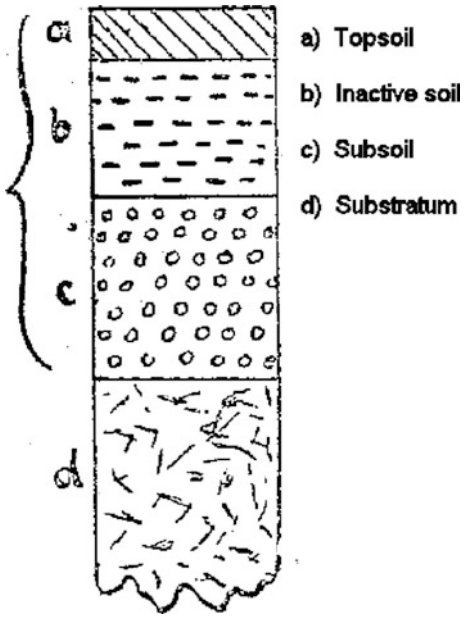

Fig. 1.1 Soil profile (Vinassa de Regny 1904)

In his text, Vinassa de Regny recognises the vertical morphology of cultivated soils. Quoting the Austrian palaeontologist Lorenz von Liburnau (1825–1911), he identifies two major soil sections: soil, further subdivided in topsoil, *suolo superficiale*, where most of humus is, and "inactive" soil, *suolo inerte*, where micro-organisms "seem to be lacking"; and subsoil (Fig. 1.1). Even if the vital part of soil is limited to topsoil, the inactive soil plays a role as reserve of water and nutrients (*magazzino di riserva*). In his opinion, and differently from contemporary agronomists, it is important to recognise the difference between inactive soil, subsoil and underlying rock, or substratum. Therefore, when considering the soil depth, all the soil sections should be taken into account. Actually, it is the recognition of the profile as the best descriptor of soil bodies. It is important to note that in none of his writings Vinassa de Regny does quote Dokuchaev and his concepts, and it is not clear whether he was aware of them.

In 1923, Giorgio Röster (1843–1927) published the text book "Agricultural soil and its relationships with air and water: complex influences on vegetation" (*Il terreno agrario nei suoi rapporti con l'aria e con l'acqua*: *influenze complesse su la vegetazione*). His definition of soil reads "agricultural soil […] is a mixture of highly fragmented mineral substances […] and, to a lesser extent, of vegetation residues at different stage of decomposition that make possible the necessary soil fertility"

> (Col nome di terra agraria […] deve intendersi una miscela di sostanze minerali in stato di grande divisione che ne formano il substrato o la base principale, alla quale si sono aggiunti in proporzione molto minore, gli avanzi che la pianta abbandona sul terreno in vario grado di decomposizione e che devono concorrere a dare al suolo la necessaria fertilità, Röster 1923).

Fig. 1.2 The foundation of ISSS, Roma 1924

In early twentieth century, the international links of Italian soil scientists were still sporadic. Some Italian scientists, among whom Vinassa de Regny (Mori 1929), attended the Second International Agrogeology Conference held in Stockholm in 1910, and took some contacts with the aim of holding an International Conference in Rome (Bollettino del Regio Comitato Geologico 1913–1914). After a series of preparatory meetings (van Baren et al. 2000), in May 1924, Rome hosted the IV International Conference of Pedology, under the patronage of the King of Italy (Fig. 1.2). The conference was held under the auspices of the International Institute of Agriculture, an international institution whose mandates would have been taken over by Food and Agriculture Organization (FAO), after World War II and the creation of United Nations.

The conference was attended by many international soil scientists, among whom Marbut and Glinka.

The geologist Gioacchino de Angelis d'Ossat (1865–1957) was the president of the Italian Organising Committee de and the microbiologist Renato Perotti was the Secretary General. Benito Mussolini, Italian Prime Minister, since few weeks and for the next 20 years, was the president of the honorary committee. On the last day of the conference, the International Soil Science Society was founded (van Baren 1974), following a decision taken in one of the conference preparatory meetings, in Zurich, in June 1923 (Actes de la IV^{eme} Conférence Internationale de Pédologie 1926). de Angelis d'Ossat, who claims the paternity of the initiative ("I had the opportunity to propose and to see flourishing the International Society of Soil Science", de Angelis d'Ossat 1928), was appointed as vice-president.

About a hundred Italian scientists attended the conference of Rome, and about 35 papers were presented. In one of his presentations, de Angelis d'Ossat 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). The dynamicity of soils and the complexity of the relations with the factors of its variability are for de Angelis d'Ossat 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 could be very useful for agriculture, provided that the information is "not superfluous" and focussed on local environmental conditions (de Angelis d'Ossat 1924b). Given that the farmer would not benefit of a geo-agronomic map, as "he practices agriculture since ancient ages" (de Angelis d'Ossat 1924b), only reclamation activities and major land-use changes would need a geo-agronomic map. Also, such a map would be beneficial for combining "the maximum income […] without diminishing the land capital, which is incorrectly considered immutable" (de Angelis d'Ossat 1924b). Not very coherently, few years later, de Angelis d'Ossat would have published the first 1:1,000,000 Soil Map of Italy (de Angelis d'Ossat 1928).

In the same period, an agronomist, Alvise Comel, and a geologist, Paolo Principi, who would have greatly influenced Italian pedology, were active.

Alvise Comel (1902–1981) had worked since 1925 at the agricultural chemistry experimental station of Udine (in the relatively peripheral region of Friuli-Venezia Giulia), one of the several agronomic experimental stations set-up in Italy after the birth of the Italian kingdom in 1861. He was pupil of Michele Gortani (1883–1966), geologist (who attended the Rome conference presenting a paper on the agro-geological mapping in Italy). Comel was tasked with surveying the soils of Friuli-Venezia Giulia for producing acidimetric maps, and he published the results in several papers since 1925 and until 1940. His scientific interests were concentrated on "terre rosse" about which he published several works. In 1941, and until 1944, he was sent in Albania serving the Italian army during the World War II, but the interval did not impede his efforts: during the war, he published two works on Albania's soils (Comel 1942a, b). He continued the surveying for most of his life, leaving a fundamental contribution to the knowledge of the soils of Friuli-Venezia Giulia (Del Zan and Menegon 2003).

Between 1937 and 1940, he published three textbooks on pedology: "Notions of climatic pedology" (*Elementi di pedologia climatica*) and "Handbook for the practical study of soil and for the geo-agronomic survey" (*Guida per lo studio pratico del terreno e per il suo rilevamento geo-agronomico*) in 1937; and "Agricultural soil" (*Il terreno agrario*) in 1940. After quoting several international soil scientists, such as Fallou, Dokuchaev and Glinka, Comel gives his own definition of soil: "soil is the solid surface of the earth that is in contact with atmosphere and that is consequently subject to physical, chemical or biological modifications"

> (terreno [è] tutta la superficie solida della crosta terrestre che si trova in contatto con l'atmosfera e che subisce di conseguenza apprezzabili modificazioni di ordine fisico, chimico o biologico, Comel 1937).

He distinguishes between "natural soil" and "agricultural soil", that is, "the result of the conscious activity of the man, who modifies the natural course of pedogenesis with the aim of satisfying his own needs".

In his books, Comel recognises the soil as a body *per se* with its individuality and dynamics: "soil lives, this is a concept that must be well understood by any soil scientist" (*Il terreno vive, ecco un concetto che deve essere ben impresso in chi del terreno vuol far mèta dei suoi studi*, Comel 1937). This is actually the first time that this concept appears in Italian pedological literature.

The degree and quality of the modifications to which soils are subject determine the differences among them, and therefore, the soils can be classified. Comel distinguished between classifications aimed at practical use of soils and pedological classifications, considering the latter as the "more scientific" ones. Without entering into the discussion about the soil classification systems, that was already a hot point of debate among soil scientists, Comel stated that a soil can be considered properly identified once some characteristics are known: the pedoclimatic environment, the parent rock, the mechanical and chemical characteristics and other site characteristics, such as morphology (Comel 1940). In this approach "the starting point" of soil, that is, the parent rock and the "final climatic soil" are well included, together with the main factors influencing the life of the plants. It is then recognised the dynamics of the soil, which, if autochthonous "must show in its profile the footprint of pedogenesis" (Comel 1937). Compared with the contemporary Italian geo-pedological literature, Comel is a step forward when stating that

> geo-lithology […] must still be considered a fundamental element for the knowledge of agricultural soils but it must be seen in the frame of the complex of the other elements that influence pedogenesis […] (Comel 1940).

Principi (1884–1963) worked in central Italy. After the first part of his academic career in Genoa, where his scientific interests were mainly about palaeobotany, in 1928 Principi moved to Perugia where he was professor of Agricultural Geology. Since then, his interests turned towards pedology. In 1940, he moved to Florence, and in 1942, he published "Geology and Pedology of the province of Florence" (*Geologia e pedologia della provincia di Firenze*) with two 1:100,000 maps (Principi 1942). In 1943, he published a monograph, "Soils of Italy, natural and agricultural soils" (*I terreni d'Italia, terreni naturali e terreni agrari*) with a soil map of the country in scale 1:3,125,000 (Principi, 1943). After the one by de Angelis d'Ossat, this is the first complete Soil Map of Italy. Soils are distinguished between "climatic types" and "azonal soils", according to the Russian pedological school. The monograph contains a complete list of the studies about Italian soils published so far. Between 1946 and 1952, Principi published a series of soil maps of the various Italian regions, later on re-edited and published as a new version of the monograph of 1943 (Principi 1961). In 1953, Principi published "Geopedology" (*Geopedologia*) the first complete textbook on pedology, since the one of Comel. In his text, Principi presents his vision of soil and pedology, giving an updated picture of the national state of the art and of the international literature (Principi 1953a).

Pedology in mid-twentieth century was still in its early stages, in Italy, and seeking for a clear identity between geology and soil chemistry. In particular, Principi was active in his efforts for defending the scientific status of pedology, in polite but open polemic with both soil chemists and geologists. In a series of publications (Principi 1953a, b, 1954, 1955a, b), Principi formalises his theories about geo-pedology ("the study of soil in situ, with the support of geological data") and about the relations with the other sister disciplines, namely agronomy and soil chemistry. "[Geo-pedology] considers soil […] as a dynamic entity, studying its origins and the various steps characterising its evolution; while [soil chemistry] studies mainly the present composition of soil". Geo-pedology is considered a more appropriate denomination as compared to agro-geology, which could have been interpreted as devoted merely to agricultural soils, while "useful applications for agriculture can be inferred more easily from the study of natural soils". The study of soil cannot be disjointed from the study of the whole soil profile (Principi 1955a).

In 1954, he writes: "Geo-pedology does not decrease the importance of soil chemistry, but […] only geo-pedology using information coming from petrography, tectonic, morphology, hydrology and climatology is capable to reach a complete knowledge of soil, of its origin, and of the transformations to which soil will be subject in time". Discussing a geo-pedological map recently published in southern Italy, he questions about the utility of a map based only on geological criteria without "taking into account the relationships between soil and vegetation" and the pedogenetic processes and dynamics (Principi 1954). Similarly, in the same paper, Principi criticises the Soil Map of Maremma compiled in 1954 by Valentino Morani and Orfeo T. Rotini (Morani and Rotini 1954), famous soil chemists (Morani was among the founders of the Italian Society of Soil Science, in 1952), where soil units were distinguished at higher level between soils over incoherent or rocky subsoil, and at lower level with a mixture of geological notations (Quaternary or Pliocene soils) and textural information (e.g. "heavy alluvial calcareous" or "loamy Quaternary"). The heavy criticism produced the reaction of Morani, who claimed the autonomous role of agronomy and soil chemistry in soil mapping. Actually, the dichotomy between pedologists and soil chemists characterises the early stages of soil science in Italy, still in twentieth century, as elsewhere in Europe since the birth of soil science (Yaalon 1997).

Principi is considered one of the fathers of pedology in Italy (Boulaine 1989), not only for the amount of papers published, more than 200 half of which pedological, but also for having been the initiator of the pedological schools of Florence and Perugia.

Even if not directly involved in soil survey and mapping, another soil scientist should be quoted here for his cultural weight in Italian agronomy, Giovanni Haussmann. Director of one of the experimental stations of the Ministry of Agriculture (the Experimental Institute for Fodder Crops of Lodi), Giovanni Haussmann (1906–1980), agronomist, was a singular figure in Italian soil science panorama. Born in Russia, he knew the Russian pedological school and followed the ideas of the Russian soil scientist Willliams. His scientific interests were about the conservation of soil fertility: "Soil is a natural body characterised by a certain degree of fertility". For Haussmann, fertility, defined as "the capability of fulfilling the plants' requirements", is the "peculiar quality of soil and only of soil" (Haussmann 1950) and is strictly linked to the soil's structural properties. Beside the strictly scientific publications, Haussmann wrote about the history of agriculture. In particular, he was interested in the relationships between soils, their characteristics and human history (Haussmann 1971).

1.3 Mapping Italian Soils: The Early Period (1940–1966)

Question: In 1966 the 1:1 M soil map of Italy was published, which is still the basis of the 1:1 M European soil map. What was the genesis of this map? How was it surveyed? How was the panel of participating pedologists selected?

Answer: About 20 soil scientists, pedologists, agronomists, foresters were involved in the so-called "Committee for Soil Map of Italy". They worked between 1961 and 1965, carrying on the survey in the different geographic areas of Italy: Northern, Central, Southern and Insular Italy. The mapping units were defined on a geomorphological basis by the various sub committees and discussed in plenary meetings of the National Committee. Moreover, several field surveys were organised attended by all the Committee members. Soils were classified according to the French system with modifications.

The first mention of the need of mapping Italian soils at national scale is due to Antonio Stoppani (1824–1891), geologist, palaeontologist, patriot and writer. Stoppani, with Torquato Taramelli (1845–1922) proposed in 1882 to the Royal Geological Committee, set up in 1867 as a branch of the Council of Mines at the Ministry of Agriculture Industry and Trade, a law for the setting of an autonomous National Geological Survey aimed at the compilation of the geological map of Italy (in open polemic with the Council of Mines). The map should have been complemented by an agricultural-geognostic map with "the indications about the lithological and chemical composition of the vegetal soil for the benefit of agricultural industry". The proposal established the responsibility of the map under the Geological Committee, with the participation of the agricultural experimental stations for soil analyses, and with the financial support of the Superior Council of Agriculture (*Consiglio superiore dell'agricoltura*) instituted in Rome in 1868 (Bollettino del Regio Comitato Geologico 1882).

Indeed, despite the efforts mainly of Taramelli, the Geological Committee was not particularly interested in mapping soils. The project did not succeed, due to the financial difficulties of the Italian kingdom and to the disputes among the Italian geologists (Corsi 2003). The geological survey would have obtained the financial and scientific autonomy in 1988 (D.P.C.M. 28 October 1988).

By initiative of Taramelli, in 1887, a project for a geognostic map of Po Valley was launched. Taramelli presents his project as "a very detailed study of the usually neglected portion of Earth that is the plain. It is connected with other studies of soil chemistry and hydraulic, as these links cannot be overlooked if we want this work to be at the same time scientifically sound and a collection of useful suggestions for agriculture, the actual main industry in that region" (Bollettino del Regio Comitato Geologico 1887). The surveys continued until 1899, but the results were not published.

These projects remained isolated initiatives. In 1901, in his annual report, the Chairman of the Geological Committee, Pellati, answering to Taramelli, declares that due to financial restrictions it was not possible for the Committee to take the responsibility for the production of agronomic maps, which instead should be under the responsibility of agricultural institutes, such as the experimental stations and agricultural extension services or *comizi agrari* (Bollettino del Regio Comitato Geologico 1901). In the same year, Augusto Stella (1863–1944), geologist and engineer, publishes a note on the bulletin of the Italian Geological Society, where he explains his ideas about the complexity, and eventual uselessness, of drafting proper agronomic maps (Stella 1901). According to Stella, whose ideas would have been endorsed by de Angelis d'Ossat (1924b), the complexity of the processes involved in the genesis of agricultural soils is too high to be represented in a sufficiently detailed map. He concludes stating that the geological map's accompanying notes, with an appendix including agricultural-geognostic information about "representative" agricultural soils, would have provided more scientifically based information as compared to unclear "agronomic" maps. Coherently with his approach, in 1902, Stella published a study on the geognostic characteristics of the soils of Montello, in northern Italy (Stella 1902).

Gioacchino de Angelis d'Ossat did not attend the first World Congress of the International Society of Soil Science, held in Washington in 1927, where Italy was represented by five official delegates: Bignami, Delfino, Orsenigo, Peroni and Rossati (Waksman and Deemer 1928). At the congress, the agro-geological map of Europe, edited by the Rumanian Gheorghe Murgoci, in scale 1:10,000,000 was presented, where only four mapping units were described for Italy. de Angelis d'Ossat was unsatisfied about the over simplification of Italian pedodiversity ("far from criticising the work of my eminent colleagues who participated in the difficult compilation of the [Europe soil] map, I would have liked a less crude comment about the Italian absence [in compiling the map]"), and on January 21, 1928, organised a meeting with soil scientists of Italian Geological Society (Bollettino della Società Geologica Italiana, 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 the central role of soil profile in soil classification (agricultural soils without [a differentiated] profile; soils with a partly developed profile; and soils with fully developed profile). However, de Angelis d'Ossat complained about the relatively low influence of geologists in the ISSS V Commission deputed to soil classification and mapping (Bollettino della Società Geologica Italiana, 1928), being still convinced that "[geology] should be taken as foundation for any classification of agricultural soils" (de Angelis d'Ossat 1928). Coherently, his map was based on the 1:1,000,000 geological map of Italy and did not contain the other information indicated by the soil cartography commission in the Rome congress: morphology, hydrography, climatology, vegetation and land use (Fig. 1.3). These

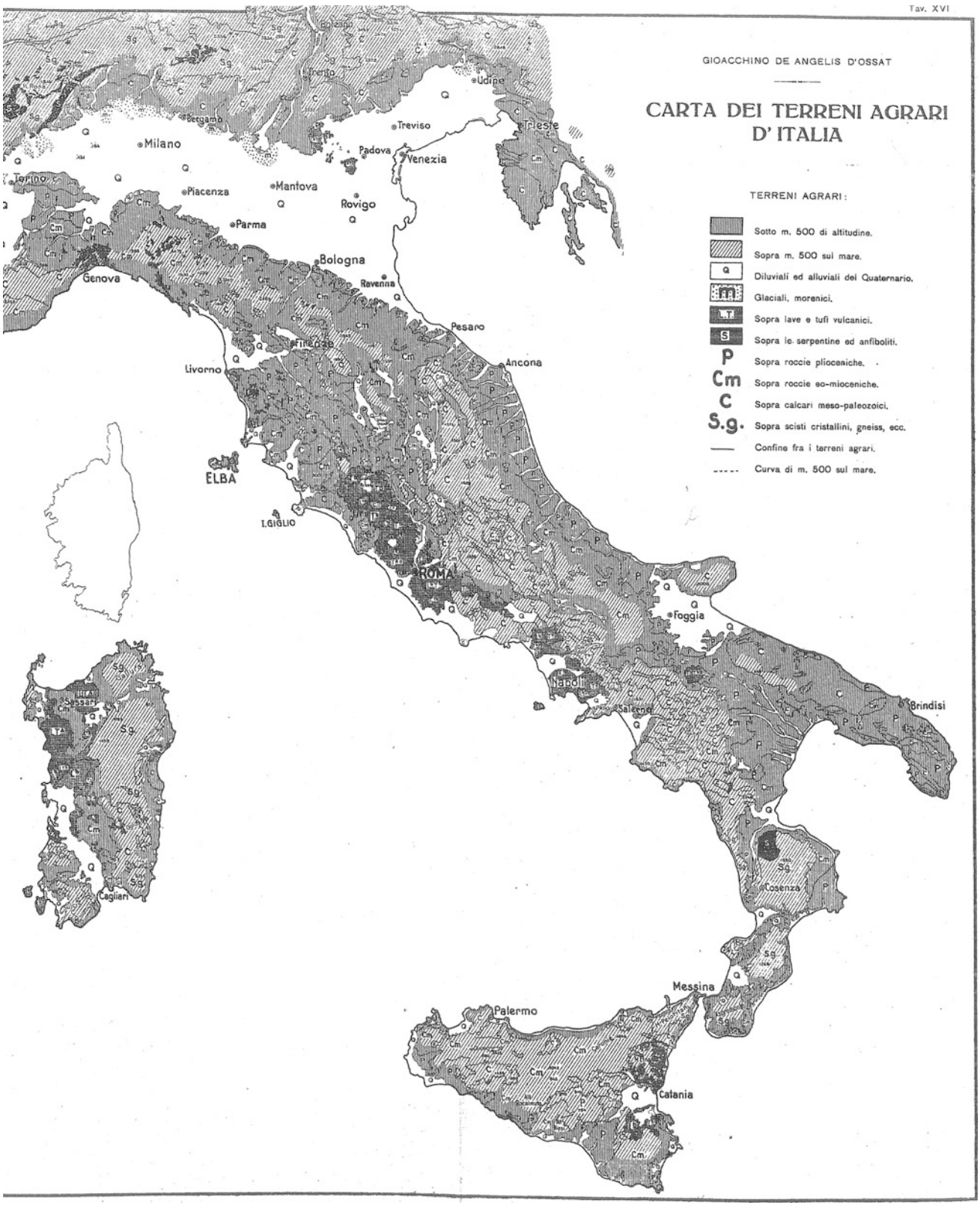

Fig. 1.3 The first soil map of Italy (de Angelis d'Ossat 1928)

would have resulted in an "excess of details", difficult to manage in a small-scale cartography (Mori 1929).

In his map, de Angelis d'Ossat classifies soils distinguishing between autochthonous and allochthonous (colluvial and alluvial soils, and glacial soils) soils. Autochthonous soils are further subdivided according to elevation (>500 and <500 m asl.) and lithology. The published soil map results in six major categories, further subdivided in mapping units differentiated by lithology (Fig. 1.3). Even if de Angelis d'Ossat is listed among the collaborators, the final version of the Soil Map of Europe, published in 1937 in scale 1:2,500,000 (Stremme 1997), was very different from the Italian one (Mancini et al. 1966).

We had then to wait until 1942 for Principi's map to be published.

When Principi moved to Florence in 1940, at the Institute of Geology and Mineralogy of the Agricultural Faculty, he had as assistant Ludovico Edlmann (1887–1974), who worked on soils of Tuscan Apennines and of Sardinia (Pietracaprina 1967–1974). In 1948, Fiorenzo Mancini became fellow assistant, after having been graduated in 1946 with a dissertation on the soil suitability for nursery industry in Tuscany. In Perugia, the chair left by Principi was taken up by Cesare Lippi-Boncambi (1911–1984), who in 1945, in a communication at the Geological Society, presented his ideas, about the constitution of a bureau for the Soil Map of Italy, under the coordination of the Royal Geological Committee (Lippi-Boncambi 1945). After the publication of the map of Principi, he proposed the realisation of a 1:100,000 (or even larger scale) soil map. The idea remained disregarded once more.

In 1950, Mancini and Lippi-Boncambi participated as Italian delegates at the IV Congress of the International Soil Science Society held in Amsterdam. Lippi-Boncambi presented a study on soils of Perugia province (Lippi-Boncambi 1950), where 30 soil typological units were mapped, following the methodology of Principi. Still in 1952, in the frame of the Marshall plan for European recovery after World War II, a group of European delegates from France, Germany, Austria and Italy attended a course on soil conservation held in the United States at the University of Georgia. Mancini was in the Italian delegation, composed mainly by agronomists, while Comel, who was supposed to participate, declined. When coming back, Mancini and his colleagues took a copy of the Soil Survey Manual just published in 1951 by USDA (USDA-SCS 1951). Few years later, Mancini published a "Short guide for studying soil in the field" (*Piccola guida per chi studia il suolo in campagna*, Mancini 1957), openly translating parts of the USDA manual, and with references to the 1937 handbook by Comel and to the British "The study of the soil in the field" (Clarke 1941). Explicitly addressed to students and field surveyors, this is the first Italian example of a field handbook, with a field form and codes for recording the main profile characteristics.

In 1953, a new soil map for Europe was planned by an European work group at FAO, in scale 1:1 M. A committee was set for correlation and for unifying the mapping and classification criteria. The group was led by René Tavernier from Belgium. Mancini was member of the committee and responsible for the correlation of the Soil Maps of Mediterranean Europe. In 1960, Mancini published the part concerning Italy in scale 1:1,500,000 (Mancini, 1960), using the legend discussed and agreed upon by the FAO work group and based on literature data available until 1959 in Italy (listed in the 1961 book of Principi).

The map was explicitly defined an "approximation" and one year later, in 1961, with the support of the Italian Society of Soil Science the Committee of the Soil Map of Italy was set up in Florence, with the aim of producing further approximations of the soil map of the Country, updated and more detailed. The project of the committee was threefold: beside a 1:1,000,000 new map of the country, some examples of 1:250,000 regional maps, and more detailed studies for pilot areas, were planned. The committee published the 1:1,000,000 map in 1966 (Mancini et al. 1966); 1:250,000 maps of the main Italian islands, Sicilia (Ballatore and Fierotti 1968) and Sardegna (Aru et al. 1967), and of the province of Trento (Ronchetti 1965); and 1:100,000 maps of the province of Belluno (Sief 1967) and of the north-west Sardinia (Pietracaprina 1964). Finally, two 1:25,000 maps were also published, one of the area of Arezzo, Tuscany (Pancaro 1966), and one of Fersina Forest, Trentino (Wolf 1967). For the preparation of the map and supporting the field activities, a new field guide was prepared by Giovanni Ferrari and Guido Sanesi in 1965 (Ferrari and Sanesi 1965). This should have been followed by a handbook for standardising the laboratory soil analyses. The handbook would have been published by Italian Society of Soil Science in 1976 and adopted as a standard reference for Italy in 1999 (Decreto Ministeriale 13/09/1999). The definition of soil given in this guide is influenced by the USDA soil survey manual: "soil is a natural body, made up by mineral material particles, containing organic matter and capable to support vegetation. […] The presence of well developed horizons is not necessary for defining soil" (Ferrari and Sanesi 1965).

Some 38 scientists participated in the drafting of the 1:1,000,000 map (Fig. 1.4), among them pedologists, geologists, agronomists and foresters, soil chemists and cartographers. The committee was organised in subcommittees according to the different geographical areas of Italy: northern, central, southern and insular Italy. Each subcommittee was responsible for drafting the soil mapping units on geomorphological basis. The units were then discussed in plenary meetings and during the field surveys

Fig. 1.4 The 1966 soil map of Italy (Mancini et al. 1966)

organised by each subcommittee in the various Italian regions. Soils were classified according to a modified version of the classification system used in France (Duchaufour 1956), few years later organised in the French CPCS system (C.P.C.S 1967). Some of the meetings and the field excursions were attended by Tavernier (Ronchetti 1963), one of the participants at the working group of the 7th approximation of the USDA—Soil Taxonomy (USDA-SCS 1960) and referent for Europe. The 7th approximation had been presented at the VII Congress of the International Society of Soil Science held in the United States in 1960, one year before the set-up of the committee. This allowed for an early discussion of the new American system (Ronchetti 1963) which would have been commonly used by Italian pedologists in the following years.

The final map was published with the contribution of the National Research Council (CNR) and received a financial support of Shell Italiana for excursions, thanks to a company manager, Francesco Favati, who graduated at the University of Florence in 1947. The map has been then updated in 1985 for the Soil Map of the European Communities 1:1,000,000 (CEC 1985), by Mancini himself with the contribution of Roberto Salandin, and in 1986, for the European Soil Database by European Commission, with the contribution of Donatello Magaldi, Ugo Galligani and Ugo Wolf (Platou et al. 1989). The mapping units' limits are still the basis of the most updated European 1:1,000,000 soil map. Finally, it must be quoted that an Italian group of scientists, formed by Angelo Aru, Giovanni Fierotti, Fiorenzo Mancini, Antonio Pietracaprina and Giulio Ronchetti, contributed to the World Soil Map, edited by FAO between 1971 and 1981 (FAO 1971–1981).

1.4 The Diffusion of Pedology (1966–1999 and Outlooks)

Question: In the second part of the last century consciousness about the importance of soil increased, and soil science and pedology spread from universities and research institutions towards soil survey agencies. What were the main subjects involved? What is the present role of research in pedology?

Answer: At National level, the Ministry of Agriculture, played, and still plays, a major role in supporting soil surveys, that are basic for a modern and sustainable agriculture. Since late 1970s, the regional administrations took up the responsibility on environmental and agricultural issues and much effort was undertaken in order to guarantee coherence at national level and among the various Italian regions. When dealing with practical applications, research is fundamental in ensuring scientifically based and updated competencies in processing soil information gathered with surveys. On the other side, the regional agencies have a major role both in stimulating the research demand and in providing the necessary feedbacks for researchers. Still some open questions remain, both in agricultural issues and environmental ones. Pedologists, both researchers and soil survey officers, should make all the efforts for exploiting at their best potentials and synergies.

Since the early mapping efforts, culminated in the constitution of the Committee of the Soil Map of Italy and in the so-called *Progetto finalizzato conservazione del suolo* (literally, focused project on soil conservation), funded by the CNR, soil survey had been mainly worked out by universities and research centres. Important exceptions were the cases of IPLA (Istituto Nazionale Piante da Legno), in Turin, and Sardinia, where two regional agencies, Ente Autonomo Flumendosa and Ente Regionale Sardo per la Sperimentazione Agraria, were active in soil surveying in early 1960s, mainly for applied pedology. Even if the early soil maps were explicitly aimed at providing information for agriculture, their applicability was limited. The first surveys were mainly intended to improve the knowledge of the Italian soils, their genetic relationships with the environmental factors and their distribution. However, information commonly included in the map legends and in accompanying notes was usually not sufficient to support applications. In 1967, a land capability map (Soil potentiality map) of Sardinia was published in scale 1:250,000 (Arangino et al. 1967), followed in 1968 by the first land capability map of Italy (Mancini and Ronchetti 1968), based on the 1:1,000,000 soil map. The Authors used an index for rating the limitations of each mapping unit (Ronchetti 1966), using an approach similar to the Storie Index Rating (SIR), proposed in 1933 by R.E. Storie (in FAO 1967). The map was questioned by the academic world, which criticised the applicative approach. After the publication in 1976 of the FAO framework for land evaluation, several examples of thematic maps were produced at general and detailed scale (for a review, see Costantini 2009). These examples, mainly published by research institutes, paved the way for the exploitation of soil maps in land planning. An early example of application of the FAO framework at national scale is given by a series of maps (scale 1:2,000,000) representing the suitability of Italian soils for maize production (Ministero dell'Agricoltura e delle Foreste 1984). The study, commissioned by the Ministry of Agriculture, involved different background researchers from various institutions.

Since late 1970s, early 1980s, when regions were entrusted with responsibility for agricultural and environmental issues, several Regional Administrations, Lombardy, Piedmont, Tuscany and Emilia Romagna started systematic soil survey programmes, mainly at semi-detailed scale, having as priority the mapping coverage of more productive agricultural soils (Filippi 2005). In those years, Emilia Romagna published a reconnaissance scale map of its territory (Casalicchio et al. 1979), so that at the begin-

ning of the 1980s three regions (Emilia Romagna, Sardinia and Sicily) and an autonomous province (Trentino) had a 1:250,000 (or 1:200,000) soil map, and, in the case of Piedmont (Regione Piemonte—IPLA 1982) and Emilia Romagna (Angelelli et al. 1981), a Land Capability map.

The regional administrations needed professional pedologists for their survey plans. Some Regional administrations, for example, Regione Emilia Romagna and Lombardy, organised training courses with this aim in the late 1980s. In 1990, an "Observatory for Pedology and Soil Quality" was set up by the Ministry of Agriculture, with the aim of supporting the Ministry and the regional authorities in soil-related matters and for soil analysis methods standardisation (DM 7/7/1990, n. 15517, 20/9/1990, n. 20611).

The Observatory for Pedology and Soil Quality, formally still operative, was composed by representatives of the Ministries of Agriculture and of Environment, by scientists of the Agriculture Research Council (CRA), CNR and Academy and by regional officers. For that reason, it acted as a coordination body among the various actors in the complex Italian panorama. It promoted and published, and presently updates, a series of soil analysis methods handbooks: physical, chemical, microbiological, biochemical, mineralogical and water analysis, eventually adopted as official standard references.

In 1991–1992, the Observatory organised two courses for pedologists, for northern and central-southern regions, funded with European structural funds (European Agricultural Guidance and Guarantee Fund, REG. CE 270/79) aimed at training personnel to be eventually recruited by the regional services or agencies responsible for soil survey. Most of the people trained in those courses are presently active in the local soil surveys.

Main aims of regional soil surveys were providing information for the correct and sustainable use of soil, and supporting other regional services, such as agricultural or land-use planning services. Several examples of soil information applications can be recalled, at the beginning mainly focussed on agricultural issues, such as the already mentioned land capability maps of Emilia Romagna and Piedmont (Angelelli et al. 1981; Regione Piemonte—IPLA 1982) and land suitability for various agricultural systems (e.g. Regione Emilia Romagna 1987).

In 1998–1999, two joint soil programmes started at national scale: "Soil map of Italy" and "Pedological methodologies" (Costantini and D'Antonio 2001). The regional soil survey teams, under the coordination of Ministry of Agriculture, by means of the Observatory for Pedology and with the scientific coordination of the Experimental Institute for Soil Study and Soil Conservation and in cooperation with several universities, carried out the project "Soil Map of Italy". Contemporarily, the project "Pedological Methodologies" was aimed at providing reference standards for land units' definition and field surveying procedures, coherent with EU standard methodologies (ESB 1999), defined in the same period by a network of European soil scientists under the umbrella of the newborn European Soil Bureau Network set at the Joint Research Centre of the European Commission in Ispra (Italy, Montanarella et al. 2005). In both the projects, the participation of most of the institutions involved in soil survey, both at national and local level, allowed for a substantial coherence of approaches, despite the lack of a clear structure in management (Filippi 2005).

The main results of the two projects were the 1:250,000 soil map and database for most Italian Regions (16 regions out of 20), pursuing both exploitation of local knowledge and consistency of information at National and European level (Filippi 2005); the editing of a field guide for soil description (Carnicelli et al. 2001) consistent with the ones adopted at local level; the publication of a 1:5,000,000 soil region map harmonised at European level (Costantini et al. 2004; see Chap. 6); the set-up of a national soil database, the so-called Italian National Centre for Soil Mapping (Centro Nazionale di Cartografia Pedologica, CNCP, http://abp.entecra.it/soilmaps/en/home.html).

The linkage between regional soil survey teams and research institutions was very strict in those years, when a productive cooperation developed. From one side, the regional soil surveys were interested in gathering soil data and exploiting them for applicative aims. From the other one, the research institutions were involved in providing a scientific support based on the societal research demand. Moreover, the cooperation with regional soil surveys assured an invaluable feedback for a direct validation of scientific issues. As an example, in the frame of a transregional project (SINA-National Environmental Information System—Soil Mapping in Areas at High Environmental Risk 1996–2000), a set of locally validated pedotransfer functions for estimating hydrological soil properties was developed for soils of northern Italy alluvial plains (Ungaro and Calzolari 2001; Ungaro et al. 2005). This was possible thanks to the cooperation of research institutions and regional soil surveys of Piedmont, Lombardy, Veneto, Friuli-Venezia Giulia and Emilia Romagna.

Between 2006 and 2009, the SIAS (Sviluppo di Indicatori Ambientali sul Suolo in Italia—Development of Soil Indicators in Italy) project was launched (http://eusoils.jrc.ec.europa.eu/projects/Meusis/italy.html), led by the Italian Agency for Environment Protection (APAT), at present part of the Institute for Environmental Protection and Research (ISPRA), with the technical support of the Regional Agency for Environment Protection of Veneto (ARPAV) and the participation of most of the Italian regions (16 out of 20). The project was aimed at developing soil indicators, adopting a harmonised methodology among the various regions, with special reference to soil erosion and organic carbon content.

The project was conceived as part of the MEUSIS project (Multi-Scale Soil Information System) which had as objective the development of an approach for up-scaling soil data from local to regional and European scale in the frame of the INSPIRE directive (2007/2/EC) (Panagos et al. 2011). In recent years, the societal demand of soil information is increasing (Hartemink and McBratney 2008) for answering to new challenges such as climate change impact and mitigation needs, food security, sustainable use of resources, pollution minimising, management of contaminated sites, land take and consumption. Italian soil science community, as the international one, "should act promptly and deliver, whilst at the same time […] should continue to be innovative and develop new thinking about soils and how they are studied and properly managed" (Hartemink and McBratney 2008). This is the subject of a specific chapter of the present book (Terribile et al., Chap. 11).

1.5 The Research Institutions

Question: Around the mid of the past century, Florence appeared to be the centre of research in pedology. Is it correct? Which are the specific roles of University, Ministry of Agriculture and National Research Council? Which are the links with the other Italian universities?

Answer: From an historical point of view, Florence and Perugia were pioneers in "modern" pedology. The presence of Paolo Principi, who worked in both the cities, created a strict link between the two universities. Many future pedologists studied in the agriculture faculty of Florence, and then moved to other seats, spreading the discipline across Italy. The constitution in Florence of an experimental institute of the Ministry of Agriculture devoted to soil science, and the setting up of a CNR study centre, again in Florence, strengthened the pedological school of Florence. Later on other pedological schools formed, in other cities. But, the Florentine heritage is still a reality. The National Research Council that funded a huge project on soil conservation, directed by myself and centred in Florence, also played a major role.

From a historical point of view, two university departments had an important role at the very beginning of Pedology in Italy, the institute of Mineralogy and Geology of the University of Florence (formerly the National Forestry Institute), and the institute of Mineralogy and Geology of the University of Perugia (formerly Regio Istituto Agrario Sperimentale di Perugia). The first director of the Florentine Institute was Alessandro Martelli (1876–1934), famous geologist, senator and Ministry of National Economics (1928–1929). He was followed by Riccardo Ugolini, geologist, who published a 1:500,000 map of Tuscany, "Tuscan rocks as a basis for a rational evaluation of agricultural soils gross production" (Ugolini 1933). With the arrival of Paolo Principi, Ludovico Edlmann and Fiorenzo Mancini, the scientific interests of the Institute turned decidedly towards soil science. Strictly connected with the Florentine one, the Institute of Mineralogy and Geology of the University of Perugia was firstly directed by Guido Bonarelli (1896–1899), geologist and palaeontologist, followed by Paolo Vinassa de Regny, Gioacchino de Angelis d'Ossat, Paolo Principi, Cesare Lippi-Boncambi and Celso Giovagnotti, who in 1980 translated the USDA Soil Taxonomy (USDA 1980).

The first chairs of pedology (geopedologia) were the ones of Mancini in Florence and of Sandri in Bologna, in 1954. Chairs of Pedology were later on set in the Universities of Sassari (1965), Cagliari (1970), Palermo (1970), both in Geology and Agriculture faculties.

In Sassari, Antonio Pietracaprina (1931–2011), geologist and pupil of Ardito Desio (1897–2001), geologist himself and famous explorer, called as assistant Paolo Baldaccini, agronomist who studied with Mancini in Florence. At the beginning of his career, Baldaccini worked in Florence at the Experimental Institute for Soil Study and Soil Conservation. Also Angelo Aru, agronomist, who started his career at the Ente Regionale Sardo per la Sperimentazione Agraria, an experimental station of Sardinia Region, worked in Florence at the Experimental Institute for Soil Study and Soil Conservation. From there, he moved back in Sardinia, becoming professor of Pedology at the University of Cagliari. In Sicily, at the Agriculture faculty of the University of Palermo, Gian Pietro Ballatore (1921–1975), agronomist and soil scientist, had as assistant Giovanni Fierotti (1925–2011), chemist and pharmacist, who became full professor of pedology. These three University seats, with their researchers, remained strictly linked to the Florentine school, being active partners in the panel for the Committee for the Soil Map of Italy.

More recently, chairs of pedology have been set up in Torino, Venezia, Milano, Siena, Napoli, Ancona, Campobasso (Mancini 1994; Nannipieri 2001).

In 1952, Gino Passerini (1889–1961) with the political support of Michele Gortani, elected Senator at Italian Parliament in 1948, founded in Florence the Experimental Institute for Soil Study and Soil Conservation (ISSDS) under the control of the Ministry of Agriculture. Passerini, agronomist and specialist in hydraulics and soil conservation, had worked to the idea of having an institute dealing with soil conservation for many years. In 1939, he presented at the Georgofili Academia of Florence the proposal of setting up an institute with a twofold function: (1) a scientific research and experimental laboratory on soil, considered as "a subject of coordinated researches in the different elemental factors (physical, chemical and biological) which influence soil dynamics and fundamental nature"; and (2) a national-level soil conservation service. In the original project, the institute should have been organised in four sections: physics, chemistry, biology and statistical economics (Pure et al. 1939). The proposal was

"unconditionally" accepted by the members of the Georgofili Academia. In 1947, the sum of 150 millions of Italian liras (correspondent to more or less 2.8 billion of euros) was allocated for the project, on a particular funding programme, "fondo—lire United Nations Relief and Rehabilitation Administration" (UNRRA), funded mainly by the United States for an extensive social-welfare programme after World War II (Passerini 1952). It took more than ten years for the project to be finally realised.

ISSDS was eventually organised in four sections: physics, chemistry, biology and genesis classification and cartography. Main research topics were on the impact of agriculture on soil quality: soil erosion, with the contribution of the group of Giancarlo Chisci who participated to the building of the erosion model EUROSEM (Morgan et al. 1998); land evaluation, with the early works of Giulio Ronchetti and Donatello Magaldi; and soil genesis and mapping, with Luciano Lulli and his collaborators. Until mid-1990s of the past century, it used to publish a yearly bulletin, with the main scientific results of the researches. With the reform of the Ministry of Agriculture and of its experimental institutes, ISSDS has been merged with the Experimental Institute for Agricultural Zoology, as Research Centre for Agrobiology and Pedology (ABP), within the network of the Agriculture Research Council (CRA).

The CNR, the largest Italian research public body, which funded the early studies of Italian soil scientists, as the Principi's maps of the province of Florence (Principi 1942) and the Soil Map of Italy, played an important role. Two so-called study centres, supported by CNR with personnel and funds, were constituted in 1969, in Florence, on Soil Colloids (CSCS), and on Soil Genesis, Classification and Cartography (CSGCCS), the latter being led by Mancini. CSGCCS played a major role in large-scale surveying of several pilot areas, in central and southern Italy and with Luciano Romagnoli (1926–1973), Guido Sanesi (1939–2006) and later on with Ermanno Busoni, specialised in research in soil physics and hydrology, soil and landscape evolution. Between 1988 and 1995, CSGCCS has published a peer review journal, "Quaderni di scienza del suolo". Following the CNR reforms, CSGCCS merged in 1998 with the Florentine section of CSCS, forming the Institute for Soil Genesis and Ecology, IGES, and, later on, with the Research Institute for Hydrogeological Protection (IRPI).

CNR played a further important role for soil science, and in particular for pedology, funding in 1978–1983 the *Progetto finalizzato conservazione del suolo* directed by Mancini. Some hundreds of scientific publication arose from that project, which was subdivided in different subprojects, dealing with slope dynamics, coastal dynamics, river dynamics and soil conservation. The central role of Florence in the development and consolidation of the Italian pedological school was somehow facilitated by the presence and character of Fiorenzo Mancini. Since the early stages of his career, Mancini, agronomist lent to earth sciences, worked at building a formal and informal network of scientists and professionals, rooted in various disciplines and from different areas, both at national and international level. This paved the road for a shared vision and a common understanding among Italian pedologists.

Finally, in recent years, the Institute for Environmental Protection and Research, ISPRA (Istituto Superiore per la Protezione e la Ricerca Ambientale), has been established in Rome (L. 133/2008), merging the competencies of a number of existing research institutes and national environmental agencies, among which the geological survey. ISPRA is the National Focal Point of the European Environment Information and Observation Network (EIONET) and the primary contact point for of the European Soil Data Centre (ESDAC), the thematic centre for soil-related data in Europe (Panagos et al. 2012) hosted at the Institute for Environment and Sustainability (IES) of the Joint Research Centre of the EU Commission (http://esdac.jrc.ec.europa.eu/; http://eusoils.jrc.ec.europa.eu/library/data/eionet/PrimaryPoints.cfm). ISPRA publishes a yearly report on the state of the environment, including a thematic chapter on soil.

1.6 The Soil Societies and Associations

Question: what role did the Italian Soil Science Society have in the development of pedology in Italy? Which the one of the Italian Association of pedologists, AIP and of the Italian Society of Pedology, SIPe? What the future?

Answer[2]: In early 1960s, the V commission, Genesis Classification and Cartography, of the Italian Society of Soil Science was entirely involved within the Committee for Soil Map of Italy. The commission has always been very active in soil survey issues, representing a cultural reference for Italian pedologists. When AIP was founded, this was seen with some cautiousness by the academic pedologists, who would have rather preferred a scientific society. This was eventually created some years later, the Italian Society of Pedology, SIPe, whose main aim was representing pedology within the academic world. As in other countries, also in Italy, the university courses on soil science, and pedology in particular, decreased in the last years. Having a recognised scientific society could facilitate the dialectic with other stronger academic disciplines. In this situation, it is unlikely a merging of the three societies, even if a stronger and official coordination could be beneficial for Italian pedology and soil science in general.

Despite the exiguous number of pedologists, and in general of soil scientists, three soil societies are active in Italy, with slight differences in aims and composition. The Italian Society

[2] The question was jointly posed to Fiorenzo Mancini and Giulio Ronchetti. Prof. Ronchetti, agronomist and soil scientist, has been director of ISSDS between 1974 and 1995.

of Soil Science, SISS, is a multidisciplinary association, gathering all the sub-disciplines of soil science. Primarily focussed on pedology, the Association of Italian Pedologists, AIP, has a more professional and applicative character as compared to the Italian Society of Pedology, SIPe, which has an academic character mainly. The three societies cooperate in their activities, organising common events, workshops, conferences and scientific field excursions.

1.6.1 SISS

Two years after the IV Congress of the International Soil Science Society held in Amsterdam, the Italian Society of Soil Science (SISS) was founded on February 18, 1952, by Gino Passerini who was then elected as its first president. Since then, 12 presidents have been elected. 14 people were founder members, among whom agronomists as Gino Passerini, soil chemists as Alberto Malquori, pedologists as Fiorenzo Mancini and Paolo Principi. In analogy with the International Society, the Italian Society was organised in disciplinary commissions (presently eight: Physics, Chemistry, Biology, Fertility, Genesis Classification and Cartography, Soil use and conservation, Mineralogy, Soil and environment). The Italian Society counts about 190 members, mostly scientists from universities and research institutions. SISS is seated in Florence, at the Institute for Soil Study and Soil Conservation. Since 1969, SISS publishes a Bulletin, and since 1982, it organises annual meetings (biannual in the last years). With the V commission on soil genesis and classification, it participated in editing the Soil Map of Italy of 1966. Between 1997 and 2006, it edited seven agricultural technical handbooks for soil and water analysis, as reference scientific society of the Observatory for Pedology and Soil Quality. The aim of SISS is mainly cultural thanks to its multidisciplinary character (www.scienzadelsuolo.org).

1.6.2 AIP

The Associazione Italiana Pedologi (Italian Association of Pedologists, AIP) has been founded in Ferrara in 1992, by the initiative of a group of professionals, researchers and technicians in pedology (100 founder members). In order to maintain a strong link with SISS, the seat of AIP was set in Florence, at the Institute for Soil Study and Soil Conservation. First president of the Association was Enrico Favi, an officer of Tuscany regional administration. The main purpose of the Association is promoting the knowledge of pedology and the role of pedologists. To this aim, AIP organises professional training courses and scientific events, often in cooperation with other scientific associations and research institutions. It holds an annual assembly, with scientific excursions. AIP maintains an updated website (www.aip-suoli.it) and publishes a periodic electronic newsletter.

The main characteristic of AIP is the coexistence of different professional figures operating in pedology, as researchers, professionals and soil survey officers. This should facilitate the following: (1) the exchange and integration of experiences; (2) the development of a common cultural approach to the discipline; (3) the perception of the societal research needs; and (4) the dissemination of the results of the research.

In 1994, AIP published a *manifesto*, reported in the box. It is worth to be noted that many of the concepts then adopted in EC Soil Thematic Strategy are present in AIP manifesto 10 years earlier.

Manifesto of pedology (version of 18/01/94, excerpt).

- What man calls soil is a natural body at the interface between atmosphere and lithosphere. It is the result of the interactions of present and past chemical, physical and biological processes.
- Soil is a continuum on the earth surface, not homogeneous and in permanent exchange of energy and matter with the surrounding environment.
- Soil is a fundamental factor in maintaining the global equilibrium needed for biomass production, in regulating the other environmental components (e.g. water), in providing a substratum for most of the biological activities, included human activities, and as information archive (palaeo-environmental aspects, archaeological remnants, etc.).
- Soil is a natural resource, very slowly recovering and expensive to recuperate; the processes acting in it are mostly irreversible or very slowly reversible. Every soil degradation process (such erosion or sealing), its destruction or the incorrect transformation of its physical, chemical or biological characteristics (salinisation, alcalinisation, pollution) lead to an irreversible loss.
- Life and welfare are strictly linked to the soil capability to produce goods, and man can benefit of it through its activities, but he can benefit of it even more if, by means of his capacity of partitioning and cataloguing the surrounding world, he delimits the different soils and defines their properties assessing the alternative possibilities of managing and using soils.
- As a natural resource, soil must be preserved for future generations. It is in our responsibility to preserve it in such a way that it will be possible to benefit of it even in future. Therefore, people having responsibilities towards soil should take into

consideration not only its chemical, physical and biological characteristics, but also the technical, socio-economic and legal aspects which directly affect soil use and conservation […].

- When planning soil surveys, both in research and professional activities, it is necessary to consider two interconnected aspects: priorities and urgency. Priorities should be defined according to the different pedological topics (if soil mapping and classification, soil–plant relationships, soil degradation, etc.) and in its planning aspect: where, why and for whom studying soil.
- Urgency is given by the fact that research, experimentation and in general, the agronomic, forestry and environmental activities are long-term activities. On the contrary, soil degradation is a quick process which can lead in some circumstances to a permanent loss of the soil resource […].
- For the sake of urgency, when fast responses are needed for planning activities, it is important that adequate financial and human resources are allocated, in order to avoid obtaining low-quality results, and eventually a weak knowledge base for any planning decision.
- The motivations for studying soils are extremely important in planning activities, that is, the range of reasons for a customer in requiring the services of a pedologist […]. It is necessary that these motivations are clear, given the pre-existing knowledge about soil, its use limitations and degradation risks, so that fragile pedoecosystems can be identified and quantified. Any planning in soil study should be coherent with the concepts of priority and urgency.
- Stakeholders and end-users must be appropriately involved, so that they can correctly exploit the results of the soil surveys activities. On the other side, the pedologists should guarantee the correctness and usability of their work results, explicitly showing potentialities and limitations in their use.
- Research and applications must be interdisciplinary in order to address environmental questions in an integrated way. Interdisciplinary should involve also disciplines other than natural sciences […].
- Finally, pedologists should always consider the sustainability of any actions involving soils in agricultural and natural environments. This can be achieved by acting with the aim of preserving or recovering environmental integrity and productivity so that humankind can continue to benefit of it.

1.6.3 SIPe

The Italian Society of Pedology, SIPe, has been founded on 9 December 1997, in Palermo, on initiative of Giovanni Fierotti. Aim of the Society is to promote, sustain and coordinate studies and research in pedology and its applications, and to facilitate relationships and collaboration among scientists, acting as an interface with other academic societies. Also, it aims at promoting the academic education in pedology, representing the discipline in national committees, such as the national research evaluation agency. It acts for funding young scientists with grants (*Certamen Peologico*). As compared to AIP, SIPe has an academic character, even if the membership is not limited to academics. It counts about 110 members, with around 10 % of young pedologists, and organises workshops, scientific excursions, etc. (www.societapedologia.it).

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