ANNUAL REPORT 1984

International Soil Reference and Information Centre
Wageningen - The Netherlands

ISRIC was born out of an initiative of the International Society of Soil Science, and was adopted by Unesco as one of its activities in the field of earth sciences. It was formally founded on 1st January 1966 by the Government of The Netherlands, upon assignment by the General Conference of Unesco in 1964.

Most of the working funds are provided by the Dutch Ministry for Education and Sciences, and are accountable to the Directorate-General for International Cooperation (DGIS) of the Ministry of Foreign Affairs.

The constituent members of the Board of ISRIC are the International Institute for Aerospace Survey and Earth Sciences (ITC) in Enschede, the Agricultural University Wageningen (LH) and the Directorate for Agricultural Research (DLO).

Advice on the programmes and activities of ISRIC is given by a Unesco-FAO appointed International Advisory Panel (IAP) and by a Netherlands Advisory Council (NAC).

The financial-administrative responsibillity for the working funds and for the permanent staff of ISRIC rests formally with the Board of Governors of ITC.

Up to 31 December 1983 the name was International Soil Museum (ISM).

CIP-GEGEVENS KONINKLIJKE BIBLIOTHEEK, DEN HAAG

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1 INSTITUTIONAL DEVELOPMENTS

The year 1984 was the first year of the Centre's functioning under its new name ISRIC. The change-of-name was welcomed by the large majority of our contacts, although a number of long-time customers, especially university visiting groups, still fondly talk about "the Soil Museum".

The soil monolith collection and exhibition programme, as the traditional core activity of the Centre, continued to receive a good deal of attention, with new material gathered in Brazil, Gabon, Indonesia, Malaysia, Spain, the U.S.A., and Uruguay. In part, this activity was facilitated by the work programme of three soil scientists of Unesco's Man and the Biosphere programme, who since more than three years receive technical backstopping from ISRIC.

There is now broad recognition that the Centre is a unique and essential institution for development of soil standards, and that it should function as a depository and processing unit of basic information on the soil resources of the world at large, and of the developing countries in particular. This manifested itself in a number of formal suggestions for the joint undertaking of specific soil-related projects, as well as straightforward requests for technical cooperation on the creation or strengthening of national soil reference collections (NASREC's). It is now likely that a number of these requests can be effectively honoured in the near future, through funds of UNEP's Clearing House Facility.

More and more it is being realized that such national soil reference collections, if combined with ample illustration material, can be an important tool in the development and safeguarding of a country's soil resources. They function as standards for soil survey and research institutions, as teaching tool for students, as means of effective communication with land use planners, and as an eye-catcher at awareness promotion of the value and fragility of the country's land resources: "down-to-earth"!

A link with a computerized soil or land resources data bank is rather obvious, and this aspect will be included in the curriculum of ISRIC's annual training course. During the past year the mode of computerizing the Centre's own data base received much attention, especially in respect of compatibility and transferability to national systems, to be started in developing countries. Funds for the necessary hardware and regular staff for development of the software and effective data input have however not yet become available.

Finances did materialize for the programme on comparison of methods, procedures and results of laboratory analysis for soil characterization purposes (LABEX), which was started on a pilot basis three years ago. The Dutch Directorate-General for International Cooperation (DGIS) approved a 2½-year project, enabling ISRIC to enlarge the group of participating laboratories to about eighty. It will also allow the organization, together with other donor agencies, of a special workshop on the evaluation of the results and the propagation of standards to be agreed upon.

The importance of worldwide accepted guidelines for soil classification, through development of an International Reference Base for soil classification (IRB) was recognized by UNEP as one of the elements of its World Soil Policy, and approved by its Governing Council in May 1984. Towards the end of the year this organization agreed to

finance, through Unesco, a two-year backstopping function at ISRIC for this activity of the International Society of Soil Science (ISSS).

The Centre is also cooperating with Commission V of ISSS on the formulation of a major programme of a digitized global soil resources inventory at 1:1 million scale, as a means to update the FAO-Unesco Soil Map of the World at 1:5 million scale, and to make it a more effective tool for both inter-country transfer of agrotechnology and country-level rural development and food production.

Considerable interest from other scientific disciplines was shown in the establishment of a reference collection of whole laterite profiles (CORLAT), and the associated standardization of structures and textures description. The search for a source of financing parts of the project is continuing.

The recent widening and deepening of ISRIC's activities was made possible in part through the stationing of volonteer scientific and technical/administrative staff. This is however not expected to be a permanent feature, and anyhow does not ease the need for a fully-fledged publication programme. Like any plant taxonomic/geographical institute of regional or global scope, the Centre should have sufficient staff to issue Soil Monolith Papers (detailed description of a typical example of recognized soil classification units) and Soil Monographs (comparative studies on a wide range of examples of a soils order). The chronic conflict between this basic scientific output and the practical need to engage in projects and programmes of more applied nature puts a heavy stress on ISRIC's small permanent staff. There is also an acute lack of office space for the various functions of the Centre.

There have however recently been stimulating signals that some bi-lateral donor agencies in the technical cooperation sphere may be prepared to contribute to ISRIC's core funding, in addition to the lion's share provided since so many years by the Dutch Directorate-General for International Cooperation (DGIS), through the Ministry of Education and Sciences. This strengthens the case to make ISRIC a separate Foundation, with international representation on its Board of Management - in accordance with the recommendations of the 1983 meeting of its International Advisory Panel. Draft regulations for such a foundation have now been prepared. In the consensus that, for the time being, the Centre would be too small to have its financial and personnel administration completely in-house, ways are being explored to conclude a management contract with a major institution in Wageningen or elsewhere. True international outlook, streamlining of administration, and safeguarding of the legal status and decision participation of the permanent and temporary personnel, are basic premises at these reorganization efforts.

Since 1 January 1984: a new name!

2 REVIEWS AND ARTICLES

SOIL CLASSIFICATION IN THE PAST --- ROOTS AND PHILOSOPHIES

Roy W. Simonson[1]

Abstract

Efforts in classification hark back to antiquity and reflect prevailing understandings of soils. The earliest attempts were to grade soils according to usefulness for growing plants. With the birth and development of geology, soils were thought formed by weathering and were classified on the basis of underlying rocks for about 100 years. Recognition of soils as natural bodies akin to but independent of rocks began during the last quarter of the 19th century and gradually led to the development of systems of classification keyed to genesis and characteristics of the soils themselves. Such systems have continued to evolve during the present century.

Introduction

Programs to classify soils of entire countries are largely a 20th century phenomenon, some having started in the last 40 years. Prior to the present century, however, efforts were made to classify soils of areas ranging mostly between a few hundred and a few thousand square kilometers in size. Most early efforts paralleled those in the classification of plants -- "Biological taxonomy developed from the practical needs of the study of living creatures, especially for medicine and food...(Walters, 1964). Eventually purposes were expanded to permit organizing and manipulating information available about soils.

Past efforts are important for several reasons. They are the take-off points for later ones, and they carry the roots of present systems. Elements of earlier systems are also used in the construction of new ones. Consequently, this paper reviews some past efforts. Knowledge of such efforts should provide better understanding of the systems of the present.

Earliest efforts

The earliest attempt for which any record exists was made in China little more than 4,000 years ago (Ping-Hua Lee, 1921; Chih-I, 1957; Wang Yun-sheng, 1979). The three reports differ on details but all state that nine broad classes were first recognized and that those were then subdivided further. The available information also indicates that the attempt was more of a land than soil classification system. Nevertheless, the broad classes were given names descriptive of soils, viz., yellow and soft, red and loose, dark blue, and muddy. Sizes of individual holdings and rates of taxation were based on the land classification.

The next attempt to classify soils of which I have found records began in Rome about 2,000 years ago (Neuss, 1914; Ehwald, 1960, 1962). The Greeks apparently recognized soil as a medium for plant growth, as did the Romans, but did not distinguish kinds

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(Ehwald, 1962; Yarilov, 1927). In the best known of Roman books on agriculture, Columella (60 A.D.) ranked soils from best to worst: Rich and mellow; Rich and dry; Well-watered; and Dry, soft, and lean. He was trying to distinguish soils that were good from those that were poor for plants. Interest in soil beyond its role as a medium for plant growth did not yet exist.

The Greek and Roman ideas were preserved and transmitted by medieval scholars (Neuss, 1914; Russell, 1973). Eventually, a desire for better understanding of mechanisms of plant growth led to investigations that touched soils even though centered on plants (Boulaine, 1983). Some further information on the composition of soils was thus obtained, especially in the late 18th and 19th centuries. The soil mantle was still not recognized, however, as a mosaic of geographic bodies with distinctive properties.

Classification systems based on geology

The birth and development of geology in the late 18th and early 19th centuries provided a new approach to the study of soils. Field methods were devised and the way was thus paved for development of two ideas essential to classification of soils on the basis of their own properties. First, field methods permitted recognition of geographic bodies of soils although those bodies were considered to be direct expressions of underlying rocks for more than a century. Second, geology offered an early theory of soils genesis, namely, that soils were formed by weathering of rocks in place or by deposition of weathered rock materials after transport. Those were initial steps in the recognition of soil bodies as geographic entities with genetic histories of their own though many more steps were needed to reach current understanding.

Numerous systems of soil classification based on geology were developed during the 19th century, although the conception of soil as a medium for plant growth did not disappear. An elaborate effort to classify soils according to their suitabilities for certain crops is the proposal by Thaer (1844) to set apart wheat soils, barley soils, oats soils, and rye soils, then grade each into classes according to productivity. Various other approaches to the classification of soils were also tried, but systems based on geology prevailed generally from the middle of the 19th through the first quarter of the 20th century with one notable exception to be discussed later. Many examples of systems proposed during the 19th and early 20th centuries are given by Glinka (1931), Neuss (1914), and Sibirtsev (1951).

One early effort to classify soils on the basis of geology was made in Albany County, New York (1,375 sq km) by Eaton and Beck (1820). In their report, the authors state that their geological survey is the first made to improve agriculture insofar as they know. The collective name given to soils of the county was "alluvial formations". These were then split into sedentary and transported materials, with the former much more extensive than the latter. Sedentary materials were next split into five and transported materials into four subclasses. Names of the five kinds of sedentary materials were granular soil, hard pan, upland loam, upland clay, and lowland loam. Parallel descriptive names are given for the kinds of transported materials. No descriptions of the "soils" are given in the report although suitabilities for local crops are discussed. The nomenclature differs from those commonly used in systems of classification based on geology.

Eaton and Beck (1820) used a system of classification with two categories (sets of classes of the same rank). The upper category consisted of two and the lower one of nine classes. The report does not indicate that any thought was given to recognition of categories *per se*. The *ad hoc* system was simply a matter of convenience.

One of the more complete systems based on geology was proposed by Fallou (1862) in Saxony. He constructed an *ad hoc* system with two categories, the upper comprising two and the lower 25 classes. The two broad classes were called residual soils and sedimentary soils. The former was then subdivided into granite soils, limestone soils, sandstone soils, and the like. The latter was split into gravelly soils, marly soils, loamy soils, and so on. The classes in the upper category were set apart by mode of accumulation of the regolith and those of the lower category partly on the basis of underlying rock and partly on the basis of physical and chemical nature of the regolith. The effort at classification was thus keyed in part to the current understanding of the origin of the soils and in part to characteristics of the regolith after it had accumulated. Fallou (1862) expressed his theory of soil formation in colorful language -- "...Soil is considered to be the product of weathering, formed as the tooth of time incessantly grinds the solid covering of our planet and decomposes and destroys its solid mass..." The approach of Fallou, according to Neuss (1914) introduced a new principle for the classification of soils. They need no longer be classified on the basis of their suitablilities for various crops.

Two departures from the geological basis were made by Hilgard during the 19th century. First, he set apart "soil belts" in the state of Mississippi, USA, according to surface geology, land configuration, and native vegetation (Hilgard, 1860). Examples of names given to the soil belts in northern Mississippi are sandy oak plains, cane hills, brown loam tablelands, flatwoods, and white lime prairies. The second departure came after Hilgard had worked in California for a long while. He concluded that climate was important to soil formation and pointed to the accumulations of carbonates in soils of dry regions as a distinctive feature (Hilgard, 1892). Thus, he recognized a soil characteristic as distinct from geology but continued to argue that classification of soils had best be done on some local basis.

The general approach to classification of soils outlined by Fallou (1862) was widely followed in the world for 50 or 60 years. That approach was a major element in the framework adopted at the outset of the soil survey program in the United States in 1899, although names assigned to kinds of soils were not keyed directly to underlying rocks or the general nature of the regolith (Simonson, 1968, 1980). Similar approaches were being followed in France, Germany, Great Britain, and Japan (Coffey, 1912).

Fifteen years after the federal soil survey was started in the United States, the skeleton of a classification system, based chiefly on geology, was proposed by a committee (Coffey, 1914). Classes in the five categories were to be set apart as follows: I. Precipitation and humidity -- soil regions; II. Dynamic agencies -- soil provinces; III. Lithology -- soil groups; IV. Specific characters and conditions -- soil series; and V. Texture -- soil class. The three classes in the top category were to be called humid, semi-arid, and arid soils. Examples of classes are not given for other categories. Dynamic agencies are listed, however, and all but one consist of agencies of weathering and sedimentation. Four groups of rocks were to be used as the basis for differentiation of classes in Category III. Recognizing classes in the top category on the basis of climate is a

departure from strictly geological grounds. At the same time, differentiae listed for all categories above the series are features outside of the soils themselves, reflecting the prevailing ideas of soil genesis. Moreover, the general names for sets of classes in the two uppermost categories are geographic terms, not keyed to the soils. The proposal does indicate the outlook on soil classification in one country in 1914, after many soil surveys had been completed. So far as I have been able to learn, nothing came of the committee proposal.

Two items in the committee discussions bring out differences in the prevailing understanding of soils. First, Coffey (1914) suggested that more classes be set apart in the top category so that the "light-colored timbered soils" could be differentiated at a high level from "black prairie soils (Chernozems)." If that were done, he argued, the system would be more in harmony with approaches elsewhere in the world, especially in Russia. The committee rejected the suggestion. Second, C.F. Marbut remarked that not enough consideration had been given to geology in the proposal. His statements 13 years later (Marbut, 1928) demonstrate a great change in point of view in little more than a decade.

Changes in the generally accepted theory that rock weathering was soil genesis were necessary before the approach to classification of soils could be changed. Theories of genesis are basic to the classification of soils, whether that be conscious or unconscious (Simonson, 1980). Some modifications of the prevailing theory were suggested during the 19th century but those had little effect in the world.

Davy (1813) considered soils to be formed by a combination of weathering of rocks and decay of organic matter. Hilgard (1860, 1891) placed great emphasis on native vegetation but more as a key to the indentification and naming of soils than to their genesis. In his scholarly monograph on the origin and nature of soils, Shaler (1891) argued that living organisms *must* participate in the formation of soils; weathering alone was not enough. Each such suggestion included some elements of future ideas but none altered the prevailing theory of rock weathering as soil genesis. The persistence of ideas once widely held is illustrated beautifully in the book "Rocks, Rock Weathering and Soils" by Merrill (1913). The three editions of the book from 1897 through 1913 all carry the following lines:

"Within the glaciated area, except where derived directly from highly colored rocks like the Triassic sandstone, the soils are everywhere dull in color, some shade of gray, drab, or brown. South of this limit ochreous-red and yellowish prevail. Along the lines of the Virginia railways southwest of Washington, these colors prevail in hues of surprising brilliancy. Although the soils throughout the region are residual, their colors seem quite independent of the kind of rock to which they owe their origin. Granite, gneiss, schist, or trappean rocks alike give rise to red and yellow highly tenacious residues of such depth and brilliancy of color that every gully, ravine, and roadway stands out against the green background of the landscape, as though painted by some Titanic hand with brushes dipped only in yellow, red, and vermillion ochres..."

Merrill (1913) did note that the "residual soils" shared certain colors (and some other characteristics) irrespective of the rocks "to which the owe their origin". His adherence to the idea of soil formation as rock weathering was strong enough, however, so that the shared characteristics of the soils struck him as an anomaly but nothing more. Actually, the first two decades of the 20th century were to pass before changes in the basis for soil classification were to set in for the world as a whole.

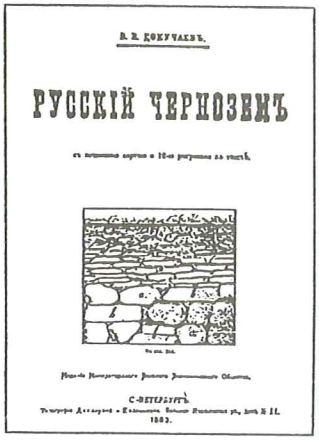
Early pedologic systems of classification

A prerequisite for any pedologic system was a break from the concept of soil as the surface mantle of loose and weathered rock. First, the soil mantle had to be recognized as consisting of a mosaic of organized natural bodies akin to but equivalent to rocks. That break was made in Russia by Dokuchaeiv (1948) at the beginning of the final quarter of the 19th century. The break did not become known outside of Russia except to few people prior to the 20th century.

News of the approach developed in Russia over the preceding 25 years did reach some people from other countries during the Seventh International Geological Congress in St. Petersburg in 1897. Sibirtsev presented the new concept of soil and his system of soil classification (Boulaine, 1984). The report was printed in French in the Congress proceedings and then summarized in an English translation published in the United States four years later (Sibirtsev, 1901a, 1902b). These reports attracted little attention although a few individuals recognized the importance of the new approach, as demonstrated 15 years later in this statement by Coffey (1912):

"To Dokuchaeiv belongs the honor of founding a new school of soil investigation, a school which viewed soil as a natural body having a definite genesis and distinct nature of its own and occupying an independent place in the series of formations of the earth's crust... The soil is considered a biological as well as geological formation, and unless the material has been influenced by life in some form it must be classed as rock and not soil..."

A brief but explicit statement of the break made by Dokuchaeiv from past concepts of soil appears in one of the bulletins published in Russia for the First International Congress of Soil Science, held in the United States in 1927. Afanasiev (1927) attributes to Dokuchaeiv the following statement; "Soil is an independent natural body which must not be mistaken for surface rocks". In this monograph on Russian chernozems,

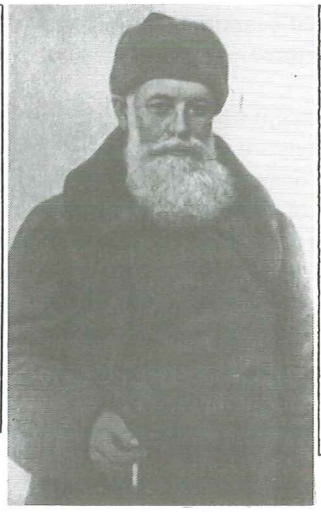

В. В. ДОКУЧАЕВЪ.

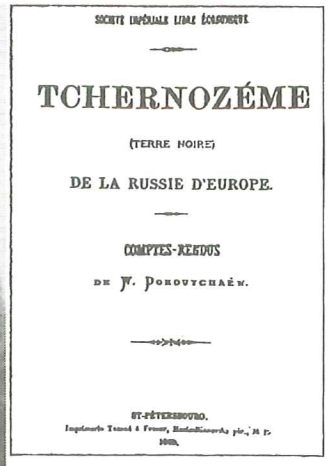
РУССКІЙ ЧЕРНОЗЕМЪ

С.-ПЕТЕРБУРГЪ

1883.

Почва есть такое же самостоятельное естественноисторическое тело, как любое растение, любое сивотное, как любой минерал...

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COMPTES-RENDUS

DE W. DOKOUTCHAÉW.

ST-PÉTERSBOURG.

1883.

V.V. Dokuchaeiv
Facimile copies of frontispiece by courtesy of Dr. J. Boulaine, France.

published in 1883, Dokuchaeiv (1948) strongly emphasized the idea that soils were the products of extremely complex interactions among local climates, plants and animals, parent rocks, topography, and ages op landscapes. That soils were natural bodies worthy of scientific study was actively promoted by Dokuchaeiv and his disciples but the ideas spread slowly, even in Russia (Muir, 1961).

As early as 1879, before his monograph on chernozems had been published, Dokuchaeiv proposed a scheme of soil classification (Glinka, 1931). The scheme had two categories with the upper one consisting of two classes, normal soils and abnormal soils. The former class was then split into dry-land vegetal soils and dry-land marshy soils, the latter into "rewashed" soils and detrital soils. The dry-land vegetal soils consisted of gray northern soils, chernozem soils, chestnut soils, and red solonchak soils. No other subdivisions were made. The system seems primitive now. Nonetheless, sketchy as it was, the scheme was a departure from classification systems based on geology, even though a residue of that remained.

Further developments followed shortly. Dokuchaeiv modified his initial scheme in 1886 (Glinka, 1931) and again in 1900 (Afanasiev, 1927). Other schemes were also being proposed, including one by Sibirtsev (1901a, 1901b) which reached people outside of Russia. The 1897 scheme of Sibirtsev (1951) differed slightly from the last by Dokuchaeiv but the similarities are far greater than the differences. Consequently, only that one will be given. Sibirtsev (1951) argued that "natural soils" could be classified into genetic classes and types as follows:

Class A. Zonal or complete soils

1. Lateritic soils -- tropics and subtropics
2. Aeolian-pulverulent soils (Sierozems)
3. Desert soils -- arid steppes
4. Chernozem soils
5. Gray forest soils -- forest steppe
6. Podzols and soddy soils -- cold regions
7. Tundra soils

Class B. Intrazonal soils

8. Solonetz soils
9. Bog or marsh soils
10. Humus-carbonate soils

Class C. Azonal or incomplete soils

11. Skeletal soils -- very stony
12. Coarse soils ("raw soils")
13. Alluvial soils -- flood plains

These early schemes reflect the state of knowledge in the soil science of their day in Russia, which was advanced as compared to those in other countries. Moreover, the primary focus on genesis of soils as the basis for their classification is apparent, although easier to see in the text materials than in the outlines of the schemes. Finally, some classes in the skeleton schemes appear in one form or another in all subsequent systems developed in the USSR and elsewhere.

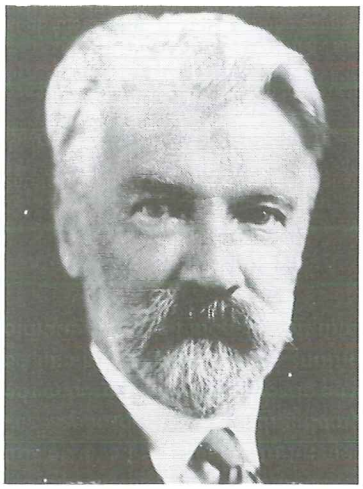
The reliance on soil genesis as a basis for classification is brought out more clearly in the scheme developed by Glinka (1931) through several stages. The system as published in 1921 is summarized here. Five types of soil formation are specified in the outline, viz., I. Lateritic (3 subclasses), II. Podzolic (8 subclasses), III. Steppe type (5 subclasses), IV. Marshy type (4 subclasses), and V. Solonetz type (3 subclasses). The five types of soil genesis form the upper and the 23 subclasses the lower category of the scheme. The eight subclasses set apart for the Podzolic type illustrate those of the lower of the two categories:

1. Burozems (brown soils in the sense of Ramann)
2. Podzolic gley soils
3. Peaty podzolic soils

4. Primary, crypto-podzolic forest soils
5. Primary, podzolic forest soils
6. Meadow podzolic soils and mountain meadow soils
7. Chernozem-like soils transitional from meadow podzolic soils
8. Secondary podzolic soils, e.g., degraded chernozems

Glinka (1931) listed the principal rather than all types of soil formation, as then understood. Others also existed as did transitions between pairs of principal types. The discussion brings out more clearly than does listing classes of types the focus on soil genesis as the basis for classification, demonstrated even better in the title of a book published by Glinka (1914) in Germany -- "Die Typen der Bodenbildung, ihre Klassifikation und geographische Verbreitung". The title indicates that the types of soil formation were to be classified and their distribution reported. During his distinguished career, Glinka greatly elaborated and extended the approach developed earlier for classification of soils in Russia.

Only three of the proposals made in Russia in the late 19th and early 20th centuries have been discussed here. Others were also made, and these are identified and discussed by one or more of Afanasiev (1927), Basinski (1959), Glinka (1931), and Sibirtsev (1951). One trend in proposals being made as the years passed was increasing complexity and progressively greater numbers of classes, reflecting growth of knowledge about the soils of the Soviet Union.



K.D. Glinka

C.F. Marbut

Later pedologic systems of classification

Soil scientists in western Europe and North America learned progressively more during the first two decades of the 20th century about the concept of soils developed in Russia which led to the initial pedologic systems. Glinka (1909) described soil zones and soil types of Russia briefly at the first agrogeological congress, held in Budapest, whereas Kossowitsch (1911) discussed soil-forming processes and major principles of soil classification at the second. More important than either was the book published by Glinka (1914) in Germany because it made the Russian ideas much more widely available. Two copies of the book reached the library of the U.S. Department of Agriculture

prior to outbreak of war. The book by Glinka had a profound effect upon the views of C.F. Marbut and through him soil classification in North America. He translated the book from German to English and eventually got it published (Glinka, 1927).

After Marbut became acquainted with the Russian ideas, he was also able to examine a wide variety of soils through extensive travel, mostly within the United States. Those observations were blended with the Russian ideas and led eventually to a skeleton system of soil classification, presented for the first time at the first International Congress of Soil Science held in Washington in 1927 (Marbut, 1928). The final version appeared eight years later (Marbut, 1935). That version consisted of six categories, some of which were named. For convenience, the categories in descending sequence are here called orders, suborders, great soil groups, families, series, and types. The scheme had two orders, five suborders, and 13 great soil groups. Numbers of families, series, and types were not indicated.

Criteria for classes in the two upper categories were specified but not for the others. The two orders in the top category were to be differentiated by accumulations of aluminum and iron in the Pedalfers and of carbonates in the Pedocals. Accumulations of all three were not known to occur within the same profiles at that time. Three suborders of Pedalfers were set apart on the basis of the silica-alumina ratios of the clay fractions. Those ratios were believed to reflect the rainfalls and temperatures under which the soils had been formed. No suborders were set apart for the Pedocals. Great soil groups (the third category from the top) are listed by name; they are approximate equivalents of the Russian soil types. What should be done with the family category was left unsettled; Marbut may not have reached a decision himself as to what might be done. Statements in his various papers suggest that the immature and post-mature soils associated with each great soil group (mature soils) were to be members of a family. The scheme was never completed by grouping series into classes in progressively higher categories.

Marbut (1951) relied heavily on the logic of J.S. Mill (1874) in classification, as had Glinka before him. Mill had picket up the logic of Aristotle from the philosophers of the Enlightenment, who got it in turn from medieval scholars (Cain, 1958). Moreover, Marbut also tried to pattern his approach on that of plant taxonomy, which harked back more directly to the logic of Aristotle (Cain, 1958; Walters, 1963).

Aristotelian logic has its drawbacks in efforts to classify natural objects. Basic to that logic was the belief that the organization and individuality of any species of matter was due to "the form" (Emerton, 1984). The "form" was the essence of any organized body. In his metaphysics, Aristotle defined "form" as that which made any matter a definite thing. Classification should be based on the form or essence rather than outward appearance. One view was that "form" was the geometry of world-shaping solids. Mill (1874) used a circle, a geometric figure, to illustrate differentiating, accessory, and accidental characteristics. Defining a circle or class of circles is a far cry from defining a natural object or class of objects such as soils. A further problem from application of aristotelian logic in soil classification follows from the distinction between *kind* and *degree* (Mill, 1874). The former was considered much more basic; *kinds* should be distinguished without fail. Presumably, kinds differed in their essences, whereas degrees did not. Distinguishing "kinds" in the sense of Mill (1874) within a universe of soils is an uncertain operation at best, especially when characteristics shared by all soils are considered along with observable differences.

Three years after Marbut published the final version of his scheme, it was modified (Baldwin et al., 1938). Much reliance was still placed on the logic of Mill (1874). Like that of Marbut, the modified scheme consisted of six categories but changes were made in all but the two lowest. Three rather than two orders were proposed. These were called zonal, intrazonal, and azonal, after Sibirtsev (1951). The zonal order was split into five and the intrazonal order into three suborders. None was recognized for azonal soils. The suborders were assigned descriptive names, e.g., Light-colored soils of arid regions, Halomorphic soils, and Calcimorphic soils. The number of great soil groups was increased from 13 to 36, with those classes corresponding approximately as before to Russian soil types. Families were to consist of similar series, with specimen series listed as illustrations. No changes were proposed for soil series and types.

The modification made in 1938 was meant to accomplish several things, viz.:

a) Place all of the geographical bias of the system into the one category, that of orders.
b) Provide places for soils that had been left out of the previous scheme.
c) Drop the concept of maturity as any part of the basis for the classification of the soils.

The 1938 scheme retains several deficiencies of its predecessor. It was also a skeleton in that the second (suborders) and fourth (families) categories were shadow rather than substance and were not used. Thus, the scheme had four rather than six categories in fact. Nor was the system ever completed by the grouping of series and types into classes in higher categories. Moreover, definitions of classes insofar as those were prepared remained general enough to allow much leeway in placements of soils in the upper categories. Similar weakness had beset previous systems of classification, reflecting the state of knowledge in the soil science of their day.

Further evolution of pedologic systems in Russia will be illustrated by a proposal made by Prasolov (1937) shortly after Marbut published the final version of his scheme. A general soil map of the world had been completed in 1936 with Prasolov as the editor. Subsequently, he proposed that the legend of that map could also serve as a scheme for classification. Thirty-five units, mostly soil types in the Russian sense, are listed in the legend which is divided into four parts. The first part has nine units and their names indicate that the soils occur under humid climates. Specimen names are: podzolic soils of coniferous forests, krasnozems and zheltozems of humid subtropics, and lateritic soils. The second part has eight units and their names indicate that the soils occur in semi-arid and arid regions. Specimen names are chernozems of steppe regions, sandy soils of deserts, and stony soils of deserts. The third part has seven units, one of which is ice rather than soil. Specimen names are solonchaks, peat-bog soils, and alluvial soils, paralleling those used earlier for intrazonal and azonal soils by Sibirtsev (1951). The fourth part has the heading: mountain soils, and consists of seven units. Specimen names are mountain-meadow soils, mountain-forest krasnozems, and soils of high-mountain deserts.

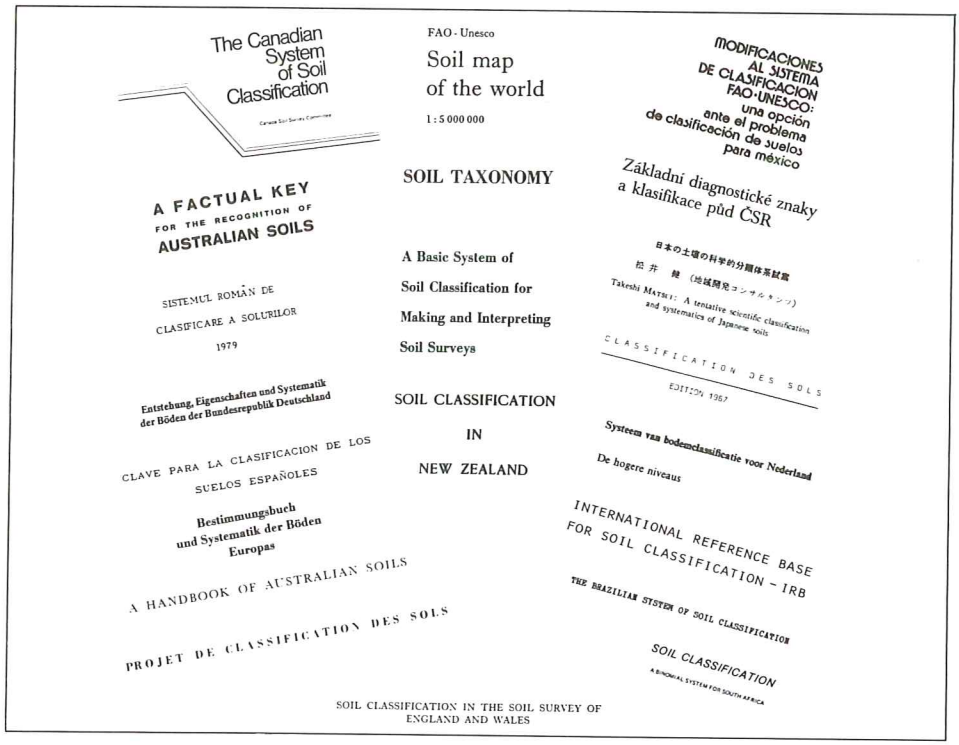
Subdivision of the legend into four parts is in effect making two categories, an upper one of broad groups and a lower one of individual soil types. No categories are suggested in the paper, but the map legend is suggestive of the classification system in the background. It seems to be an extension and expansion of previous efforts in Russia with continuing major emphasis on genesis of the soils as the proper basis for their classifi-

cation. One conclusion in the paper refers to "the principal genetic types of soil singled out according to processes of soil formation". Full explanations cannot be given in a short paper. Further insight into this approach to classification, however, is provided in a later report on soils of western Europe by Prasolov and Petrov (1944). Continued expansion and elaboration of the general approach are expressed in later schemes proposed in the Soviet Union (Ivanova, 1956; Ivanova and Rozov, 1970; Kovda et al., 1967).

Ten years after Prasolov (1937) and Baldwin et al. (1938) had proposed schemes, Kubiena (1948) offered a different approach. His system had maxima of five categories for some soils and three for others. The highest category consisted of three divisions. One was then split into soil types and subtypes and the others into classes, orders, types, and subtypes. All told, the outline of the scheme lists three divisions, 16 classes, four orders, 43 soil types, and 18 subtypes.

One division is called subaqueous or underwater soils. It is split into soil types with one of those subdivided into a pair of subtypes. No classes or orders were recognized. Examples of soil types are gyttja and sapropel.

The second division is called semi-terrestrial soils, those affected by groundwater. That division is split into four classes, all but one of which are subdivided further into orders or soil types. One class is subdivided into orders and those two into types. All other classes save one are split directly into soil types. Examples of classes are peat soils and saline soils. Types of the latter class are solonchak, solonetz, and solod. All told, the division has 11 soil types.



The third division is called terrestrial soils, dry ones. It is split into eight classes, one of which is not subdivided further and another into orders and then into soil types. All told, the division has 17 soil types. Examples of classes are primitive soils, rendzinas, steppe soils, red earths and laterites, and podzols. The class of "braun und rotlehme" is first split into a pair of orders, (a) calcareous loams and (b) brown and red loams on silicate parent rock. Examples of soil types are chernozems, chestnut soils, brown earths, laterites, and podzols.

Presented with the table listing the categories and their constituent classes is a diagram of an evolutionary tree to suggest pathways of genesis of soils. The caption for the diagram includes the phrase "natural system of soils".

The basis adopted by Kubiëna (1948) for distinguishing soils in the highest category of his scheme, i.e., water and water relations, differs from those of all other schemes reviewed. In contrast, the classes in lower categories are generally but not entirely equivalent to classes at some level in other schemes. Names of some soil types are identical wth those used in Russia. Moreover, that the genesis of the soils is considered important is suggested by the diagram of the evolutionary tree.

Epilogue

Classes identified in early pedologic systems may reappear in the orginal or in modified forms in later schemes. The original names may also be preserved. A few names pre-date the earliest pedologic systems, e.g., chernozems, referred to by Lomonosov in 1763 for the soils of the tundra, marshes and peat bogs, and of the steppes "where grasses grow" (Stschussiev, 1926). The meaning of the term has been restricted since that early use. Even when the names have not been retained, however, the class concepts or modifications may have appeared in later schemes. Thus, Coffey (1914) referred to chernozems as equivalent to "dark-colored soils of grasslands" in the United States. Marbut (1935), Baldwin et al. (1938), and Kubiëna (1948) all used the name and the class concept of chernozems. The Borolls (Mollisols) in the current American scheme consist largely of soils that were called chernozems in the past (Soil Survey Staff, 1975). Similar histories exist for other class concepts and names in early systems, although not all were retained even in modified form.

All schemes of soil classification that have been proposed reflect theories of soil genesis held by their architects. Soil properties recorded depend on the theory or theories held by the observer (Simonson, 1980). The selection and weighting of characteristics as class criteria also depend on theories of soil genesis. Differences in those theories are readily evident in past attempts to classify soils. Fallou (1862) considered rock weathering to be soil formation and selected his class criteria accordingly. Marbut (1935) subscribed to a theory of multiple independent processes of soil genesis and selected his class criteria on that basis. Russian investigators have used theories of soil genesis as criteria in their classification systems, arguing that no other approach is proper (Gerasimov and Ivanova, 1959). An explanation for that approach has been offered by Gilmour and Walters (1963) in their discussion of philosophy and classification. Those authors propose that the use of genesis by Russian pedologists parallels the use of phylogeny in the taxonomy of animals and plants. The parallel approaches in the

classification of animals and plants, on the one hand, and of soils, on the other, are considered to be derivatives of the theory of evolution proposed by Darwin. The application of Darwin's theory to animals and plants is rather direct, whereas the application to soils constitutes quite a stretch. Soil scientists such as Marbut (1951) have tried, however, to parallel systems used for plants in the classification of soils.

Schemes of soil classification in the past relied on prevailing theory or theories of soil genesis, either directly or indirectly. In the first case, theories are part of the basis for selection and weighting of class criteria. Foundations for the two approaches differ. Theories of soil genesis must always include a large element of conjecture because soil development proceeds over long intervals of time. Watching the full set of processes is not feasible. On the other hand, soil characteristics can be observed and measured in the same ways by different individuals. Thus, the observations and measurements can be checked for their validity. That data presented by any individual should be reproducible is a basic principle in science.

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3 ACTIVITIES OF THE SECTIONS

3.1 SOIL MONOLITH COLLECTION

During the reporting period the number of soil monoliths increased with 47 to 635 (see table below).

Acquisitions in 1984

Brazil: Mr. J.H. Kauffman of ISRIC collected in cooperation with soil scientists from EMBRAPA-SNLCS 13 profiles in the states of Pará, Paraná, Rio de Janeiro and Sao Paulo. They are mainly Ferralsols/Oxisols, representing the major great groups of the Brazilian 'Latossolos' (see chapter 6 for details).

Gabon: Mr. A.J. van Kekem, Unesco-MAB soil scientist, Abidjan, Ivory Coast, collected 6 profiles, mainly Ferralsols/Oxisols, in cooperation with soil scientists from the Institut de Recherches Agronomiques et Forestières (IRAF), Libréville.

Indonesia: Messrs. G.W. van Barneveld, D. Legger and H. van Reuler collected three profiles near Malang, Java, to complete a toposequence in volcanic material, from which already two profiles were collected at an earlier occasion.

Malaysia: Mr. H. van Reuler, former Unesco-MAB soil scientist stationed at the Centre for Soil Research in Bogor, Indonesia, collected seven soil profiles in West Malaysia in cooperation with the Agricultural University (UPM), Serdang. The collection mainly contains Ferralsols/Oxisols and Acrisols/Ultisols.

Spain: Mr. J. Boixadera, participant of the M.Sc. Course in Soil Science and Water Management, Agricultural University Wageningen, collected two profiles. His M.Sc. thesis will be based on these profiles.

U.S.A.: Dr. J.M. Kimble, National Soil Survey Laboratory, Lincoln, Nebraska, coordinates the collection of about 30 profiles all over the country. In 1984 a consignment of 11 profiles arrived.

Uruguay: Mr. A.I. Califra, Direccion de Suelos - M.A.P., who is a former participant of the annual training course, and Mr. R.F. Breimer, Unesco-MAB soil scientist at Unesco's regional office in Montevideo, collected five profiles from the major soils of the country.

General

Arrangements for collecting soil profiles have been made with institutions and individuals in a number of countries. Some of these have plans for the establishment or

enlargement of soil reference collections for their own purpose.

The countries with which ISRIC is in contact include: Brazil, Burundi, People's Republic of China, Ecuador, Indonesia, Israel, Ivory Coast, Kenya, Mali, Mexico, Pakistan, Poland, Portugal, Rwanda, Spain (Canary Islands), Sri Lanka, Sudan, U.S.A., Venezuela, Vietnam and several countries in North Africa and the Near East.

Most of the sampling will be carried out by non-ISRIC soil scientists, part of whom are participants of the annual training course.

Mr. Braz Calderano Filho, soil scientist with EMBRAPA-SNLCS, takes a soil profile in Brazil under humid conditions.

Course participant Hsu Li-yu removes water from a profile pit in a soil with high groundwater.

ISRIC's soil curator takes a monolith in hard limestone.

Preparation of monoliths

Because of the appointment of a new technician and the need to build up the necessary experience, the output was somewhat less than last year. Also, the technician was fully involved in the running of the training course.

During the reporting period about 20 profiles have been impregnated and prepared for exhibition. During the annual training course about sixteen soils were treated as exercise. Also, a growing number of soils needs to be repaired; parts of the monolith having become loose. This aspect will ask more attention during the years to come.

Monolith collection, December 1984
Within parentheses: acquisitions in 1984

Australia	33		Malaysia (West)	7	(7)
Belgium	4		Mali	1	
Botswana	7		Mozambique	8	
Brazil	14	(13)	Namibia	11	
Cameroon	1		Netherlands	24	
Canada	21		New Zealand	5	
People's Rep. of China	8		Nigeria	14	
Colombia	19		Norway	3	
Czechoslovakia	8		Oman	4	
Denmark (Greenland)	6		Philippines	6	
Finland	5		Romania	11	
France	11		Rep. of South Africa	20	
Fed. Rep. of Germany	17		Spain	20	(2)
Ghana	4		Sri Lanka	4	
Gabon	6	(6)	Sweden	17	
Greece	14		Syria	4	
Hungary	20		Thailand	13	
India	30		Turkey	13	
Indonesia	25	(3)	United Kingdom	11	
Ireland	11		U.S.A.	21	(11)
Italy	17		U.S.S.R.	62	
Jamaica	3		Uruguay	6	(5)
Japan	4		West Samoa	5	
Kenya	33		Yugoslavia	3	
Malaysia (East)	11		Zambia	10	
			Total	635	(47)

3.2 LABORATORY, LABEX PROGRAMME

Regular analytical work

For the collection, 39 soil profiles were analyzed. Analytical work not related to the collection is given under section 5.4.

The largest number (10) of monoliths came from Indonesia and concerned two catenas developed on volcanic parent material. Six Dutch monoliths were analyzed for the training course (section 3.7) and four monoliths to be studied in cooperation with students of the M.Sc. Course of the Agricultural University Wageningen (Spain: 2, Greece: 1, Ghana: 1). Other monoliths of which the analyses were completed were from: People's Republic of China (8), Malaysia (1), Mozambique (4), and Uruguay (6).
In anticipation of next year's ('85) focussing of attention on Ferralsols/Oxisols many additional analyses were carried out.

Research

Research was focussed this year on the silver thiourea (AgTU) CEC method: 1. Work on the correlation of the AgTU method with the ammonium acetate method was completed (see chapter 4), and 2. Application of AgTU method to measure the pH dependence of the CEC. On the latter, a poster-paper was presented at the Panel on Volcanic Soils in Tenerife in June 1984.

Programme on comparison of methods, procedures and results of laboratory analysis for classification purposes (LABEX)

This year, the Dutch Directorate-General for International Cooperation (DGIS) granted a fund for a 2½ year programme of an expanded laboratory cross-checking programme. A start was made to increase the number of participating laboratories to about 80 and the number of reference samples to 15 (see Appendix 2).

Bulk samples of about 100 kg were kindly collected and forwarded to ISRIC by: Mr. J.H. Kauffman/EMBRAPA-SNLCS (Brazil), Dr. J.A. McKeague (Canada), Mr. J.O. Job (France), Dr. G. Varallyay (Hungary), Mr. F.N. Muchena/Mr. A. Weeda (Kenya), Dr. J.S. Shamsuddin/Mr. H. van Reuler (Malaysia), Dr. T. Mouheich (Syria) and Drs. C.S. Holzhey, J.M. Kimble and M.J. Mausbach (U.S.A.). Drying and sieving procedures on samples from a number of countries was starterd.

A full-time professional officer for the project was appointed to take up duty on 1 January 1985.

A second report on the pilot round was prepared dealing with data variability of exchangeable base saturation and pH (Technical Paper 8).

3.3 MICROMORPHOLOGY

Technical work

The preparation of thin sections is carried out by the technician of ISRIC at the laboratory of the Netherlands Soil Survey Institute (Stiboka).

In 1984 approximately 200 thin sections have been made: 138 sections were made for the regular collection of ISRIC (3 from Australia, 48 from Indonesia, 7 from Japan, 27 from Kenya, 11 from Mozambique, 5 from Rwanda, 4 from Uruguay, 27 from the U.S.A., and 2 from Zambia). Thin sections for special projects included 25 for the MAB project, 2 for an Andosol poster session at Tenerife, and 2 for ITC (support field work).

Approximately 30 medium-sized thin sections were prepared. These are the first specimens of the planned Reference Collection of Thin Sections.

In 1984 samples for treatment were received from China, Ghana, Indonesia, Ivory Coast, Mali, Oman, Spain, Sri Lanka, U.S.A., Uruguay, and Zambia.

The technician participated in a project, initiated by Stiboka, involving the development of improved methods for the impregnation of soil samples. The work included sampling in the field and tests in the laboratory to establish optimal drying procedures.

Investigations

For the description of thin sections the new ISSS-sponsored system is employed (Handbook for soil thin section description, by P. Bullock, N. Fedoroff, A. Jongerius, G. Stoops and T. Tursina).

ISRIC participates in a working group, including micromorphologists of the Agricultural University Wageningen, the University of Amsterdam, the Free University in Amsterdam and the Netherlands Soil Survey Institute. The aim is to arrive at a standardized procedure to make brief and comprehensive descriptions, according to the terminology of the new descriptive system. The proposals of the working group are tested at ISRIC.

Comprehensive descriptions of thin sections were made of a Placic Podzol from Ireland and a Calcic Chernozem from Romania, to be incorporated in Soil Monolith Paper 3 and 6 respectively.

Standard soil descriptions were made of one soil from Nigeria (Ferric Luvisol) and two soils from Kenya (Eutric and Humic Nitosol).

Thin sections of Andosols from Chile, Colombia, Ecuador and Hawaii were studied and photomicrographs were prepared to support the poster session on the Panel on Volcanic Soils, at Tenerife.

Five working meetings with Dr. H. Tjong Tjin Joe from Surinam were held to study thin sections, prepare photomicrographs and discuss characteristics of concretionary formations and distributions of iron in five laterite profiles from Surinam.

A registration system has been developed for the storage and retrieval of photomicrographs, made during the investigations of the thin sections. Diapositives are registered either in correspondence to the monoliths of the collection, or according to the

micromorphological features, as recognized in the descriptive system. An explanatory text of this storage system has been prepared in English and Dutch.

Reference collection of thin sections

The ISSS Subcommission on Soil Micromorphology has requested ISRIC to set up a reference collection of thin sections, supporting the new ISSS-sponsored Handbook.

A start has been made with the establishment of such a collection and approximately 30 thin sections were prepared.

3.4 DOCUMENTATION

Soil monolith documentation

During the year 1984, the number of soil monoliths at ISRIC increased to 635. Arrangements for increasing the collection have been made with a number of countries especially in the developing world. A series of soil profiles was kept in storage with all information collected from the field and literature. For each completed soil monolith, not only the complete field description of site and soil, but also the analytical data, micromorphological descriptions of thin sections, slides, photographs and the results of the interpretative study at ISRIC are kept in separate files.

Also this year the files of a number of soil monoliths have been rearranged, screened and completed where possible. The description and classification of soil profiles are made according to the FAO guidelines, FAO-Unesco Soil Map of the World legend and USDA Soil Taxonomy. It appears that many field descriptions from the different countries are incomplete and not made according to the FAO guidelines.

The analytical data, which are usually provided by the country of origin of the profile, were also checked and compared with the data of ISRIC.

Map collection and Library

Maps and publications form an important part of the Centre's documentation. The coverage is the whole world with emphasis on developing countries. The collection is dominated by soil and related geographic information on climate, vegetation, land use, land capability, geology and geomorphology. At present the map collection includes about 4000 sheets and some 600 photonegatives and transparencies.

The acquisition policy is to obtain world coverage of soil maps at reconnaissance and smaller scales, examples of more detailed soil maps and index maps/lists of all soil surveys carried out in a country. Other thematic maps are collected mainly if they complement soil information. The selection criteria are the relevance of the maps for soil science, agricultural development and environmental issues.

One of the purposes of maintaining the map collection is its use for the possible

A map of ISRIC's collection is consulted by Mr. M.L. Moura, guest researcher.

updating of the Soil Map op the World at scale 1:5 million and the compilation of a new, computerized world soil map at 1:1 million. The map collection increasingly serves as a source of basic information for use by scientists, students and consultants in soil correlation studies and in the preparation of missions abroad.

The library collection includes about 4300 publications, about 2500 of which are on a regional basis, mostly reports on soil and land surveys. The remainder is constituted mainly by textbooks on soil science and related subjects, bibliographies and atlases. There is an annual increase of two to three hundred publications.

ISRIC has subscriptions to about 35 journals.

3.5 SOIL CLASSIFICATION AND CORRELATION, SOIL MAP UPDATING

As before, ISRIC was active in the assembling and collating of new information on soil classification systems that are proposed or currently in use in various parts of the world. The English language field guide of "Classification des Sols" by an ORSTOM Working Group (Segalen et al.) was issued as ISRIC Technical Paper 7. Consultations continued on a similar publication of the new Brazilian soil classification system and the criteria employed therein, and contacts were made with the Dokuchaeiv Soils Institute for an extract of the major present-day Russian classification systems. An updated description of the FAO-Unesco Soil Map of the World legend units occurring in the tropics and subtropics, as prepared by a consultant for the German Technical Assistance organization (GTZ), is also under consideration for publication in English.

The preparation for the elaboration of an International Reference Base for soil classification (IRB, see also Annual Report 1983), under the responsibility of the International Society of Soil Science (ISSS) had a slow start due to lack of funds. At the end of

the year, however, formal approval was given by UNEP for a two-year project support, to be channeled through Unesco and ISRIC.

Partly in cooperation with others, Dr. W.G. Sombroek prepared papers on new trends in soil classification for meetings in Madrid, Bangkok, and Belém (Brazil). He also prepared, at the suggestion of the Chairman of ISSS Commission V, a discussion paper on aim, approach, materials and methods, and costs of a project for a global soil resources inventory at a 1:1 million level of accuracy, using an interactive graphical system of digitized mapping (see also his article in Annual Report 1982).

3.6 EDUCATION AND INFORMATION

In 1984 the total number of registered visitors was about 1600, which is slightly more than in the preceding year.

Group visits

About 1450 persons visited ISRIC in groups, mainly from educational institutions, such as universities, teacher courses, agricultural and technical colleges and from international training courses and congresses. The ISRIC exhibition has been incorporated in the courses on regional soil science of the Agricultural University Wageningen and its M.Sc. Course on Soil Science and Water Management, of the Tropical Section of the National Agriculture College, Deventer and of other international courses held in the Netherlands, e.g. at ITC, Enschede. In addition, groups of students are regularly coming from Belgium, France, Federal Republic of Germany, Scandinavia and the United Kingdom. See also Appendix 1.

Individual visits

The number of people coming individually or in very small groups that have signed the guestbook in the exhibition hall (after their visits) amounts to about 150. It should be noted that only part of the visitors signs the book. Most visitors are professional soil scientists, and two-third of them come from abroad, in 1984 from over 65 countries.

Course on Soil Classification

As in the previous year, ISRIC was requested by the National Agricultural College, Deventer, to organize a Course on Soil Classification for a selected number of students of this college. The course was held at the premises of ISRIC and included lectures, slide shows, demonstrations, discussions and exercises on the USDA system Soil Taxonomy and on the soil units of the FAO-Unesco Soil Map of the World. The course was attended by 21 students.

Lectures by guests

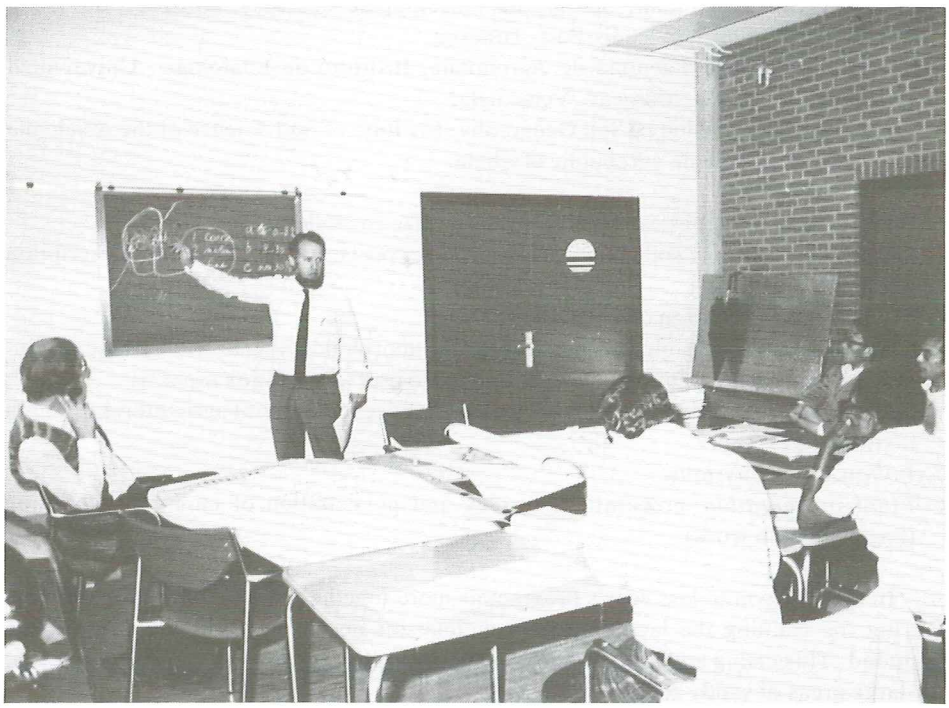
In 1984 a number of guests of ISRIC has presented lectures on topics related to their research. The lectures were held at the premises of ISRIC; staff members of various institutes were invited to attend.

- Dr. C.R.M. Butt, principal research scientist of the Institute of Energy and Earth Resources, CSIRO, Australia, presented a paper on: Some aspects of granite weathering and silcrete formation in Western Australia.
- The Working Group on Clay Minerals of the Royal Netherlands Geological and Mining Association convened at the premises of ISRIC. Papers related to various aspects of clay mineralogy were presented by Dr. P. Buurman, Dr. L.P. van Reeuwijk, and Dr. J.J. Reynders.

Extramural lectures

As in the previous years, staff members of ISRIC participated in the Standard course Soil Survey of ITC, Enschede, The Netherlands by giving lectures on special topics of soil classification and soil genesis. Both the FAO-Unesco Soil Map of the World and the USDA system Soil Taxonomy were discussed. These lectures are illustrated with slides, hand-outs, lecture notes and other materials derived from the ISRIC collection.

Lecturing on soil classification
to participants training course.



3.7 TRAINING

Course on the Establishment and Use of National Soil Reference Collections

The fourth international Course on the Establishment and Use of National Soil Reference Collections was held at ISRIC from 4 June to 13 July 1984 under the direction of Ir. J.H. Kauffman.

The objective of this Unesco-recognized course is to train soil scientists, in particular from developing countries, in all aspects related to national soil reference collections (NASREC).

The course was attended by five participants, three from Northern Africa, one from Asia and one from South America. Three participants were sponsored by Unesco; one was financed through the cooperation programme between the Royal Netherlands Academy of Arts and Sciences (KNAW), ISRIC, and the Academia Sinica-Nanjing Institute of Soil Science; one participated on own funds. Unfortunately, a participant from Syria, to be financed by the Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD), could not attend for personal reasons.

The participants were:

- Mr. Hassan M. Fadul, Soil Survey Administration, Ministry of Agriculture and Irrigation, Wad Medani, Sudan;
- Mr. Said Jait, Département des Sciences du Sol, Institut Agronomique et Vétérinaire Hassan II, Rabat Instituts, Morocco;
- Mr. Abderrahmane Mami, Service de Cartographie des Sols, Direction des Sols, Ministère d'Agriculture, Tunis-Port, Tunesia;
- Dr. Anibal Rosales, Facultad de Agronomia, Instituto de Edafologia, Universidad Central de Venezuela, Maracay, Venezuela;
- Mr. Hsu Li-yu, Division of Soil Geography, Institute of Soil Science of the Academia Sinica, Nanjing, People's Republic of China.

The course activities can be broadly categorized as follows:

1. *Fieldwork:* sampling soil monoliths and lacquer peels, soil and landscape description and photography;
2. *Workshop:* preparation of soil monoliths;
3. *Lectures/exercises:* soil classification, micromorphology, laboratory, land evaluation, soil reference collections with regards to users, exhibition aspects;
4. *Excursions:* exhibition techniques, soil and landscape, several agricultural research institutes;
5. *Follow-up discussions;*
6. *Final presentation:* preparation, display and presentation of monolith exhibition (based on own work).

In comparison to last year's programme more time has been reserved for lectures. During the training the lacquer peel technique for impregnating soils has also been included. This cheap and quick alternative for monolith sampling, is especially relevant for large areas of sandy soils in North Africa.

Closing ceremony of training course 1984.
From left to right: Dr. W.G. Sombroek, Director ISRIC; Mr. A.B. Bos, ISRIC assistant; Dr. F. Fournier, UNESCO; Mr. A. Mami,Tunesia; Dr. A. Rosales, Venezuela; Mr. Hsu Li-yu, People's Republic of China; Mr. S. Jait, Morocco; Mr. Hassan M. Fadul, Sudan; and Mr. J.H. Kauffman, course leader.

At the fifth course it is intended to have the majority of the participants from Africa south of the Sahara.

Follow-up activities are related to the establishment of soil reference collections (NASREC's) in the respective countries. An a means of cooperation between these national soil reference collections and ISRIC a Newsletter will be issued once to twice per year.

4 GUEST RESEARCH

Establishment of a reference base for red clay soils in Mozambique

(Mr. J.H. Kauffman)
Period: 1 January - 30 April 1984, and August 1984

The programme has already been outlined in Annual Report 1983.

In the above mentioned period the following activities have been carried out:

- a comprehensive computer-assisted statistical and graphical analysis of the ISRIC and INIA laboratory results of the 20 reference profiles;
- a report on the micromorphology of five selected profiles (by Dr. M.J. Kooistra, Stiboka);
- some additonal research in the field of aggregate stability and mineralogy of rock and soil samples;
- graphical catena analysis of five areas, based on study research fieldwork by Mr. R. Swart;
- in view of classification difficulties according to Soil Taxonomy and the Soil Map of the World legend systems, an interpretative classification of five selected reference profiles was requested from twenty specialists in tropical soils.

The report on this study will be finalized in 1985.

The single extraction silver thiourea method for determination of the cation exchange capacity of soils

(Mr. M.L. Moura)
Period: 1 January - 31 December 1984

Research was continued on the correlation of the silver thiourea (AgTU) CEC method with the ammonium acetate method.

Results obtained of 35 samples from 6 profiles of Mozambique show that there is a good correlation (correlation coefficient = 0.975).

During the second half of the year, research was carried out on the application of the AgTU method for determination of the CEC of calcareous, gypsiferous and saline soils. With some restrictions, also for these problem soils the AgTU method appears to be very useful.

5 PROJECTS

5.1 SOIL STUDIES IN 'MAN AND THE BIOSPHERE' (MAB) PROJECT SITES

The programme of support to soil studies in 'Man and the Biosphere' (MAB) reserves and research sites in developing countries, through the backstopping of three associate experts employed by Unesco throught DGIS, continued during the year.

The cooperative programme between ISRIC and Unesco started in 1980 and is now in its final stage. The associate expert stationed in Southeast Asia returned to The Netherlands in July 1984. For the other two experts 1984 was also the last full contract year.

One communal activity was the preparation of comprehensive guidelines for the benefit of future studies in MAB sites by local soil scientists. The first draft of these guidelines has been finished. The final version will be published as a Unesco- MAB Technical Note.

Progress per region

Africa (Mr. A.J. van Kekem, based at the Institut d'Ecologie Tropicale, Abidjan, Ivory Coast).

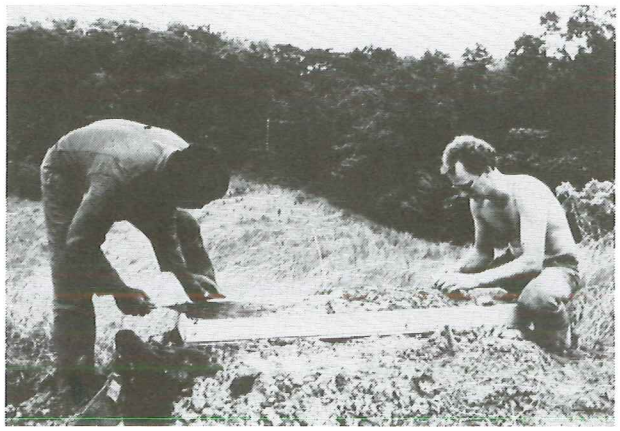
The soil studies in the Mount Kulal-Marsabit area in Northern Kenya were completed in 1983. The soil map at scale 1:250.000 has been printed in colours. The report which includes detailed descriptions of the soil mapping units and a chapter on land evaluation, is being edited.

The soil survey was carried out in the framework of the Unesco-Fed. Rep. of Germany Integrated Project of Arid Lands (IPAL), which aims at finding solutions for the most urgent environmental problems associated with desert encroachment and ecological degradation of arid lands. The soil survey forms an important part in the study of the vegetation, the basis of a land evaluation study. The results of the studies are integrated in a management plan for the area which may lead to an improvement of the natural environment and of the existence base of the pastoralists.

The soil study in the rainforest of the M'Passa Biosphere Reserve, Makokou, Gabon, carried out in support of research on the functioning of the forest ecosystem, has been completed. The report, including two black and white soil maps (at scales of 1:10,000 and 1:100,000), has been published.

In August/September a mission to Gabon was carried out to collect for ISRIC 6 soil monoliths of representative soils of the country. At the same time a good start was made with the establishment of a national soil reference collection in Gabon by taking the same soil monoliths, in cooperation with a Gabonese colleague, for the local soil survey institute. During the same mission a programme was set up to monitor soil structure and fertility under agro-forestry trials in Makokou. The same programme will be used for an agro-pastoral project in Lebamba. Both programmes are being followed up by the local soil survey.

Considerable attention was given to the Tai project, in the southwest of Ivory Coast.



Taking a soil profile in Gabon. Left: Mr. J.B. Moutsinga, IRAF, Libréville; right: Mr. A.J. van Kekem, Unesco-MAB associate expert.

The aim of the project is to provide a scientific base for the exploitation of the natural resources and to guide the human occupation structure in the region. At the same time the project has to provide scientific data on the functioning of the ecosystem of one of the last remains of the primary forest in West Africa. Some missions were carried out to the area so that the soil scientist could familiarize himself with the landscape and the soils. The legend of the soil map has been rewritten, utilizing the approach used in the MAB programme, so that the soils of the area can easily be compared with the results of soil surveys of other MAB sites. Preparations are being made for a land evaluation study. Some assistance was provided to the preparation of a Unesco-financed film on the scientific part of the Tai project. Assistance was also provided to the sampling of termite mounds.

The soil scientist attended a meeting of the West African Committee on Land Evaluation and Soil Correlation in Niamey, Niger.

Latin America and the Caribbean (Mr. R.F. Breimer, based at the Unesco Regional Office (ROSTLAC) in Montevideo, Uruguay).

In January the survey report accompanying the soil map of the Mapimi Biosphere Reserve, Durango, Mexico, was completed. Progress has been made in the printing of the soil map (scale 1:100,000) at ITC and the maps are expected to appear in 1985. The survey report is being published at ROSTLAC and is expected at the same time. During a mission to Gomez Palacio, Durango, in October preparations were made for a book on the natural resources of the reserve, to be published by the Institute of Ecology in Mexico City. Mr. Breimer is co-author of chapters on vegetation and environment and on soils. This book is due to appear late 1985.

The survey report of the physiographic soil map of the Pampa de Achala, Cordoba, Argentina, was nearly completed at the end of 1984, awaiting the analytical data of four profiles, analyzed in Montevideo. During a stop-over in Cordoba arrangements were made for the preparation of an article on vegetation and environment of the area, to be presented to the periodical Mountain Research and Development (Boulder, Colorado).

During a short mission in December the balance was drawn of the three-year erosion measurement project, executed by the Laboratory of Ecology of the Catholic University

of Chile, aimed at the investigation of goat grazing/browsing management alternatives in mediterranean central-Chilean ecosystems. The main conclusion was that alleviation for vegetation degradation and soil erosion problems will have to be sought through reforestation with native forage species like *Acacia caven* and *Prosopis chilensis*.

Other activities included:

- Dispatch of five Uruguayan soil monoliths to ISRIC
- Mission to Medellin, Colombia, to give lectures at the University of Colombia on ecological principles and biological methods of soil conservation and on watershed management
- Elaboration of a paper on methods for the evaluation of environmental degradation in watersheds for a Uruguay River Basin Conservation Seminar in Sao Borja, Brazil.

Southeast Asia (Mr. H. van Reuler, based at the Centre for Soil Research in Bogor, Indonesia, till August 1984).

In the period January-June some short fieldtrips were carried out. In cooperation with the Soil Science Department of the Brawijaya University in Malang, East Java, soil monoliths were collected of a toposequence of soils developed in volcanic ash.

The Sumoga-Bone National Park is located in North Sulawesi. With help of a World Bank loan an extensive irrigation project is developed. Through the same loan the catchment area of this project is being developed as a National Park. This combination of irrigation and nature conservation is unique. The area was visited on invitation of the Nature Conservation Service and its purpose was to advise on soil matters.

In June the Fifth ASEAN Soil Conference was attended in Bangkok, Thailand and a paper on ISRIC was presented.

5.2 COOPERATION WITH THE PEOPLE'S REPUBLIC OF CHINA

As already outlined in Annual Report 1983, a cooperative programme has been developed since 1980 between the Nanjing Institute of Soil Science, Academia Sinica, and ISRIC, for strengthening scientific relations and exchange of soil scientists. The programme is funded by the Academia Sinica (Chinese Academy of Sciences) and the Royal Netherlands Academy of Arts and Sciences (KNAW).

In 1984 a Chinese soil scientist attended ISRIC's annual training course.

5.3 THE INTERNATIONAL COLLECTION OF REFERENCE LATERITE PROFILES (CORLAT)

The pre-project preparations for the establishment of an interdisciplinary Collection of Reference Laterite Profiles (CORLAT) continued this year.

Another activity was the distribution of the first Newsletter of this project. The Working Party of CORLAT (see for more information Annual Report 1983) will send

periodically a Newsletter to the counsellors and interested institutes as a means to provide communication in the pre-project phase.

A further step was taken into this project through a joint request by ISRIC, the Department of Civil Engineering and Irrigation of the Agricultural University Wageningen, and DHV-Consulting Engineers at Amersfoort to Stichting MPW for a one-year project on soil-mechanical properties of lateritic materials. This project aims at the improvement of classification criteria of lateritic materials for engineering application and the characterization of the geotechnical properties of laterites.

Attention was also paid to the promotion of the CORLAT project. Contacts were established with a great number of potential counsellors of the project.

Lack of funds has continued to be a crucial bottleneck for the effective realization of this internationally well-received project. In the meantime, the Working Party will continue to function with volunteer staff.

5.4 SPECIAL PROJECTS

- In the course of the year instruction on the impregnation of soil profiles was given to soil scientists from Greece and Kenya.
- There is a growing demand for data on ISRIC's soil samples and several requests could be met. Small amounts of soil material have been made available to soil scientists who are undertaking special studies on Xanthic Ferralsols and on iron-manganese nodules.
- The exhibition 'Down to Earth' for which ISRIC prepared the soil monoliths, is travelling throughout the U.K. since March 1984.

Botswana. Ten samples analyzed on basic parameters (texture, CEC, bases, pH) for reference purposes (Dr. A. Remmelzwaal)

Indonesia. Forty-seven samples fully analyzed (Unesco-MAB)

Iraq. Two desert dust samples fully analyzed (Mr. J.K. Shallal Al-Juburi)

Ivory Coast. One profile fully analyzed (Unesco-MAB)

Jamaica. Six samples analyzed on basic parameters as well as X-ray diffraction for reference purposes (Dr. H.A. de Wit)

Kenya. Two profiles fully analyzed, 15 plant samples on C and N (ITC)

Spain. Six profiles fully analyzed (ITC)

Sri-Lanka. Ten profiles fully analyzed (ITC)

6 TRAVEL AND MISSIONS

From its establishment in 1966, an intensive international cooperation was regarded as an essential element of ISRIC's activities. Although this still has a high priority, it is becoming more and more difficult because of budgetary (and sometimes manpower) constraints to attend important international and national gatherings, e.g. congresses, workshops, symposia, but also establishments and institutes with which ISRIC could enter into fruitful cooperation. Fortunately, outside funding or joint funding was easing budgetary constraints for some of the travels and missions carried out in 1984.

(84/1) Workshop on Soil Biological Processes and Tropical Soil Fertility, Lancaster, U.K., January 1984, sponsored by the International Union of Biological Sciences (IUBS) Decade of the Tropics Programme, and the Unesco Man and the Biosphere Programme. *Participant: Ir. W.G. Wielemaker, Agricultural University Wageningen, on behalf of ISRIC.*

Exchange of ideas on how soil biological processes contribute to soil fertility and how they can be promoted. Contribution to a workshop document containing: (1) an exposé about the role of soil biological processes in soil fertility; (2) a research proposal, containing a minimum package for a programme to investigate the major deficiences in our knowledge on the interaction between soil biological processes, management practices and soil fertility. The proposal envisages the establishment of project sites and programme centres; and (3) methods. In a contribution, the participant mentioned the work of ISRIC; its involvement in the Man and the Biosphere programme of Unesco and the Dutch programme of research on tropical forests ('Tropenbos'). He also gave some views on the role of termites in ecosystems, based on his own work.

For implementation of the programme, a committee of 6 persons was appointed. Dr. W.G. Sombroek was included in the Scientific Advisory Group.

The final workshop document appeared as Biology International, the news magazine of the International Union of Biological Sciences (IUBS), Special Issue 5, 1984, with as title: Soil biological processes and tropical soil fertility, a proposal for a collaborative programme of research.

(84/2a) International Workshop on Classification and Management of Andisols, Chile and Ecuador, January 1984, organized by the SCS Soil Management Support Services in cooperation with the local Soil Science Societies. *Participant: W.G. Sombroek.*

Improvement of classification criteria for Andisols and related soils on volcanic ash deposits, and discussion of their management problems, viz. the international ICOMAND Commission, on the basis of field inspection of many profiles in the two countries, and research papers from other areas. Arrangements for participation of several Latin American countries in ISRIC-initiated programmes.

(84/2b) Visit to Soil Science Institutions in Venezuela, Caracas, and Maracay, Venezuela, January 1984. *Participant: W.G. Sombroek*

Discussions on cooperation, especially with regard to the establishment of a Venezuelan national soil reference collection.

(84/3) Sixth Meeting of the West and Central African Sub-committee for Soil Correlation and Land Evaluation, Niamey, Niger. February 1984, convened by FAO. *Participant: C.A. van Diepen, as observer for ISRIC and Stiboka.*

Conference on "Land evaluation for irrigated agriculture: case studies", hosted by the Soils Department of the National Agricultural Research Institute of Niger (INRAN). There were delegates from 14 countries of the region and observers from 8 international organisations among the 50 participants. The conference included visits to several irrigation scheme in Niger. After conference visit to ICRISAT's Sahelian Centre and AGRYMET.

(84/4a) Seventh International Soil Classification Workshop on "Characterization, Classification and Utilization of Wetland Soils", Los Baños, Philippines, March-April 1984, organized by the SCS Soil Management Support Services in cooperation with the International Rice Research Institute (IRRI) and the Philippine Bureau of Soils. *Participant: C.A. van Diepen.*

Attendance of conference and presentation of paper Wetland soils of the world, their characterization and distribution in the FAO-Unesco approach. Static definitions of soil wetness as used in current soil classification systems cannot adequately describe the dynamic nature of actual soil wetness regimes.

Participation to soil excursion to rice areas in Luzon.

(84/4b) Visit Soil Science Department of the Agricultural University of Malaysia (UPM), Selangor, Malaysia, April 1984. *Participant: C.A. van Diepen.*

Stop in Malaysia on the way back from the Philippines to make arrangements with UPM for the collection of soil profiles for ISRIC's soil correlation research on Ferralsols and related soils. Visit to national soil reference collection (100 profiles) at the Soil Survey Service of the Ministry of Agriculture in Kuala Lumpur.

(85/5) Twelfth Session of the UNEP Governing Council, Nairobi, Kenya, May 1984. *Participant: W.G. Sombroek, as observer for ISSS and ISRIC.*

Promotion of acceptance of UNEP's World Soils Policy and its Plan-of-Action. Screening of individual countries' comments and priorities on the various elements of the Plan. Amalgamation of the project proposal on support for soil monolith collection and cataloguing programme of ISRIC with that on the elaboration of an International Reference Base for soil classification of ISSS. Formulation of a project proposal for support from UNEP's Clearing House Facility towards the establishment of national soil reference collections in a number of developing countries. Contacts with UNEP's Global Environmental Monitoring Service for promotion of adequate soil-geographic input in its envisaged Global Resources Information Base programme. Discussions in methodology of FAO/UNEP's Desertification Hazard Mapping project.

Discussions with Kenya Soil Survey, ICRAF, IPAL and the Regional Centre for Surveying and Mapping on modes of cooperation.

(84/6) Primero Congreso Nacional Espanola de la Ciencia del Suelo, Madrid, Spain, June 1984, organized by the Spanish Society of Soil Science. *Participant: W.G. Sombroek.*

Strengthening of contacts with Spanish soil scientists. Presentation of paper on

ISRIC and about recent trends in soil classification.

(84/7) Meeting of the IGU-ICA Joint Working Group on Small-scale Digitized Natural Resources Mapping and visit to Unesco Division of Ecological Sciences, Paris, France, June 1984. *Participant: W.G. Sombroek.*

Review of possibilities for a multi-disciplinary programme for digitized small-scale maps of natural resources.

Discussions with Unesco Staff on cooperation in ISRIC programmes.

(84/8) Third International Panel on Volcanic Soils, Tenerife, Spain, July 1984, organized by the University of La Laguna. *Participants: L.P. van Reeuwijk, W.G. Sombroek and former ISRIC guest researcher Dr. Ch. Mizota.*

Presentation of one paper and two posters. Discussions on classification and management of Andosols. Arrangements for support local soil reference collection (see 84/13).

(84/9) Consultancy mission to Mali. July 1984. *Participant: C.A. van Diepen.*

Quick reconnaissance (three weeks field work) of soils in the irrigation schemes of the "Office du Niger" in the Inner Delta of the Niger river and review of existing soils information of the area. Evaluation of the use potential and constraints of the soils for irrigated rice cropping; on request of DGIS for its project of technical assistance to the Office du Niger for the improvement of farmer's rice cultivation. A short visit to villages in southern Mali to inspect soils and soil conservation activities of the Dutch funded integrated rural development project Mali-Sud.

Two mission reports have been submitted to DGIS.

(84/10a) Visits to USDA Soil Conservation Service and its Soil Management Support Services, and headquarters of several international organizations, Washington DC, U.S.A, September 1984. *Participant: W.G. Sombroek.*

Representation of ISSS at the biannual meeting of the International Council of Scientific Unions and at the interunion Committee on the Application of Science to Agriculture, Forestry and Aquaculture (CASAFA). Strengthening of contacts with bio- and geo-scientific Unions.

Discussions with Canadian soil scientists on ISSS and ISRIC programmes, and with Canadian Development Cooperation officials on support for ISRIC's core programme.

(84/10b) Visits to USDA Soil Conservation Service and its Soil Management Support Services, and headquarters of several international organizations, Washington DC, U.S.A, September 1984. *Participant: W.G. Sombroek.*

Discussion on cooperation on ISRIC's LABEX programme and on small-scale soil resources mapping, with US soil scientists, CGIAR-Secretariat, the American Association for the Advancement of Science, and the Resources of the Future Inc.

(84/11) Soil profile collection trip to Malaysia, October 1984. *Participant: H. van Reuler.*

From 1-21 October soil monoliths were collected in Peninsular Malaysia. During this trip mainly Ferralsols/Oxisols and closely related soils were collected. The collection

was carried out in cooperation with the Soil Science Department of the Agricultural University (UPM) in Serdang, Selangor.

(84/12) Soil profile collection trip and study tour to Brazil, September-December 1984. *Participant: J.H. Kauffman*

Common interest of the national Brazilian Soil Survey Institute (EMBRAPA-SNLCS) and ISRIC resulted in a monolith sampling and training programme, which was executed in Brazil from 18 September to 1 December 1984.

From thirteen sites in the states of Pará, Paraná, Sao Paulo and Rio de Janeiro, two series of soil profiles have been taken; one for the ISRIC collection and the other for the national soil reference collection. During this work three staff members of EMBRAPA have been trained in the collection of soil profiles.

Several aspects on the preparation, display and use a national soil reference collection have been explained and discussed in several sessions. Moreover, Mr. Kauffman participated in the third national soil correlation and classification meeting from 21-28 September.

EMBRAPA has developed its own classification, nomenclature and field criteria for Ferralsols, Luvisols, Acrisols and Nitosols. Since this is a useful contribution to tropical soil science, ISRIC proposed to publish the Third Approximation of the Brazilian soil classification system in its Technical Papers series. This suggestion was favourably received.

(84/13) Soil profile collection trip to Tenerife, Canary Islands, Spain, September-October 1984. *Participant: A.B. Bos.*

From 23 September to 8 October eight soil profiles and two lacquer peels were taken from sites prepared for the excursion of the International Panel on Volcanic Soils. Instruction on collection and preparation of monoliths and lacquer peels was given to staff members of the Department of Soil Science, University de La Laguna.

(84/14) Visit to ORSTOM and Unesco Headquarters, Paris, France, October 1984. *Participant: W.G. Sombroek.*

Discussions on international cooperation for a Dutch Government initiated programme for research on tropical forest ecosystems ('Tropenbos').

(84/15a) 1º Simposio Internacional do Tropico Umido, Belém, Brazil, November 1984, organized by EMBRAPA's Centro de Pesquisas Agropecuarias do Tropico Umido (CPATU) in cooperation with the German Gesellschaft für Technische Zusammenarbeit (GTZ). *Participant: W.G. Sombroek.*

Presentation of paper on research needs for soils of the humid tropics.

(84/15b) Selection of prospective sites for tropical forest research, Brazil and Colombia, November 1984. *Participant: W.G. Sombroek, on consultancy for the multi-disciplinary research programme of the Dutch Government Department of Science Policy ('Tropenbos').*

Field inspection of several sites in the Brazilian and Colombian Amazon regions. Discussions with local research organization on modes of cooperation.

(84/16) Meeting to review the Desertification Methodology and Database of project "Desertification Assessment and Mapping - phase II", FAO, Rome, Italy, December 1984. *Participant: Mr. R.F. van de Weg, Netherlands Soil Survey Institute (Stiboka), on behalf of W.G. Sombroek.*

Discussed were the methodology, including the modelling, developed in the project. The results of the Desertification Hazards Map of Africa, at the national level in Egypt, Kenya, Senegal and Sudan were reviewed. A workshop and other follow-up activities were planned.

REQUEST FOR MAPS AND REPORTS ON SOIL RESOURCES

Cartographic materials form an important part of ISRIC's documentation section. Geographic coverage of the collection is the whole world with emphasis on developing countries. The subject emphasis is on soils, but related geographic information on climate, ecology, vegetation, land use, land capability, geology, geomorphology, etc. is also of importance to the collection.

The acquisition policy is to obtain world coverage of maps at reconnaissance and smaller scale; examples of more detailed maps and index maps/lists of soil and related surveys carried out in a country. The selection criteria are relevance of the maps for soil science, agricultural development and environmental issues.

The major purpose of maintaining and enlarging the map collection at ISRIC is its use for the possible updating of the FAO-Unesco Soil Map of the World at scale 1:5 million and the compilation of a new, computerized world soil map at 1:1 million. The map collection serves also as a source of basic information for scientists and students using ISRIC's facilities for guest research or training.

You are kindly requested to send maps and accompanying reports,

of the types indicated above, either:
— directly to ISRIC, P.O.Box 353, 6700 AJ Wageningen, The Netherlands;
— through the Dutch Embassy or Consulate in your country;
— or through the Regional Offices of Unesco and FAO.

7 RELATIONS WITH OTHER INSTITUTIONS

7.1 INTERNATIONAL RELATIONS AND ACTIVITIES

Contacts and activities with international institutions included the following:

Food and Agricultural Organization of the United Nations (FAO, Rome and Regional Offices).

- Map collection for the updating of the FAO-Unesco Soil Map of the World
- Elaboration of an International Reference Base for soil classification (IRB)
- Exchange of publications and documentation, on soils and their management, agro-climatic zones, and potential population supporting capacities
- FAO advice to ISRIC on the preparation of a Chart of World Soils
- Comments on the FAO/UNEP methodology for assessment of desertification hazards.

United Nations Educational, Scientific and Cultural Organization (Unesco, Paris and Regional Offices)

- Unesco-ISRIC cooperative programme for soil studies in project areas of Unesco's "Man and the Biosphere" (MAB) programme, including the preparation of a MAB Technical Note
- Unesco financial support for ISRIC's International Course on the Establishment and Use of National Soil Reference Collections
- Establishment of an international Collection of Reference Laterite Profiles (CORLAT) at ISRIC.

United Nations Environment Programme (UNEP, Nairobi)

- Advice on the promotion of UNEP's World Soils Policy and the elements of its Plan-of-Action
- UNEP financial support for the elaboration of an International Reference Base for soil classification (IRB).
- ISRIC participation in UNEP-GEMS Global Resources Information Data base (GRID)
- UNEP possible financial support of an ISRIC programme to assist in the establishment of national soil reference collections in a number of developing countries, through UNEP/DGIS "Clearing House Facility".

International Society of Soil Science (ISSS)

- Administrative assistance to the Secretariat-General of ISSS, housed at ISRIC
- Hosting the mid-term meeting of the ISSS Executive Committee of the Society
- Organizing and editing of the book-review section of the six-monthly Bulletin of the Society
- Participation in the ISSS Working Group "International Reference Base for soil classification" (WG/RB), through formulation of proposals and assembling of documen-

tation
- Establishment of a reference collection of soil thin sections for the ISSS Subcommission on Soil Micromorphology
- Registration of visual training aids on soil science
- Repository of biographical material on outstanding soil scientists and on the early history of organized soil science for the ISSS Working Group on the History, Philosophy and Sociology of Soil Science (WG/HP).

Other international contacts

- Commission of the European Communities (EG, Brussels); submission, c.q. screening of research proposals
- International Service for National Agricultural Research (ISNAR, The Hague); exchange of programmes information
- International Development Research Centre (IDRC, Ottawa); support soil data centres
- Office de la Recherche Scientifique et Technique Outre-Mer (ORSTOM, Paris); exchange of information
- Centre Technique de Coopération Agricole et Rurale (CTA, Wageningen/Ede); exchange of data
- U.S. Agency for International Development (USAID) and several of its soil-related programmes (IBSNAT, SMSS); exchange of information; attendance of workshop; requests for financial support
- Several of the International Agricultural Research Centres of the Consultative Group on International Agricultural Research (IITA, IRRI, CIAT); exchange of information
- National Soil Survey and Soil Research Institutes in many countries.

7.2 NATIONAL RELATIONS AND ACTIVITIES

- National Unesco Committee for MAB/SCOPE (Amsterdam); cooperation on organization of a Seminar on Tropical Forest Ecosystems.
- Royal Netherlands Academy of Arts and Sciences (KNAW, Amsterdam); continuation of cooperation programme with Nanjing Institute of Soil Science of the Academia Sinica.
- International Institute for Aerospace Survey and Earth Sciences (ITC, Enschede); management servicing to ISRIC; lecturing at ITC Soils Course; analysis of soil and water samples; soil data base development; map preparation for MAB soil scientist
- Department of Science Policy of the Dutch Ministry of Education of Sciences (MOW-WB, The Hague); cooperation on the elaboration of a multidisciplinary research programme on tropical forests (Tropenbos).
- Museum for Education (Museon, The Hague); advice on exhibition in soils section of new building; taking of three monoliths.
- Netherlands Organization for the Advancement of Basic Research in the Tropics (WOTRO, the Hague); request for support on comprehensive study of three bauxitic

laterite profiles.

- Centre for World Food Studies (SOW, Wageningen/Amsterdam); exchange of information.
- Department of Soil Science and Geology of the Agricultural University Wageningen (LH); cooperation clay mineralogy; exchange of information; representation at international meetings.
- International Agricultural Centre (IAC, Wageningen); visitors accommodation; guest researcher's fellowships; advice on soil-related projects in developing countries.
- M.Sc. Course in Soil Science and Water Management of the Agricultural University Wageningen (LH); guidance of three students at thesis work.
- Netherlands Soil Survey Institute (Stiboka, Wageningen); cooperation micromorphology, including methodology of descriptions; map preparation for MAB soil scientist; exchange of information; representation at international meetings.

8 PUBLICATIONS

8.1 SOIL MONOLITHS PAPERS

Drafs of two Soil Monolith Papers were completed: SMP 3, Placic Podzol/Placaquod, Ireland by D. Creutzberg, J. Kiely and S. Diamond and SMP 7, Calcic Chernozem/Vermic Haplustoll, Romania by N.M. Pons-Ghitulescu.

8.2 SOIL MONOGRAPHS

Considerable progress was made on the preparation of the second monograph (draft completed), viz: 'Clay mineralogy and chemistry of Andisols and related soils from diverse climatic regions', by C. Mizota and L.P. van Reeuwijk.

8.3 TECHNICAL PAPERS

Technical Paper 7, 'Project of Soil Classification' (translation of Projet de Classification des Sols, prepared by a working team led by P. Segalen of ORSTOM) was published (translated by C. Esduck, edited by P. Segalen and C.A. van Diepen).

Technical Paper 8, 'Laboratory methods and data exchange program for soil characterization. A report on the pilot round. Part II: exchangeable bases, base saturation and pH', appeared also in 1984 (L.P. van Reeuwijk).

8.4 ANNUAL REPORT

In Annual Report over the preceding year was issued as usual. It includes two articles, viz: 'On the way to improve international soil classification and correlation: the variability of analytical data', by L.P. van Reeuwijk and 'Information exchange for earth scientists working in laterite areas', by M.J. McFarlane and W.G. Sombroek

8.5 MISCELLANEOUS

In 1984 the following articles were published:

- P. Buurman and L.P. van Reeuwijk. 'Protoimogolite and the process of podzol formation: a critical note'. J. Soil Sci., 1984, vol.35, pp. 447-452
- C. Mizota and L.P. van Reeuwijk. 'Clay mineralogy and chemistry of Andisols and related soils from diverse climatic regimes'. Comm. Congr. Intern. de Suelos Volcanicos (Tenerife), Serie Informes 13, 1984, pp. 681-682 (ext. abstr.)
- W.G. Sombroek. 'Soils of the Amazon region'. Chapter 20 in: H. Sioli, editor. 'The Amazon, limnology and landscape ecology of a mighty tropical river and its basin', pp. 521-535. Dr. W. Junk Publ., Dordrecht/Boston/Lancaster, 1984.

The following poster papers were presented at the Congr. Intern. de Suelos Volcanicos at Tenerife:

- D. Creutzberg and W.G. Sombroek. 'Some micromorphological aspects of the development of Andisols'
- L.P. van Reeuwijk and A.J.M. van Oostrum. 'A rapid method to determine a CEC delta value of soils'.

Under the title *Working Paper and Preprint* a new informal series of ISRIC contributions has seen the light. Most of these will ultimately be published in the proceedings of meetings at which the papers were presented. Copies are made available on request only. The following have appeared:

- (82/1) 'A Quest for an Alternative to the Use of Soil Moisture Regimes at High Categoric Level in Soil Taxonomy'. W.G. Sombroek. Presented at Fifth International Soil Classification Workshop, Khartoum, Sudan, November 1982
- (82/2) 'Vertisols in the Collection of the International Soil Museum and Some Suggestions of Classification'. Hans van Baren, Wim G. Sombroek and Abraham Kaplan. Presented by W.G. Sombroek at Fifth International Soil Classification Workshop, Khartoum, Sudan, November 1982
- (83/1) 'The International Soil Museum (ISM): Past, Present and Future'. W.G. Sombroek. Presented at the IBSRAM-ACIAR Soils Workshop, Townsville, 12-16 September 1983
- (83/2) 'ISM-Unesco/MAB Workshop on Soil Research in Biosphere Reserves and Other MAB Sites'. Wageningen, 15-18 June 1983
- (84/1) 'Identification and Use of Subtypes of the Argillic Horizon'. W.G. Sombroek. Presented at the International Symposium on Red Soils, Nanjing-China, 15-19 November 1983
- (84/2) 'Wetland soils of the world, their characterization and distribution in the FAO-Unesco approach'. C.A. van Diepen. Presented at the Seventh International Soil Classification Workshop on Characterization, Classification and Utilization of Wetland Soils, Los Baños, March-April 1984
- (84/3) 'The International Soil Reference and Information Centre (ISRIC)'. W.G. Sombroek and H. van Reuler. Presented at the Fifth ASEAN Soil Conference, Bangkok, June 1984
- (84/4) 'Towards a global soil resources inventory at scale 1:1 million'. W.G. Sombroek, ISSS/ISRIC, October 1984 (first draft of a discussion paper)
- (84/5) 'Recent Advances in Soil Classification' G.W. van Barneveld and W.G. Sombroek. Presented at the Fifth ASEAN Soil Conference, Bangkok, June 1984
- (84/6) 'Soils of the Humid Tropics: state of knowledge and research priorities'. W.G. Sombroek. Presented at 1^{o} Simposio do Tropico Umido, Belém, Para, Brazil, November 1984

The following *Consultancy Mission Reports* have been made:

- (83/1) 'Report on an international Workshop on ''tackling soil constraints to food production in the tropics'', leading to the formation of an International Board of Soil Research and Management (IBSRAM)', Townsville, Australia, 12-16 September 1983. W.G. Sombroek

- (84/1) 'Projet Arpon. Les sols irrigués des casiers rizicoles de l'office du Niger au Mali'. C.A. van Diepen
- (84/2) 'Les sols et leur conservation au "Mali-Sud"'. C.A. van Diepen.
- (84/3) 'Verslag van de Sixième Réunion du Sous-Comité de Corrélation des Sols de l'Afrique de l'Ouest et du Centre, Niamey, 6-12 Février 1984'. C.A. van Diepen (in Dutch).

Noteworthy are also:

- A descriptive brochure 'Down to Earth, an introduction to soils' by S. Northcliff, written to accompany a touring exhibition of the same name in the U.K., contains colour photographs of ten monoliths prepared at ISRIC
- As usual, a number of articles on ISRIC and its activities have appeared in newspapers and magazines, in The Netherlands as well as abroad. During his trips abroad, the Director of ISRIC was interviewed for newspapers, radio and television in Japan, Spain (Madrid and Tenerife) and Venezuela. A television programme in Japan on world food supplies featured, among others, ISRIC.

REQUEST FOR INFORMATION ON VISUAL TRAINING AIDS

During the last decade a large increase in the use of films, slides and videotapes and other training aids can be noticed at universities, agricultural highschools, training institutes, etc. This will also apply to soil science. Unfortunately, there is no central listing of the available material.

In cooperation with the Secretariat of the ISSS a register of such visual aids is now being made. It will, in due course, appear in the Bulletin of the ISSS.

We would be grateful if recipients of the Annual Report could send to the Secretary-General of the ISSS, P.O. Box 353, 6700 AJ Wageningen, the Netherlands a listing of available films, slides or slide sets, and videotapes on soil science *sensu largo*.

Please supply information on:

- title and main contents,
- level of audience,
- size and length of film,
- type of sound track,
- video system type,
- year of preparation,
- availability and price,
- ordering/contact address.

9 PERSONNEL

9.1 BOARD OF MANAGEMENT

Members of the Board of Management on 31 December 1984 were:
- Prof. Dr. Ir. G.H. Bolt, Chairman Netherlands Advisory Council
- Prof. Dr. L. van der Plas, Agricultural University Wageningen
- Ir. P. van der Schans, International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede
- Ir. R.P.H.P. van der Schans, Directorate of Agricultural Research, Ministry of Agriculture and Fisheries, Wageningen (Chairman)
- Prof. Dr. Ir. T. Wormer (personal member).

9.2 INTERNATIONAL ADVISORY PANEL

The International Advisory Panel (IAP) met in 1967, 1972, 1979 and 1983. The members of the last IAP were:
- Dr. F. Fournier, Division of Ecological Sciences, Unesco, Paris, France
- Dr. H. Ghanem, Institut Agronomique et Vétérinaire, Rabat, Morocco (for Northern Africa)
- Prof. E.G. Hallsworth, IFIAS Save-Our-Soils Project, Brighton, U.K. and past President ISSS (for Australia and ISSS)
- Mr. G.M. Higgins, Land and Water Development Division, FAO, Rome, Italy
- Dr. C.S. Holzhey, USDA Soil Conservation Service, Lincoln, Nebrasca, U.S.A. (for North America)
- Dr. M. Jamagne, Service d'Etude des Sols et de la Carte Pédologique de France, Olivet, France (for Western Europe)
- Mr. F.N. Muchena, Kenya Soil Survey, Nairobi, Kenya (for Africa south of the Sahara)
- Dr. A. Osman, Soil Science Division, Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD), Damascus, Syria (for the Middle East)
- Dr. C.R. Panabokke, Sri Lanka (for South and East Asia): could not attend
- Dr. C. Valverde, Programa Nacional de Suelos, Lima, Peru: at present International Service for National Agricultural Research (ISNAR), The Hague, The Netherlands (for Latin America and CGIAR institutes)
- Dr. G. Varallyay, Research Institute for Soil Science and Agricultural Chemistry, Budapest, Hungary (for Eastern Europe).

9.3 NETHERLANDS ADVISORY COUNCIL

Members of the NAC on 31 December 1984 were:
- Ir. J.G. van Alphen, International Institute for Land Reclamation and Improvement, Wageningen

- Dr. J.P. Andriesse, Royal Tropical Institute, Amsterdam
- Prof. Dr. Ir. J. Bolt, Department of Soils and Fertilizers, Agricultural University Wageningen (Chairman)
- Dr. Ir. J. Bouma, Soil Science Society of The Netherlands
- Prof. Dr. Ir. A. van Diest, Royal Netherlands Society of Agriculture, Wageningen
- Dr. Ir. P.M. Driessen, Centre for World Food Studies, Amsterdam-Wageningen
- Dr. Ir. J.C. Dijkerman, M.Sc. Course in Soil Science and Water Management, Agricultural University Wageningen
- Dr. Ir. G.W.W. Elbersen, International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede
- Ir. J. van der Heide, Institute for Soil Fertility, Haren
- Ir. B. van Heuveln, State University Groningen
- Ir. W.B. Hoogmoed, Soil Tillage Laboratory, Agricultural University Wageningen
- Dr. F. Kadijk, Laboratory for Soil and Crop Testing, Oosterbeek
- Dr. Ir. T. de Meester, Department of Soil Science and Geology, Agricultural University Wageningen
- Prof. Dr. Ir. F.R. Moormann, State University Utrecht
- Dr. F.W.T. Penning de Vries, Centre for Agrobiological Research, Wageningen
- Drs. J.F.Th. Schoute, Free University, Amsterdam
- Dr. J. Sevink, University of Amsterdam
- Dr. Ir. P.K.J. van der Voorde, Euroconsult, Arnhem
- Ir. W. van Vuure, Directorate of Agricultural Research, Ministry of Agriculture and Fisheries, Wageningen
- Drs. R.F. van de Weg, Soil Survey Institute, Wageningen
- Dr. Ir. G.P. Wind, Institute for Land and Water Management Research (ICW), Wageningen

Mutations:
- Prof. Dr. Ir. J. Bennema, Department of Soil Science and Geology, Agricultural University Wageningen, was succeeded by Dr. Ir. T. de Meester
- Dr. Ir. J. Bouma, Soil Survey Institute, Wageningen, was succeeded by Drs. R.F. van de Weg
- Ir. J.C. Pape, Soil Science Society of The Netherlands, Wageningen, was succeeded by Dr. Ir. J. Bouma.

9.4 ISRIC STAFF

Staff members of ISRIC on 31 December 1984 were:

Dr. Ir. W.G. Sombroek	: Director, soil classification and correlation, soil ecology
Drs. J.H.V. van Baren	: Curator, documentation
Drs. D. Creutzberg	: Soil micromorphology, educational affairs
Ir. J.H. Kauffman	: Senior soil scientist
Dr. Ir. L.P. van Reeuwijk, M.Sc.	: Soil chemistry, mineralogy and physics

Drs. E.J. van Waveren	: Soil documentation
(vacancy)	: Publications, agricultural applications
Ing. R.O. Bleyert	: Soil micromorphology, map documentation
W.C.W.A. Bomer	: Technician, photography and drawing
Ing. A.B. Bos	: Monolith preparation, technical services
J. Brussen	: Internal administration*
J.R.M. Huting	: Laboratory analyst
A.J.M. van Oostrum	: Senior laboratory analyst
J.D. Schreiber	: Technician, thin-section preparation
R.A. Smaal	: Laboratory analyst
Mrs. Y.G.L. Karpes-Liem	: Clerical services
Mrs. P.C. van Leeuwen	:
Mrs. A.R. Hazeleger-v.d. Weerd	:
Mrs. J.C. Jonker-Verbiesen	: Domestic services
Mrs. J. Nijhuis-Möller	:

Persons working at ISRIC on a voluntary basis during (part of) 1984 were:

J.G. ten Bokkel	: Laboratory analyst
Mrs. M. Bruijn-Fuchsová	: Clerical services
B. van Lagen	: Laboratory analyst
W.C.A. Oostrom	: Library assistant
G.D. Scheffer	: Typist, library assistant

* External administration by ITC, Enschede.

9.5 GUEST RESEARCHERS

Soil scientist working at ISRIC during (part of) 1984 as guest researchers were:
Ir. J.H. Kauffman
N. Lauv, M.Sc.
Drs. M.L. Moura
Dr. N.M. Pons-Ghitulescu.

APPENDIX 1 - GROUP VISITS IN 1984

Professional

Institutions	Approximate number of persons
Belgium	
University of Ghent	23
Bulgaria	
"N. Pushkarov" Soil Institute, Sofia	4
Fed. Rep. of Germany	
Universität Bochum	15
Universität Bonn	40
Geologisches Landesamt Nordrhein-Westfalen	40
Fachhochschule Gartenbau Osnabrück	30
Universität Trier	30
The Netherlands	
International Institute of Hydraulic and Environmental Engineering, Delft	25
International Institute for Aerospace Survey and Earth Sciences (ITC) Enschede	55
Centre Technique de Coopération Agricole et Rurale, Wageningen/Ede	20
International Symposium on Water and Solute Movement in Heavy Clay Soils, Wageningen	35
Meeting Executive Committee of the ISSS	5
ICRA International Course for Development Oriented Research in Agriculture, Wageningen	2 visits of 20
ILRI International Course on Land Drainage Wageningen	25
Working Group on Clay Mineralogy of KNGMG	15
Free University, Amsterdam	12
University of Amsterdam	2 visits of 25
College of Agriculture, Den Bosch	25
National College of Agriculture, Deventer	3 visits of 26
Agricultural College, Hoofddorp	15
State University, Utrecht	2 visits of 45
College of Forestry and Land and Water Management, Velp	30
Agricultural University Wageningen (including international courses)	17 visits of 26
Netherlands Soil Survey Institute (Stiboka), Wageningen	80 and 2 visits of 28
Sweden	
Swedish University of Agricultural Sciences, Uppsala	12
United Kingdom	
Wye College, Ashford	48
University of North Wales, Bangor	8
Portsmouth Polytechnic	18
UNEP delegation	4

Non-Professional

The Netherlands	
Rijksscholengemeenschap, Tiel	30
Rijksscholengemeenschap, Wageningen	25
School for Analysts (Stova), Wageningen	26

APPENDIX 2 LABORATORIES PARTICIPATING IN THE LABORATORY EXCHANGE PROGRAMME (LABEX)

ARGENTINA

Secretaria de Agricultura
INTA
Departamento de Suelos
1712 Castelar F.C.S.

AUSTRALIA

CSIRO Davies Laboratory
Private Bag
Aitkenvale, QLD 4814

CSIRO Division of Soils
Private Bag no. 2
Glen Osmond, SA 5064

Dept. of Primary Industries
Meiers Road
Indooroopilly, QLD 4068

AUSTRIA

Institut für Bodenforschung
Gregor-Mendelstrasse 33
A-1180 Wien

BELGIUM

Geological Institute
Krijgslaan 281
B-9000 Gent

BENIN

Centre Nat. d'Agro-Pédologie
B.P. 988
Cotonou

BOLIVIA

CIAT, Bolivia
Casilla 247
Santa Cruz

BOTSWANA

Dept. of Agricultural Research
Private Bag 0033
Gaborone

BRAZIL

SNLCS-EMBRAPA
Rua Jardim Botanico 1024
22460 Rio de Janeiro, RJ

BURKINA FASO

Bureau National des Sols
B.P. 7028
Ouagadougou

CAMEROON

Centre de Recherche d'Ekona
PMB 25
Buea

CANADA

Canadian Forestry Service
Analytical Serv. Laboratory
5320, 122 Street
Edmonton, Alberta T6H 3S5

Land Res. Research Institute
Central Experimental Farm
Neatby Bldg
Ottawa, Ontario K1A OC6

CHILE

INIA
Casilla 5427
Santiago

CHINA, PEOPLE'S REP. OF

Institute of Soil Science
P.O. Box 821
Nanjing

COLOMBIA

CIAT
Apartado Aereo 6713
Cali

Inst. Geogr. 'Agustin Codazzi'
Apartado Aereo 6721
Bogota

COSTA RICA

CATIE
Turrialba

Universidad de Costa Rica
Centro de Inv. Agronomicas
Ciudad Univ. 'Rodrigo Facio'

CUBA

Instituto de Suelos
Apartado 8022
Ciudad Habana 8

ECUADOR

Nat. Soil Dept. PRONAREG
Sancho de la Carrera 285,
CCI No. 11
Quito

EGYPT

Faculty of Agriculture
University of Cairo
Giza

FIJI

Koronivia Research Station
P.O. Box 77
Nausori

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ORSTOM
70-74, Route d'Aulnay
F-93140 Bondy

GERMANY, FED. REP. OF

Bundesanst. f. Geowissenschaften
Postfach 51 01 53
D-3000 Hannover 51

Universität Hamburg
Von-Melle-Park 10
D-2000 Hamburg 13

GHANA

Soil Research Institute
Academy Post Office
Kwadaso, Kumasi

GREECE

Agricultural Research Service
Land Reclamation Institute
570 00 Sindos

HUNGARY

Plant Protec. and Agric. Station
Fo ut 230
H-2481 Velence

Research Inst. for Soil Science
Herman Otto u. 15
H-1022 Budapest

INDIA

Nat. Bureau of Soil Survey
Regional Centre, Hebbal P.O.
Bangalore 560 024

INDONESIA

Centre for Soil Research
Jalan Ir. H. Juanda 98
Bogor

IRAN

Soil Institute of Iran
Kargar Shomali Avenue
Teheran

IRELAND

National Soil Survey
Johnstown Castle
Wexford

JAMAICA

Min. of Agriculture
Soil Survey Unit
Hope Gardens
Kingston 6

JAPAN

Hokkaido University
Faculty of Agriculture
Kita 9, Nishi 9, Kita ku
Sapporo 060

Kyoto University
Laboratory of Soils
Kitashirakawa, Sakyo ku
Kyoto 606

Tropical Agric. Research Centre
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Yatabe Tsukaba
Ibaraki 305

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Amman

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Kenya Soil Survey
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Nairobi

MALAWI

Chitedze Research Station
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Lilongwe

MALAYSIA

Soil Management Branch
Jalan Mahameru
Kuala Lumpur 10-02

MALI

SRCVO Laboratoire des Sols
Sotuba
B.P. 438
Bamako

MEXICO

Centro de Edafologia
Colegio de Postgraduados
56230 Chapingo

MOROCCO

Inst. Agron. & Veter. Hassan II
B.P. 6202
Rabat Instituts

MOZAMBIQUE

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Caixa Postal 3658
Maputo

THE NETHERLANDS

Agricultural University
Dept. of Soil Science & Geology
P.O. Box 37
6700 AA Wageningen

Agricultural University
Dept. of Soil Science and Plant Nutr.
P.O. Box 8005
6700 EC Wageningen

ISRIC
P.O. Box 353
6700 AJ Wageningen

Lab. for Soil and Crop Testing
P.O. Box 115
6860 AC Oosterbeek

Royal Tropical Institute
Mauritskade 63
1092 AD Amsterdam

NEW ZEALAND

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Rotorua

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P.M.B. 1044
Samaru, Zaria

IITA
P.M.B. 5320
Ibadan

PAKISTAN

Soil Survey of Pakistan
P.O. Shahnoor Multan Road
Lahore

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Bureau of Soils
Soil Research Division
P.O. Box 1848
Ermita, Manila

IRRI
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Manila

PORTUGAL

Centro de Estudos Pedologia
Tapada de Ajuda
1399 Lisboa Codex

SENEGAL

ISRA-CNRA
B.P. 51
Bambey

SIERRA LEONE

Land and Water Develop. Div.
P.M. Bag 187
Freetown

SPAIN

Departamento de Edafologia
La Laguna Tenerife
Islas Canarias

SRI LANKA

Land Use Division
P.O.B. 1138
Colombo 7

SUDAN

Soil Survey Administration
P.O. Box 388
Wad Medani

SURINAM

Dept. of Soil Survey
Hoek Coppenamestr./Comm.
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SWEDEN

Swedisch Univ. Agr. Sciences
Dept. of Soil Sciences
Box 7014
S-750 07 Uppsala

SYRIA

ACSAD
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Damascus

TANZANIA

National Soil Service
P.O. Box 5088
Tanga

THAILAND

Soil Analysis Division
Paholyotin Road, Bangkhen
Bangkok 10900

TOGO

Dir. des Etudes Pédologiques
B.P. 1026
Lomé

TUNESIA

Direction des Sols
Route de la Soukra
Ariana

UNITED KINGDOM

Caleb Brett Laboratories Ltd.
Lancots Lane
St. Helens Merseyside WA9 3ES

ICI Jealott's Hill Research St.
Bracknell
Berkshire RG12 6EY

The Macaulay Institute for Soil Research
Craigiebuckler
Aberdeen AB9 2QJ

Rothamsted Experimental Station
Harpenden
Herts. AL5 2JQ

Trop. Soils Analysis Unit, LRDC
Coley Park
Reading RG1 6DT

URUGUAY

Direccion de Suelos
Casilla Correo 14.005 D4
Montevideo

USA

Univ. of Hawaii
College of Tropical Agriculture
2500 Dole Street Krauss Hall 22
Honolulu HI 96822

U.S. Dept. of Agriculture
Soil Conservation Service
100 Centennial Mall North
Lincoln NE 68508-3866

U.S.S.R.

Dokuchaev Soil Science Institute
Pyzhevsky Lane 7
Moscow 109017

VENEZUELA

CENIAP, MAC Seccion Suelos
Apdo. 4653
Maracay 200

ZAMBIA

Mt. Makulu Central Research St.
P.O. Box 7
Chilanga

ZIMBABWE

Chem. and Soil Research Inst.
P.O. Box 8100, Causeway
Harare

(status: December 1985)

PUBLICATIONS

Soil Monolith Papers

1. Thionic Fluvisol *(Sulfic Tropaquept)* Thailand, 1981
2. Orthic Ferralsol *(Typic Haplustox)* Zambia, in prep.
3. Placic Podzol *(Placaquod)* Ireland, in prep.
4. Humic Nitosol *(Oxic Paleustalf)* Kenya, in prep.
5. Humic Acrisol *(Orthoxic Palehumult)* Jamaica, 1982
6. Acri-Orthic Ferralsol *(Haplic Acrorthox)* Jamaica, 1982
7. Calcic Chernozem *(Vermic Haplustoll)* Romania, in prep.

Technical Papers

1. Procedures for the Collection and Preservation of Soil Profiles, 1979
2. The Photography of Soils and Associated Landscapes, 1981
3. A New Suction Apparatus for Mounting Clay Specimens on Small-Size Porous Plates for X-ray Diffraction, 1979
4. Field Extract of ''Soil Taxonomy'', 1980, 3rd printing 1983
5. The Flat Wetlands of the World, 1982
6. Laboratory Methods and Data Exchange Program for Soil Characterization. A Report on the Pilot Round. Part I: CEC and Texture, 1982, 2nd printing 1983
7. Field Extract of ''Projet de Classification des Sols'', 1984
8. Laboratory Methods and Data Exchange Program for Soil Characterization. A Report on the Pilot Round. Part II: Exchangeable bases, Base saturation and pH, 1984

Monographs

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- to transfer specialized information - by lecturing and by publishing on the collected materials and on research data, and by advising on the establishment of national and regional soil reference collections
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