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ANNUAL REPORT 1987

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 founds 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 memebers of the Board of ISRIC are the International Institute for Aerospace Survey and Earth Sciences (ITC) in Enschede, the Wageningen Agricultural University (WAU) 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 responsibility for the working funds and for the permanent staff of ISRIC rest 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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ANNUAL REPORT 1987

International Soil Reference and Information Centre
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CONTENTS

1 THE ORGANIZATION AND ITS DEVELOPMENTS

1.1 ORGANIZATION

During the year 1987 the activities of ISRIC were organized in six complementing sections, three programmes, consulting and miscellaneous projects.

Sections

Soil monolith collection

This section deals with the building up of ISRIC's world collection of monoliths and encompasses all work from selecting and taking of the soil profile to the final monolith being placed in the exhibition room or reference store ("pedonarium"). Related is the National Soil Reference Collection Programme (NASREC) and the Collection of Reference Laterite Profiles (CORLAT).

Laboratory

Besides regular analytical work for the monolith collection, this section carries out a number of ad-hoc analyses, particularly for reference purposes. Related is the Laboratory Methods and Data Exchange Programme (LABEX).

Micromorphology

The work includes the preparation and description of the thin sections belonging to the soils of the collection. Like the laboratory, the micromorphology section is involved in a number of other activities as well.

Documentation

This section deals with the development of ISRIC's Soil Information System (ISIS), with the library, and with the map collection.

Soil classification correlation and mapping

Activities in this section are mainly related to the development of a Revised Legend for the FAO/Unesco Soil Map of the World, to some International Committees for the improvement of the United States Department of Agriculture Soil Taxonomy, and to the development of an International Reference Base for national soil classification systems (IRB). Related is the establishment of a World Soils and Terrain Digital Database at 1:1 million scale (SOTER).

Transfer of Knowledge

This section deals with the Course on the Establishment and Use of National Soil Reference Collections, with receiving visitors, lecturing, and supplying written and oral information.

Programmes

These are longer term activities, for which however only fixed-term extra funds have been secured.

National Soil Reference Collections Programme (NASREC)

This programme encompasses support for the building up of a number of national soil reference collections in selected countries of Africa, South America and Asia.

Laboratory Methods and Data Exchange Programme (LABEX)

This soil sample exchange programme between about 120 laboratories aims to improve the quality of soil analytical data by providing external references and standard procedures to the participants.

Preparation of a World Soils and Terrain Digital Database (SOTER)

This is a programme to support the establishment of a geographic information system on the soils of the world at scale 1:1 million, an ISSS initiative that is a sequel to the FAO/Unesco Soil Map of the World project of the sixties.

The United Nations Environment Programme (UNEP) in Nairobi awarded a major contract for the global assessment of soil degradation (GLASOD project, see section 4.2) to be accompanied by quantification of status and hazards of the various forms of soil and land degradation in at least one pilot area - the latter based on the ISSS-initiated methodology for the establishment of a World Soils and Terrain Digital Database (SOTER).

Consulting and Projects

This embraces not only missions of ISRIC staff members, but also the employment of extra personnel at ISRIC to carry out specific projects. Most of these projects are not likely to develop into longer term programmes.

1.2 INSTITUTIONAL DEVELOPMENTS

The shift of the focus-of-attention of the Centre from monolith collection to application of the assembled documentation, already mentioned in the previous Annual Report, received a strong impetus in 1987.

The special funding programme NASREC continued in full swing, the LABEX programme obtained assurance of continued funding till end 1990, still mainly from its early donor agency DGIS, but increasingly also from several other agencies and the participants in the scheme themselves. FAO contracted ISRIC to carry out a compilation of the soil resources of Eastern and Northeastern Africa at 1:1 million scale accompanied by a preliminary assessment of the irrigation suitablities of the land units concerned (SMEA project).

The Dutch Ministry of the Environment requested the Centre to carry out a background study on the potential effects on world climate of global changes in soil conditions and land use pattern, and the organization of an international conference on "Soils and the Greenhouse Effect" in 1989 (ISEC project).

In the meantime, the Commission on Soil Genesis, Classification and Cartography of ISSS recognized that the need for an International Reference Base for soil classification (IRB) is becoming ever greater - in view of the multiplication of national systems. Work on such a reference base was therefore made part of the regular programme of that Commission and the director of ISRIC was invited to participate in a core group to elaborate on concepts and criteria. Several meetings were held during the year, alternating in Rome, Leuven and Wageningen, with Prof. A. Ruellan as Chairman and Prof.Dr. R. Dudal as Secretary. Reference publications on all national soil classification systems, formalized or in preparation, are being assembled at ISRIC, for eventual input into a computerized repository of terms and definitions used in various countries in the past or at present.

ISRIC's preoccupation with small-scale updated mapping of the soil resources of the world, and those of the tropics and subtropics in particular, received a strong impetus through acceptance-in-principle of the SOTER approach to digitized storage of soil and terrain information by a number of international organizations such as UNEP for its Global Resources Information Database (GRID) system. ISRIC contracts with FAO (SMEA project, see section 4.2) and UNEP (GLASOD project, including SOTER development for a Latin American pilot area, see section 4.2) are the first tangible results.

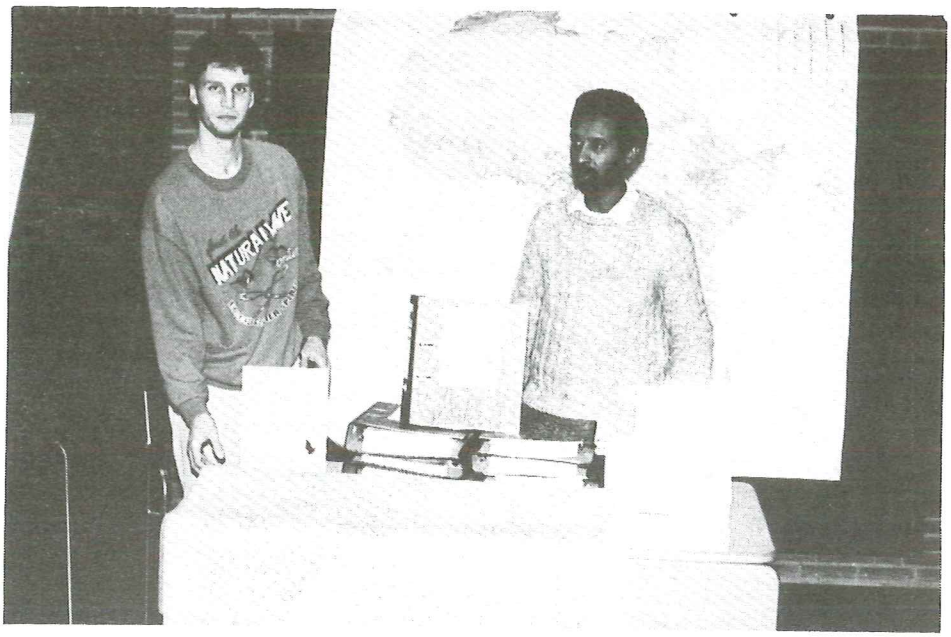
Computerised baseline compilation of all natural resources, at global, regional and national levels, got the attention of several scientific unions, UN specialised Agencies, and agricultural development-oriented research organizations. A consensus is emerging to the effect that a 1:1 million level of accuracy will suffice for many purposes. Technical facilities for interactive systems of resources database (on soils and terrain, on vegetation and land use patterns, on climate and hydrology, etc.) are becoming less and less expensive, and plans for a digital topo base for the world's land resources are nearing the operational stage (WDDES project).

One of the results of starting the activities mentioned before, is a diminishing of attention given to some traditional core activities, including the programme of publications on key soil monoliths.

Educational functions became strained, also because a request to the EEC "Erasmus" programme for financial support was not met. Substantial attention could however be given to the building up of the ISRIC Soil Information System (ISIS) thanks to the acquisition of an appreciable amount of hard- and software.

The increased level of activities on special fund programmes and projects, and the strong inflow of documentation (maps, reports, monoliths) caused an acute shortage of working space. Towards the end of the year extra space was kindly provided by the neighbouring Department of Soils and Geology of Wageningen Agricultural University. Towards the end of the year, the organizational and financial prospects for the availability of a permanent annex of 350 m2 in another neighbouring University building appeared quite positive.

Preparations for the creation of a Foundation ISRIC were finalised, and it was decided to work out a Management contract for financial and personnel administration by the "Stichting ITC", thereby continuing the long-time association with this International Institute for Aerospace Survey and Earth Sciences in Enschede, the Netherlands.



Authors of new Soil map of Northeastern Africa

2 ARTICLE

IRRIGATION SUITABILITIES OF SOILS OF EASTERN AND NORTHEASTERN AFRICA AT 1:1 MILLION SCALE

*Endale D.M. and R.T.A. Hakkeling**

Abstract

Soil irrigability assessments for upland crops and paddy rice of some 1770 mapping units comprising nine countries in Eastern and Northeastern Africa were recently carried out at ISRIC. The data were obtained during compilation of a 1:1 million scale soil map of these countries. This paper summarizes the procedure adopted and results obtained.

1 INTRODUCTION

The dramatic advance in man's ability to acquire, handle, analyse and disseminate data about earth surface features in this computer era has equally aroused the users demand for better quality resource data and maps to make better decisions in resource assessment, planning and management. A case in point is the demand for the updating and expansion of the information in the FAO-Unesco soil map of the world.

This development has, among others, precipitated an initiative for the preparation of a world soil and terrain digital database at a scale of 1:1 million (SOTER). Such data permit several applications at world, continental, national, state and provincial levels for assessment and planning purposes. One such application being irrigation potential assessment.

ISRIC recently compiled a draft 1:1 million scale soil map of nine East and Northeast African countries under an FAO contract. These were Burundi and Rwanda, Djibouti, Egypt, Ethiopia, Kenya, Somalia, Sudan, Tanzania and Uganda. The purpose was:

1. To test at 1:1 million scale the latest FAO/Unesco legend for the soil map of the world.
2. To provide an estimate of the extent, at regional level, of the soils that may have a potential for irrigation.
3. To gain experience in data handling as a step towards the realization of SOTER.

Irrigation is an expensive undertaking. The ultimate socio-economic benefit determines its viability. Likely interactions between soil, applied water and crops as well as management practices, engineering and socio-economic factors need to be considered in evaluating irrigation potentials. Nevertheless the knowledge of soil and topography is useful to initially identify promising areas of land which justify a more detailed land and economic evaluation leading to resource optimization.

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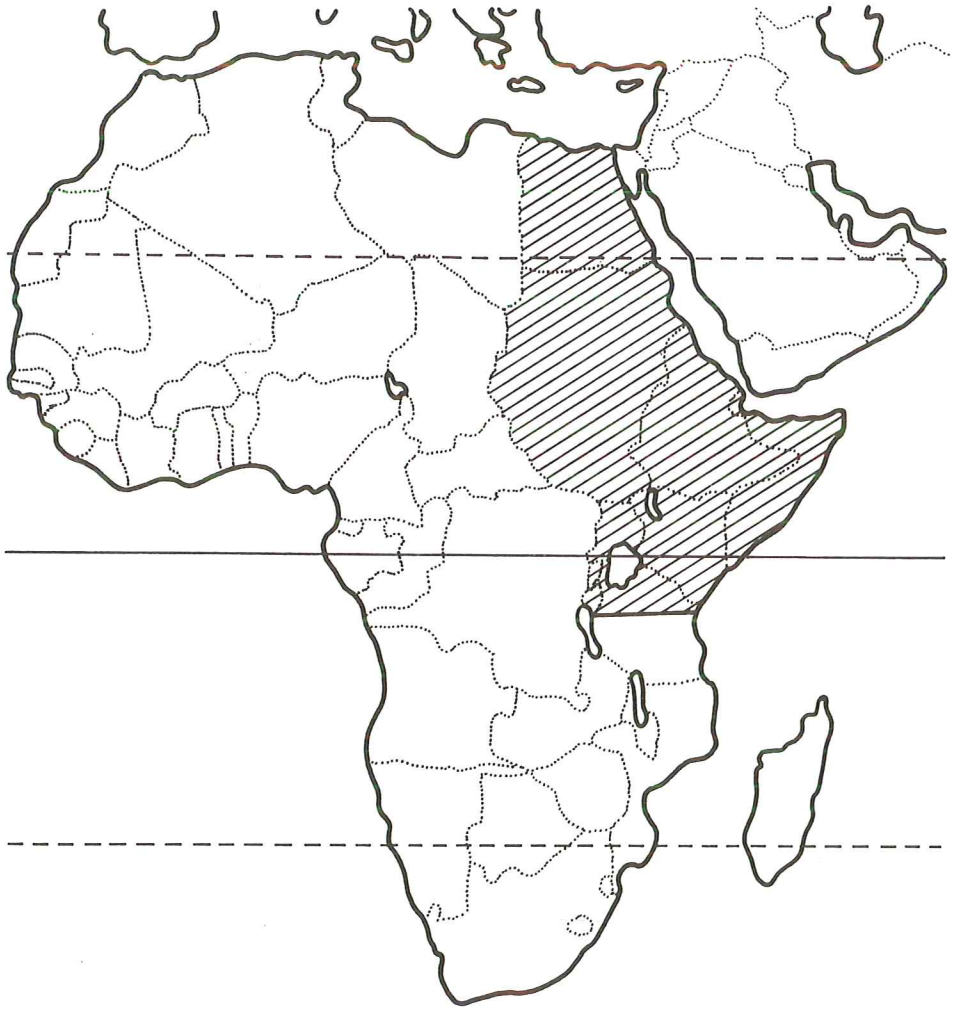

Area for which soil suitability for irrigation is assessed

2. METHODS AND MATERIALS

2.1 General

Some 1770 units with more than of 4000 soil associations have been identified in this exercise. The irrigability assessment for each soil association and then map unit is thus a repetitive and tedious process for which computers prove to be ideal. The assessment was therefore carried out by a desk microcomputer with data managed in dBASE III. Space does not allow the inclusion of the program or the full results here which run to some 400 pages of printout. A flow chart of the program is included (Fig. 1).

The assessment was done for upland crops and paddy rice. Gravity irrigation with all the necessary infrastructures in place is assumed; cost or commandability factors are not considered. The variation in the land requirements for different upland crops is recognised, but the scale allows only a broad generalization.

2.2 Database

The irrigability assessment was preceded by the preparation of a 1:1 million scale soil map. This map was compiled from existing maps and reports supplemented by Landsat imagery for areas without or with unreliable soil maps. Soils were classified using the latest version of the Revised Legend of the FAO/Unesco Soil Map of the World. Data for each mapping unit soil association were recorded on attribute sheets which gave details for up to three soil units. Only the FAO/Unesco unit name and area percentage were given for any additional soil which normally occupied a small proportion of the association.

A set of soil and terrain properties available and considered relevant for the irrigability assessment on these attribute sheets was then extracted and made into a separate database. These properties comprise the FAO/Unesco unit name (including levels II and III), area percentage, drainage, slope, texture, phases and percentage coverage of the phases. To facilitate programming the data were entered in coded form (Appendix 1).

The original data sources in general do not show the percentage nor the distribution or overlap of phases in a mapping unit or associated soils. This makes irrigability assessment difficult. Consequently only two phases were considered with a mechanism to insure that no set of phases cover a soil or map unit completely.

Selection of soil texture from the attribute sheets is important and entails a degree of personal judgement. Consideration should be given to which of the top or subsoil textures exerts more influence on irrigability.

Different soil classifications were used in the original reports (Soil Taxonomy, FAO/74, CCTA, at times none, etc.) which had to be brought to a common base, viz the latest FAO/Unesco soil legend. Such correlation causes the loss or addition of data which may or may not be accurate. Classes or differing soil classifications do not correspond exactly. This could cast doubt on the assessment results of some of the units.

2.3 Soil Irrigability

Characteristics of particular relevance to irrigability assessment are:

Soil characteristics

- effective soil depth	*
- particle size distribution	*
- structure stability (pre/post irrigation)	
- porosity	
- infiltration rate	
- saturate hydraulic conductivity	*
- water retention characteristics	*
- salinity/alkalinity	*
- calcium carbonate content	*
- gypsum content	*
- pH	*
- depth to groundwater	*
- salinity of groundwater	
- toxic substances	

Site characteristics

- topography	
- surface stoniness	*
- subsurface stoniness	*

The attribute sheets give only partial information on these characteristics; information on those marked with asterisks can be inferred to some degree from the FAO/Unesco soil name and from phases. FAO/Unesco soil units have been defined in terms of measurable and observable properties, many of which are relevant to soil use. The units distinguished have predictive value for the use of the soil.

Mainly on the basis of this inferred information, a suitability classification for upland crops and paddy rice was estimated for each of the 153 soil units of the latest provisional FAO/Unesco soil legend for use in the calculation model (Appendix 2). For some Fluvisols and Planosols, the drainage condition was taken into account to estimate this initial classification (Appendix 3.5).

The classification has 3 classes:

S1 - very suitable; no or few slight limitations
S2 - moderately suitable; slight to moderate limitations
N - not suitable; severe limitations.

Also distinguished are the following associations:

S1/S2 - 50% S1 and 50% S2
S1/S2/N - 33% S1, 34% S2 and 33% N
S2/N - 50% S2 and 50% N

2.4 Calculation model

Each soil association is downgraded on the bases of limitations considered in successions, from an initial 100% irrigable (S1). In a first step, those irrigability constraints which can be deduced from the soil unit name are considered. The result is a classification with the structure indicated above (2.3). Each is therefore initially proportioned into S1, S2 and N for each utilization type.
A second group of constraints, which were not yet taken into account in the first step are then considered. This results in modifications to the S1, S2, and N divisions above. A fourth class (S3) is introduced here. This allows two further limiting properties to units rated S1 in the first step before they are considered non-irrigable, and one for S2. Modifications are made for limitations on the basis of slope, texture, 1st phase, 2nd phase and level III soil name. They take the form of downgradings, either single or again in associations (Appendix 3):

[0]	= no downgrading	[0/-1]	= 50% [0] and 50% [-1]
[-1]	= downgrade 1 class	[0/N]	= 50% [0] and 50% [N]
[N]	= downgrade to not suitable	[-1/N]	= 50% [-1] and 50% [N]

For the 4th or additional soil associations, when these exist, the attribute sheets give only the FAO/Unesco unit name and area percentage. Modifications as above cannot therefore be followed. Instead blanket 35% [0], 35% [-1], and 30% [N] modifiers were applied. These occupy only up to 10 to 15% of a soil association.

After each soil association is treated in this way, the corresponding classes are summed for the mapping unit. Classes 2 and 3 are then combined in class 2, moderate to marginal soils. Final suitability classification for the whole mapping unit is given as x/y/z, indicating area percentages of suitable (x), moderate to marginal (y), and not suitable (z) soils.

Data per mapping unit are either read from files of each country or entered interactively at the prompt of the computer.

Modifying twice for the same property must be avoided. The initial classification based on the FAO soil name for Vertisols and vertic units, for example, already takes into account limitations due to their fine texture, so no further texture modification is necessary. Original data sources showed many Ferralsols as being fine textured. As they are not considered to have the limitations of fine textured soils in other soil units, however, Ferralsols are excluded from texture modification.

The latest legend of the FAO/Unesco soil map has introduced level III subunits. These are either intergrades between second level soil units or they indicate characteristics in addition to those in the definition at soil unit level. Their effect is considered but only if it had not already been taken into account in the previous steps.

An approach for soil irrigability assessment as described above was suggested by FAO in their publication "Land Resources for Populations of the Future". The methodology was considered acceptable for work at a 1:1 million scale and was adopted with modifications to match the compiled data of the soil map. This was particularly true in view of the limited time available for the consideration of alternative models.

3 RESULTS

Results are shown as two sets of computer printouts (Appendix 4). The first set shows the percentages for each soil association and each utilization type falling in S1/S2/S3/N as downgrading proceeds through the two steps of modifications. This guides the reader who wishes to check the procedure, analyse the relative importance of unit-erived limitations compared with the others like phases or third-level ones, and perhaps note anomalies and errors. Final suitability classes of each mapping unit are given in percentages falling in S1/S2+S3/N.

The second set of results is a summarized output showing soil irrigability falling in S1/S2+S3/N for each soil as percentage of its area and that of the corresponding map unit. Final soil irrigability is also given as S1/S2+S3/N for each mapping unit. Old and new mapping unit identifiers refer to identifiers in the original reports and the new soil map respectively. The latter is based on the dominance and range of soil types, textures and slope classes in a mapping unit.

Results are available as above for each of the 1770 mapping units delineated for the nine countries covered. Final estimates of the proportions of irrigable soils of these countries awaits digitizing of the soil map by FAO, after which areas of mapping units become available leading to the expression of soil irrigabilities in hectares.

4 DISCUSSION AND CONCLUSION

The quality of a database determines the attainable degree of accuracy of any model. Without an appropriately detailed and accurate database a sophisticated model loses credibility, it may in fact work less well than a simple model. In this case, time did not allow the development and comparison of various models.

The sources of the information for the database constructed here were variable in quality and at times conflicting. Also, these sources were not solely intended for use in irrigability assessment and specific data needed were not always available. In places, the sources provided only satellite image interpretation without or with little supporting ground information. Furthermore, compilation lead to further generalization with some loss of available detail, which is sometimes important for irrigability assessment. There is, therefore, a considerable variation in reliability within the database.

Although the model is thus necessarily a simple one, it nevertheless gives a perspective, at this scale, of soil irrigability of the region as a whole. In combination with other environmental databases at similar scales on such aspects as topography, hydrology and climate, the irrigation potential can be assessed. It is hoped that this exercise will also generate further interest leading to improvements, and to similar studies in other regions.

As a test of reliability, results were compared with irrigabilities given in small scale irrigation studies in central Ethiopia (Awash Valley), Southern Somalia (Inter Riverine Agricultural Study) and Eastern Kenya (Bura Irrigation Scheme). Given differences in objectives, assumptions and scales, results were comparable.

Once more detailed data become available, improvements are possible in the estimation of mapping unit component percentages, texture, phase distribution and the soil classification.

Flow chart

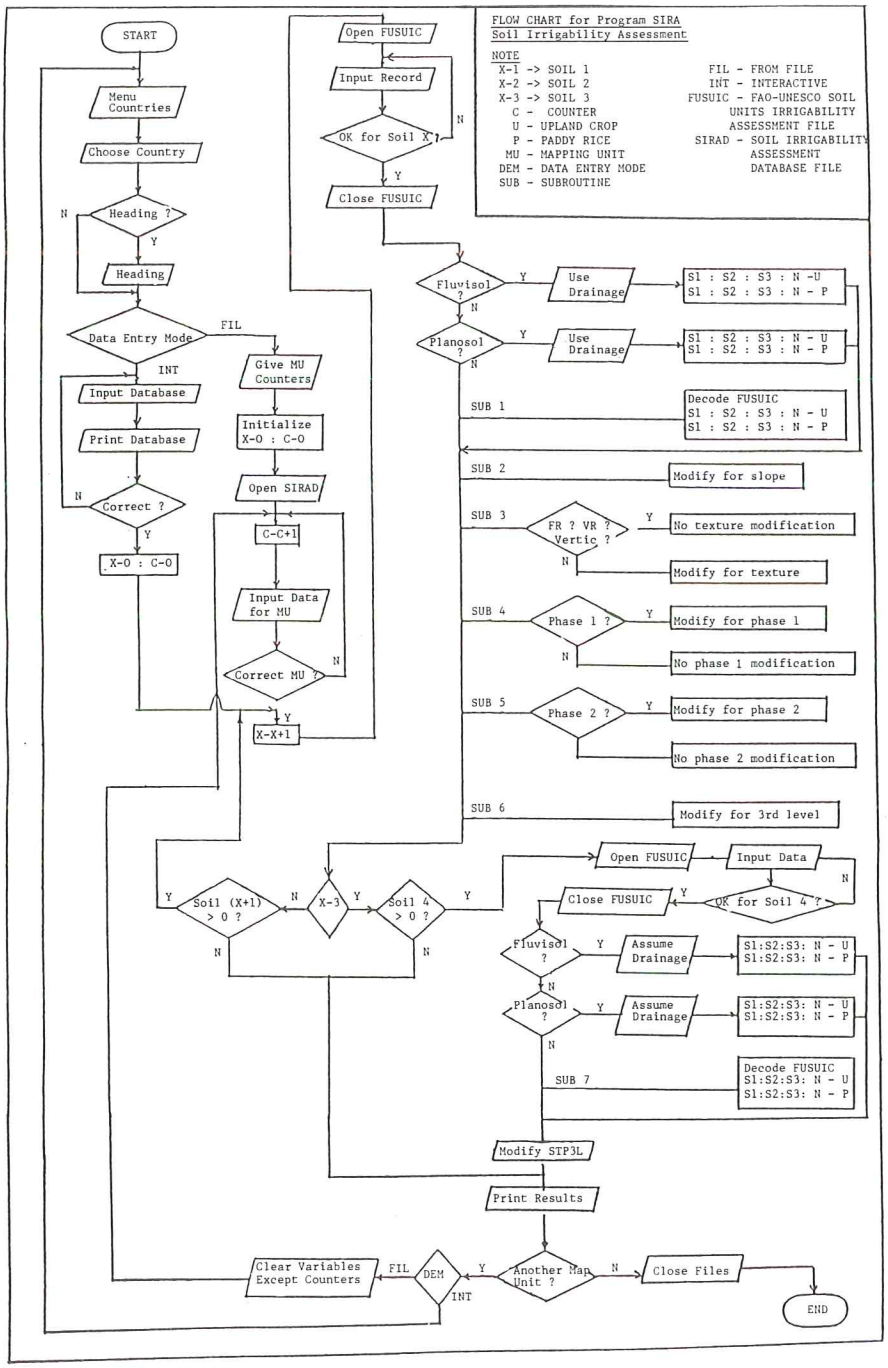

Fig. 1 Flow chart of computer program for soil irrigability assessment.

5 ACKNOWLEDGEMENTS

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Appendix 1: *Code Interpreters for Database*

1.1 *Texture* *

Class 1 - S, LS
2 - SL
3 - L, SCL, SiL, Si
4 - CL, SiCL
5 - SC, SiC, C

Data code	*Texture class combination*
1	1-1
2	1-2
3	1-3
4	1-4
5	1-5
6	2-2
7	2-3
8	2-4
9	2-5
10	3-3
11	3-4
12	3-5
13	4-4
14	4-5
15	5-5
16	Others: rock, peat etc.

1.2 *Drainage*

Code	*Class*
1	Well
2	Imperfect
3	Poor
4	Well/Imperfect
5	Well/Poor
6	Imperfect/Poor
7	No information

1.3 *Slope, Phase, Level III Soil Names*

See appendices 3.1, 3.3, and 3.4 respectively.

* *Texture Class*
1 - coarse
2 - coarse/medium
3 - medium
4 - medium/fine
5 - fine

Appendix 2: *Soil Irrigability Classification for FAO/Unesco Subunits (1988) (Examples).**

Level I	*Level II*	*Soil Irrigability Class* Upland Crop	Paddy Rice
Gleysols (GL)	Eutric Gleysols (GLe)	S2/N	S1/S2/N
	Thionic Gleysols (GLt)	N	N
Regosols (RG)	Calcaric Regosol (RGc)	S1/S2	S2/N
	Gypsic Regosols (RGj)	N	N
Leptosols (LP)	Eutric, Lithic, etc.	N	N
Arenosols (AR)	Haplic, Gleyic, etc.	N	N
Andosols (AN)	Haplic Andosols (ANh)	S1	S2
	Gelic Andosols (ANi)	N	N
Vertisols (VR)	Haplic Vertisols (VRh)	S2/N	S1
	Yermic Vertisols (VRy)	N	N
Cambisols (CM)	Dystric Cambisols (CMd)	S1	S1
	Calcaric Cambisols (CMc)	S1/S2	S2/N
Calcisols (CL)	Haplic Calcisols (CLh)	S1/S2	S2/N
	Arenic Calcisols (CLq)	N	N
Solonetz (SN)	Haplic Solonetz (SNh)	N	S2/N
	Gypsic Solonetz (SNj)	N	N
Solonchaks (SG)	Haplic Solonchaks (SCh)	S2/N	S2/N
	Sodic Solonchaks (SCn)	N	N
Kastanozems (KS)	Calcic Kastanozems (KSk)	S1/S2	S2/N
	Gypsic Kastanozems (KSj)	N	N
Chernozems (CH)	Calcic Chernozems (CHk)	S1/S2	S2/N
	Gleyic Chernozems (CHg)	S2/N	S1/S2/N
Phaeozems (PH)	Calcaric Phaeozems (PHc)	S1/S2	S2
	Gleyic Phaeozems (PHg)	S2/N	S1/S2/N
Greyzems (GR)	Haplic Greyzems (GRh)	S1	S2
	Gleyic Greyzems (GRg)	S1	S1/S2/N
Luvisols (LV)	Haplic Luvisols (LVh)	S1	S2
	Gleyic Luvisols (LVg)	S2/N	S1/S2/N
Lixisols (LX)	Ferric Lixisols (LXf)	S2	S2
	Yermic Lixisols (LXy)	N	N
Podzoluvisols (PL)	Eutric Podzoluvisols (PLe)	S1/S2/N	S2/N
	Gelic Podzoluvisols (PLi)	N	N
Podzols (PZ)	Haplic, Gelic, etc	N	N
Acrisols (AC)	Haplic Acrisols (ACh)	S2	S2
	Gleyic Acrisols (ACg)	S2/N	S1/S2/N
Alisols (AL)	Haplic Alisols (ALh)	S2	S2
	Gleyic Alisols (ALg)	S2	S1/S2/N
Nitosols (NT)	Haplic Nitosols (NTh)	S2	S2
	Umbric Nitosols (NTu)	S1/S2	S2
Ferralsols (FR)	Haplic Ferralsols (FRh)	S2	S2
	Yermic Ferralsols (FRy)	N	N
Plinthosols (PL)	Umbric Plinthosols (PLu)	S2	S1/S2
	Albic Plinthosols (PLa)	S2/N	N
Histosols (HS)	Folic, Terric, etc.	N	N
Anthrosols (AT)	Aric Anthrosols (ATa)	S2/N	S2
	Urbic Anthrosols (ATu)	N	N
Fluvisols (FL) :	Use drainage except Yermic, Thionic (N;N)		
Planosols (PN) :	Use drainage except Gelic, Yermic (N;N)		

* Full list includes 153 soil units

Appendix 3: *Modifications*

3.1 *Modifications for slope*

		Modifications (%)					
		Upland Crops			*Paddy Rice*		
Slope Code	*Slope Class (%)*	[0]	[-1]	[N]	[0]	[-1]	[N]
1	0-2	100	-	-	100	-	-
2	0-5	50	50	-	40	60	-
3	0-8	30	70	-	30	40	30
4	0-16	10	30	60	10	20	70
5	0-30	5	20	75	-	-	100
6	2-5	25	75	-	-	100	-
7	2-8	15	85	-	-	50	50
8	2-16	5	45	50	-	25	75
9	2-30	-	25	75	-	15	85
10	5-8	-	100	-	-	-	100
11	5-16	-	20	80	-	-	100
12	5-30	-	10	90	-	-	100
13	5-30+	-	-	100	-	-	100
14	8+	-	-	100	-	-	100

3.2 *Modifications for texture*

		Modifications (%)					
	Texture	*Upland Crops*			*Paddy Rice*		
Texture Code	*Class Group**	[0]	[-1]	[N]	[0]	[-1]	[N]
1	S	-	25	75	-	-	100
2	S-SL	25	20	55	15	20	65
3	S-L	50	15	35	45	10	45
4	S-CL	50	25	25	55	10	35
5	S-C	40	40	20	65	10	25
6	SL	50	15	35	33	34	33
7	SL-L	75	10	15	65	20	15
8	SL-CL	65	20	15	75	15	10
9	SL-C	25	55	20	80	10	10
10	L	100	-	-	100	-	-
11	L-CL	75	25	-	100	-	-
12	L-C	50	50	-	100	-	-
13	CL	50	50	-	100	-	-
14	CL-C	25	75	-	100	-	-
15	C	-	100	-	100	-	-
16	Rock, peat, etc	-	-	100	-	-	100

* See appendix 1.1 for full grouping

3.3 *Modifications for phase*

Phase Code	*Phase Group*	*Modifications* *Upland Crops*	*Paddy Rice*
1	Phreatic, Gilgai, Inundic	[0]	[0]
2	Sodic	[-1]	[0]
3	Salic, Placic	[-1]	[-1]
4	Duripan, Fragipan, Petrocalcic, Petroferric	[-1/N]	[-1]
5	Petric	[-1/N]	[-1/N]
6	Anthraquic	[N]	[0]
7	Lithic, Rudic, Petrogypsic, Lithic/Rudic	[N]	[N]
8	Salic/Sodic	[N]	[-1]

3.4 *Modifications for level III soil names*

level III soil name *Code*	*Group*	*Modifications* *Upland Crops*	*Paddy Rice*
1	All level III except 2 to 7 inclusive	[0]	[0]
2	Stagni, Verti	[-1]	[0]
3	Ferri, Sali	[-1]	[-1]
4	Albi, Areni	[-1]	[0]
5	Calci	[0/-1]	[-1/N]
6	Gleyi	[-1/N]	[0/N]
7	Takyri, Yermi, Mazi, Lepti, Ali	[N]	[N]

3.5 *Modifications for Fluvisols and Planosols for differing drainage classes*

Soil and Drainage Class	*Modifications (%)* *Upland Crops* [0]	[-1]	[N]	*Paddy Rice* [0]	[-1]	[N]
Fluvisols						
Well drained	80	20	-	25	50	25
Imperfectly drained	10	80	10	50	50	-
Poorly drained	-	20	80	75	25	-
Planosols						
Well drained	75	25	-	-	75	25
Imperfectly drained	10	75	15	50	50	-
Poorly drained	-	25	75	75	25	-

Appendix 4: *Results*

International Soil Reference and Information Centre
Soil Irrigability Assessment
SMEA Project

KENYA: *Result 1*

MAP & SOIL UNIT IDENTI-FIERS	IRRIGABILITY CLASSES : UPLAND CROPS & PADDY RICE																									
	WITH NO MODIFI-CATION				AFTER MODIFICATION OF																				FINAL SUITABIL. CLASSES		
					SLOPE				TEXTURE				PHASE I				PHASE II				III LEVEL						
	S1	S2	S3	N	S1	S2	S3	N	S1	S2	S3	N	S1	S2	S3	N	S1	S2	S3	N	S1	S2	S3	N	S1	S2	N
ACho2-5bc Um19/H15																											
ACh	0	50	0	0	0	8	43	0	0	0	8	43	0	0	8	43	0	0	8	43	0	0	8	43			
	0	50	0	0	0	0	25	25	0	0	0	25	25	0	25	25	0	0	25	25	0	0	25	25			
LPd	0	0	0	20	0	0	0	20	0	0	0	20	0	0	0	20	0	0	0	20	0	0	0	20			
	0	0	0	20	0	0	0	20	0	0	0	20	0	0	0	20	0	0	0	20	0	0	0	20			
LVh	15	0	0	0	2	13	0	0	0	2	13	0	0	2	13	0	0	2	13	0	0	2	13	0			
	0	15	0	0	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8	8	0	0	8	8			
FRh	0	15	0	0																	0	5	5	5	0	33	67
	0	15	0	0																	0	5	5	5	0	43	57
ACho3-5bc Um19																											
ACh	0	40	0	0	0	6	34	0	0	0	6	34	0	0	6	34	0	0	6	34	0	0	6	34			
	0	40	0	0	0	0	20	20	0	0	0	20	20	0	20	20	0	0	20	20	0	0	20	20			
ALh	0	0	20	0	0	3	17	0	0	0	3	17	0	0	3	17	0	0	3	17	0	0	3	17			
	0	20	0	0	0	0	10	10	0	0	0	10	10	0	10	10	0	0	10	10	0	0	10	10			
LVh	20	0	0	0	3	17	0	0	0	3	17	0	0	3	17	0	0	3	17	0	0	3	17	0			
	0	20	0	0	0	0	10	10	0	0	10	10	0	0	10	10	0	0	10	10	0	0	10	10			
FRh	0	20	0	0																	0	7	7	6	0	43	57
	0	20	0	0																	0	7	7	6	0	54	46

KENYA: *Result 2*

MAPPING UNIT IDENTI-FIERS (new & old)	SOIL COMPO-NENT SYMBOL	SOIL % OF MAPPING UNIT	SOIL COMPONENT IRRIGABILITY %						MAPPING UNIT IRRIGABILITY %					
			UPLAND CROPS			PADDY RICE			UPLAND CROPS			PADDY RICE		
			S1	S2	N	S1	S2	N	S1	S2	N	S1	S2	N
ACho2-5bc Um19/H15	ACh	50	0	15	85	0	50	50	0	8	43	0	25	25
	LPd	20	0	0	100	0	0	100	0	0	20	0	0	20
	LVh	15	0	100	0	0	50	50	0	15	0	0	8	8
	FRh.	15	0	70	30	0	70	30	0	11	5	0	11	5
		100							0	33	67	0	43	56
ACho3-5bc Um19	ACh	40	0	15	85	0	50	50	0	6	34	0	20	20
	ALh	20	0	15	85	0	50	50	0	3	17	0	10	10
	LVh	20	0	100	0	0	50	50	0	20	0	0	10	10
	FRh	15	0	70	30	0	70	30	0	14	6	0	14	6
		100							0	43	57	0	53	46

3 REGULAR ACTIVITIES BY THE SECTIONS

3.1 SOIL MONOLITH COLLECTION

During the reporting period the number of soil monoliths increased with 35 to 776 (see table below).

Monolith collection, December 1987

Within parentheses: acquisitions in 1987

Australia	39	Mozambique	8
Belgium	4	Namibia	11
Botswana	7	Netherlands	24
Brazil	29	New Zealand	5
Cameroon	1	Nigeria	14
Canada	21	Norway	3
People's Rep. of China	15	Oman	4
Colombia	19	Pakistan	6
Czechoslovakia	8	Peru	1
Denmark (Greenland)	6	Philippines	6
Ecuador	20 (20)	Poland	14 (14)
Finland	5	Romania	11
France	12	Rwanda	10
Fed. Rep. of Germany	17	Rep. of South Africa	20
Ghana	4	Spain	20
Gabon	6	Sri Lanka	4
Greece	15	Sweden	17
Hungary	20	Switzerland	1
India	30	Syria	4
Indonesia	25	Thailand	13
Ireland	11	Turkey	13
Italy	17	United Kingdom	11
Ivory Coast	7	U.S.A.	25
Jamaica	3	U.S.S.R.	62
Japan	4	Uruguay	10
Kenya	65	West Samoa	5
Malawi	1 (1)	Yugoslavia	3
Malaysia (East)	11	Zaire	2
(West)	7	Zambia	11
Mali	9		
		Total	776 (35)

Acquisitions in 1987

Ecuador: Within the framework of the NASREC programme, twenty profiles have been collected by Messrs. G. del Posso from PRONAREG, former course participant and J.H. Kauffman, ISRIC's soil scientist. The profiles are representative for four major ecological regions: the Andean-, the coastal-, the Amazon region and the Galapagos Islands. The Andean profiles form a toposequence in volcanic parent material.
Malawi: Within the framework of the CORLAT project, one laterite core was collected by Dr. M.J. McFarlane and the British Geological Survey (see section 4.3). A soil profile belonging to the core was also collected.
Poland: Through the cooperation of Dr. H. Kern, Institute of Soil Science and Plant Cultivation in Pulawy, ISRIC received a collection of fourteen soil profiles and related samples and information. They illustrate the main soils of Poland.

Note: Compared to the listing in Annual Report 1986, collections of the People's Republic of China and of Mali are in fact one less than mentioned.

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.

In the coming two years a part of the profiles-to-be-collected will come from the countries participating in the National Soil Reference Collection programme (NASREC).

Except for the NASREC profiles most of the sampling will be carried out by non-ISRIC soil scientists, part of whom are participants of the annual training course.

Preparation of monoliths

During the reporting period about 30 profiles have been impregnated and 25 monoliths have been re-impregnated/repaired. During the annual training course about 12 profiles have been taken and treated as exercise material.

International Collection of Reference Laterite Profiles (CORLAT)

In 1987, as in previous years, the programme of support to the collection of reference laterite profiles was continued. The work included secretary administration and promotion of the programme. Despite the lack of funds, some activities were organized.

- a poster on the progress of the programme and data on the first CORLAT profile (Trombetas, Brazil) was presented in the Eurolat meeting at Freising, Fed. Rep. of

Germany (March 1987). During this meeting, information on CORLAT was distributed to interested scientists.
- in cooperation with Dr. M.J. McFarlane and the British Geological Survey, a core of a complete laterite profile and the overlying soil were collected and transported to ISRIC. The twenty-eight meters deep core is representative for a section on a dambo landscape with "low-level laterite" from Malawi, Africa.

Furthermore, a modest programme of activities for the future was formulated and discussed with some members of the Working Party.

3.2 LABORATORY

Regular analytical work, related to the collection

For the collection this year 32 profiles were analyzed: Kenya (6), Zaire (2), France (1, in cooperation with guest researcher Dr. Pons-Ghitulescu), Brazil (16, under special cooperation programme with EMBRAPA-SNLCS), and People's Republic of China (7, under special cooperation programme with Royal Academy of Sciences, KNAW). In addition, for the NASREC programme thirteen profiles from Ecuador were analyzed. For the CORLAT programme a lateritic profile from Brazil was completed.

Other work

- As usual, for several departments of ITC analytical work was carried out related to research and student field work. Four M.Sc. students from Cameroon and Kenya spent a month in the laboratory for in-service training working on their own samples.
- For the LABEX programme, some fifty samples of individual participants were analyzed on selected soil parameters.

3.3 MICROMORPHOLOGY

Technical work

The treatment of undisturbed soil samples and the subsequent preparation of thin sections is carried out by the technician of ISRIC at the laboratory of the Netherlands Soil Survey Institute (Stiboka) at Wageningen. There is a close cooperation with the technician of Stiboka and there are material contributions to the laboratory.

In 1987, 115 samples were received for treatment from the following countries: Brazil, People's Republic of China, Ecuador and Mali.

In the same year 104 thin sections were prepared. 71 thin sections were made for the regular soil collection of ISRIC. These concerned soils from Brazil, Kenya, Malay-

sia, Oman and Uruguay. Thin sections for other studies totalled 33, including samples for various research and student's projects of ITC.

The production of thin sections during 1987 was seriously hampered by the installation of a new grinding machine and alterations of the laboratory.

Investigations

The regular descriptions of thin sections is carried out according to the system as proposed in the Handbook for Soil Thin Section Description, which was published in 1985 under the auspices of the ISSS. The wide range of soils available at ISRIC permits a critical testing and application of the definitions and terminology of the new system. It is the aim of ISRIC to support the system by making suggestions for improvements so that the Handbook can be strengthened with time.

In 1987 descriptions were made of thin section of soils from Brazil, Kenya, and Thailand. The first batch of a set of reference diapositives of relevant micro-morphological features, including an explanatory text was prepared. It is envisaged that this reference set will be made available for teaching and educational purposes.

Photomicrographs were made of features in thin sections of Brazil, Hawaii, Indonesia and Malaysia for various persons, such as staff members and students of ITC and the Agricultural University.

A detailed study of thin sections of four soils from Oman was commenced in cooperation with Dr. E.M. Bridges, in view of a publication on the micromorphology of some Aridisols.

3.4 DOCUMENTATION

ISRIC Soil Information System (ISIS)

The soil monolith documentation forms an essential part of the information which is available at ISRIC. Improving the access to this information was felt to be necessary. During the years 1985 and 1986 a (micro-)computer-based soil information system was developed, in 1987 improvements were made. The system which will become fully operational early 1988, has been published in a Technical Paper.

The system requirements are:
Hardware: IBM-XT (or compatibles on which dBASE III runs without problems); at least 256 Kb RAM; Harddisk; Printer, which can print 132 characters/line.
Software: dBASE III/DOS 2.10 (or later).

ISIS will help to improve storage, retrieval and selection of the data of the collected soil monoliths. It is primarily developed to handle the documentation of ISRIC's soil reference collection. Consequently, the soil descriptions are extensive and the selection and output procedures are written to meet ISRIC's requirements. ISIS can however also be considered as a concept for the development of a soil information system at national

level. Anyone familiar with the dBASE III application language can easily change the procedures to make the system suitable for use in a non-ISRIC environment.

At the end of 1987 the field data of about 140 monoliths were stored. A part of the recently entered data was first stored in a portable personal computer (PC) during fieldwork in Mali and Ecuador. These data were later transferred to the main system. The portable PC and the ISIS programme work as a field notebook. This method enables to work out the field data shortly after collection. It can then immediately be discussed.

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.

One of the purposes of maintaining the map collection is its use for updating of the Soil Map of the World at scale 1:5 million and the compilation of a new, computerized world soil map at 1:1 million. It proved very useful as basic material for the new Soil Map of East Africa (see section 4.2).

Efforts are being made within The Netherlands to have information on available maps included in a database. The work is being coordinated at an office located in the Royal Library, The Hague. Mr. J.H.V. van Baren is member of the 'Council of Participants' of this project.

The library collection includes about 5000 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. Unfortunately, the library holdings are not computerized. ISRIC has subscriptions to about 35 journals. The map and book 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. There is especially an increase in its use by students of Wageningen Agricultural University, participants of the M.Sc. Course in Soil Science and Water Management, and the International Course for development-oriented Research in Agriculture (ICRA).

3.5 SOIL CLASSIFICATION, CORRELATION AND MAPPING

ISRIC continued to cooperate in the revision of the Legend terminology of the FAO/Unesco Soil Map of the World. An ad-hoc working group, composed of Mr. M.F. Purnell-FAO, Prof.Dr. R. Dudal, Catholic University of Leuven, and Dr. W.G. Sombroek of ISRIC reviewed and incorporated many suggestions received from specialists

working in different countries. Good use was also made of many of the modifications for the US "Soil Taxonomy" system recommended by its International Committees in which ISRIC staff participates. Especially in African countries, where the FAO approach to soil classification is widely used in national mapping programmes, publication of the Revised Legend, now due early 1988, is eagerly awaited.

3.6 TRANSFER OF KNOWLEDGE

Group visits

About 1400 persons visited ISRIC in groups, mainly from educational institutions, such as universities, agricultural and technical colleges, and from international training courses, congresses and meetings. The ISRIC collection has been incorporated in the courses on regional soil science of Wageningen Agricultural University and its M.Sc. course in Soil Science and Water Management, of the Tropical Section of the National Agricultural College, Deventer, and of other courses held in the Netherlands, e.g. at ITC, Enschede.

In addition, groups of students are regularly coming from Belgium, the Federal Republic of Germany, and the United Kingdom. See also Appendix 1.

In February 1987, ISRIC hosted a meeting on the Working Group on Methodology of the International Board for Soil Research and Management (IBSRAM). The lecture room of ISRIC is increasingly being used for lecturing, meetings and courses, e.g. for the neighbouring International Agricultural Centre and the 'Tropenbos' programme.

Individual visits

The number of people coming individually or in small groups is estimated to be about 400. Most visitors are professional soil scientists, and two-third come from abroad. They usually visit ISRIC for discussions with staff members or for consulting the monolith collection, the library and the map collection.

Course on the Establishment and Use of National Soil Reference Collections

The objective of this course is to train soil scientists, in particular from developing countries, in all aspects related to national soil reference collections.

The course was held from 10 May to 20 June 1987 and was attended by five participants, four from Africa and one from Latin America. Two participants were sponsored by Unesco, one by a Directorate General for International Cooperation (DGIS) project and one by a United Nations Environmental Programme project (NASREC). Unfortunately two participants, one from Rwanda and one from Brazil

could not attend due to national organisational reasons.

The participants were:

- Mr. Joseph Abu Bockari from Freetown, Sierra Leone (Unesco)
- Mr. Owuso Dwomo from Kumasi, Ghana (Unesco)
- Mr. D. Endale from Ethiopia (NASREC)
- Mr. Simon Mwangi from Nairobi, Kenya (DGIS)
- Mr. Egberto Soto from Arequipa, Peru (DGIS)

The course curriculum consisted of six major elements:

1. Fieldwork: taking soil profiles and lacquer peels, profile description and sampling, photography of soils and landscape;
2. Workshop activities: conservation and preparation of soil profiles (=monoliths);
3. Lectures and exercises: soil classification, land evaluation, micromorphology, laboratory methods, computerized soil data handling, use of national soil reference collections, soil horizon designation;
4. Excursions: three soils and landscape oriented excursions;
5. Final presentation: preparation and presentation of a small monolith exhibition (monoliths made during the course);
6. Follow-up discussions on the development of national soil reference collections.

In comparison to last year's programme the following new elements were added: lectures on soil horizon designation, case study on crop-soil relationships, more exercises in ISRIC's monolith exposition and computerized soil data handling.

Until now the course was held annually. In the future the course will be given bi-annually. Furthermore, the course length will be extended with about two weeks and the number of participants will be increased.

The eighth course will be given in the period May-June 1989.

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 genesis and classification, mineralogy and soil chemistry. Both the FAO-Unesco Soil Map of the World and the USDA Soil Taxonomy system were discussed. These lectures are illustrated with slides, hand-outs, lecture notes and other materials derived from the ISRIC collection.

ISRIC was invited by the Swedish University of Agricultural Sciences to give lectures on classification of soils in the tropics and on land evaluation at the Second Post-graduate Soil Conservation Course and for the Department of Soil Sciences, in Uppsala, Sweden. A lecture on soil classification and geography was given at the College on Soil Physics, International Centre for Theoretical Physics, Trieste, Italy. Mr. J.H.V. van Baren gave these lectures.

Lectures by guests

In 1987 two guests have presented lectures on topics related to their research. The lectures were held at the premises of ISRIC, and staff members of various institutes were invited to attend.

- Ir. A. Heuperman (Institute for Irrigation and Salinity Research, Victoria, Australia): Overview of Salinity Problems in South-east Australia
- Dr. E.M. Bridges (University College, Swansea, U.K.): Soil Horizon Designations.

Publications issued in 1987

Technical Papers

TP 9: Procedures for Soil Analysis. Second edition. Edited by L.P. van Reeuwijk.
TP 13: Proceedings of an International Workshop on the Laboratory Methods and Data Exchange Programme, 25-29 August 1986, Wageningen, The Netherlands. Edited by L.K. Pleijsier.
TP 14: Guidelines for the Description and Coding of Soil Data. E.J. van Waveren.
TP 16: Comparative Classification of Some Deep, Well-Drained Red Clay Soils of Mozambique. J.H. Kauffman.

Working Paper and Preprint

87/1 Description of Units of the FAO-Unesco Soil Map of the World Legend as used for educational purposes at ISRIC. D. Creutzberg
87/2 Aridisols of the World, occurrence and potential. Fourth International Soil Correlation Meeting (ISCOM), October 1987, Lubbock, Texas, U.S.A. W.G. Sombroek.
87/3 Soil Horizon Designations (draft for discussion). E.M. Bridges.
87/4 A Select Bibliography of References on Soil Horizon Designations. E.M. Bridges.

Also published were:

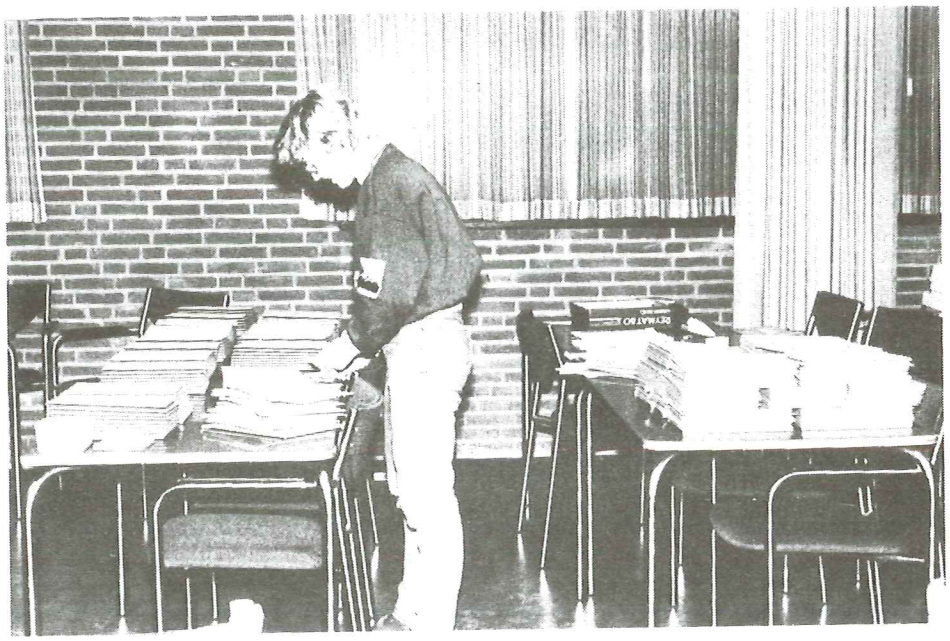
- Soils of the World. Wall chart. Compiled by P. Lof, edited by J. van Baren. Elsevier Science Publishers, Amsterdam. Prepared in cooperation with ISRIC, FAO and Unesco.
- Micromorphological characteristics of Nitosols. D. Creutzberg and W.G. Sombroek. In: Micromorphologie des Sols, edited by N. Fedoroff, L.M. Bresson and M.A. Courty. p. 151-155, AFES, Plaisir.
- The establishment of an international collection of reference laterite profiles. M.L. Moura. 2. Geomorph. N.F., Supplement Band 64, p. 111-118.
- Classificaçao de solos usada em levantamentos pedologicos no Brasil. M.N. Camargo, E. Klamt e J.H. Kauffman. B. Inf. Soc. Bras. Ci. Solo, Campinas, Vol. 12(1), p. 11-33.

Annual Report 1986 contains two articles, viz. Soil Classification as used in Brazilian Soil Surveys, by M.N. Camargo, E. Klamt and J.H. Kauffman, and Soil Data, a Matter of Concern, by P.M. Driessen.

Miscellaneous activities

To the following participants of the M.Sc. Course in Soil Science and Water Management, Wageningen Agricultural University attendance was given:
Miss B. Sriprasert, Thailand (preparation of thesis, supervised by Mr. J.H.V. van Baren); Mr. E. Suluvale, Western Samoa (provision of thin sections of Hawaii and discussions on their micromorphological interpretation); and Messrs. J.P. Magoggo, Tanzania, A. Mateos, Venezuela, J.E. Soto, Peru and A.A. Szogi, Uruguay (help of various nature).

Four Ph.D. students of the International Training Centre for Post- graduate Soil Scientists, Ghent, Belgium, spent some time at ISRIC for the provision of documentation and discussions.



Preparing ISRIC publications for shipment.

4 NON-REGULAR ACTIVITIES

4.1 PROGRAMMES

National Soil Reference Collection Programme (NASREC)

During the last decade, ISRIC has been requested by soil institutes in many countries to support the establishment of National Soil Reference Collections (NASREC's). A few countries already received assistance through incidental project support. For several others initial steps have been taken through the short annual course on this subject given since 1981. The NASREC programme, a three-year project financed by DGIS/UNEP, enables ISRIC to strengthen its capacity to support countries initiating such programmes.

In 1987 the activities of the programme embraced:

- Processing of collected soil, climate and other ecological data from field mission to Mali;
- Execution of the first field mission to Ecuador in March and April. The creation of the Ecuadorian NASREC is the responsibility of the soils department of PRONAREG of the Ministry of Agriculture. The mission objectives were realized in cooperation with Mr. Guillermo del Posso, Head of the Soils Department, and it included the following: drafting of a workplan; the selection of a number of representative sites; the collection of the soil profiles for the Ecuadorian NASREC; the collection of the necessary information on soil, climate, landscape, geology, vegetation and land use; the establishment of contracts for the housing of the Ecuadorian NASREC and with the future user groups. During the mission to Ecuador short visits have been made to Venezuela to evaluate the incipient Venezuelan NASREC and to Peru to discuss future coopertion.
- Coordination of ISRIC's "International Course on the Establishment and Use of National Soil Reference Collections", which was held in May and June (see section 3.7).
- Execution of the first field mission to Indonesia in October and November. The creation of the Indonesian NASREC is the responsibility of the Centre for Soil Research (PPT) in Bogor. The mission objectives were realized in cooperation with Mr. Permadhy Soedewo. It included similar activities as those realized for Ecuador.

The process of data collection and elaboration during the fieldmissions was improved by the use of a portable computer. Direct processing 'on the spot' of the collected information in a final format for the users could be demonstrated. Further statistical and graphical elaboration of data is foreseen.

Laboratory Methods and Data Exchange Programme (LABEX)

The LABEX programme is a soil sample exchange programme between a large number of laboratories with its secretariat at ISRIC. The aim is to improve the quality of soil analytical data by providing external references to the participants.

In 1987 the LABEX programme continued the work started in previous years.

During the Workshop held in 1986 a great number of recommendations was made and these took shape in 1987. The workshop proceedings were compiled and published as Technical Paper 13.

To promote communication with and between participants the LABEX Newsletter was started. During 1987 three issues appeared, in May, September, and November.

Another workshop recommendation was to draft analytical procedures for use in the programme. With the Newsletters these drafts were distributed and comments were invited. The programme is currently involved in the following analyses: texture (hydrometer and pipette methods), pH, CEC and exchangeable cations, exchangeable acidity, extractable acidity, organic carbon, carbonates, gypsum, extractable P (Olsen, Bray, Dabin methods), P-retention, extractable Si, P, Al, Fe (oxalate, dithionite, pyrophosphate extraction), 15-bar water retention.

During 1987 the number of participants further increased to nearly 120. Due to work involved the preparation of the workshop proceedings in the first half of the year and the compiling and drafting of the analytical procedures thereafter, the mailing of soil samples could not start before October. For this Sample Exchange 1987 soil samples are mailed only to those participants, who responded positively to the invitation to participate in this round.

LABEX receives special funding from paying participants and sponsors as DGIS, USAID/SMSS and GTZ. DGIS who sponsored the programme for 100% during the period 1985-1987, has reduced its support. For the years 1988, 1989 and 1990 the DGIS funding will be limited to 100%, 75%, and 50% respectively. Therefore participants in the industriralized countries have been asked to pay a participation fee. Donor agencies have been asked to sponsor the participation of third-world participants.

It is expected that the resulting funds will be just sufficient to run the programme up to 1991.

4.2 CONSULTING AND PROJECTS

Agroclimatology

The International Rice Research Institute (IRRI), Philippines requested the services of Dr. L.R. Oldeman to make an agroclimatic characterization of Madagascar and to assist the national agricultural research center of Madagascar (FOFIFA) with the establishment of a number of agrometeorological stations, and the training of research staff to analyze and use the recorded weather data. The consultancy was in 1987 extended for a period of another eight months, including a 4½ month stay in Madagascar (8 March - 23 July 1987).

Achievements: Preparation and printing of an agroclimatic database of Madagascar. A total of 178 sites were entered: 25 synoptic stations with monthly climatic data on total precipitation, number of rainy days, minimum-, maximum-, mean temperature and calculated daytime and nighttime temperature, total radiation, relative humidity and calculated mean vapour pressure and vapour pressure deficit, wind speed and estimated potential evapotranspiration (Modified Penman method). Rainfall and temperature data were collected for an additional 69 sites; rainfall data only for 66 sites and

temperature data only for 19 sites.

Preparation of an agroclimatic map of Madagascar: a draft map was prepared at a scale of 1:2 million. The agroclimatic zones are based on the length of the continuous wet period when precipitation is equal or more than 1.5 potential evapotranspiration and on the length of the dry period, when precipitation is less than 0.5 potential evapotranspiration. The map and the technical report will be submitted to FOFIFA early 1988.

Establishment of six agrometeorological stations at major rice research sites of FOFIFA (Mahitsy in the basin of Antananarivo; Ambohitsilaozana in the Alaotra basin; Sahambavy in the Fianorantsoa region; Kianjasoa in the Midwestern region; Tsararano in the Marovoay plain; and Tanandava in the Mangoky delta). Each site is equipped with maximum-, minimum thermometers; dry bulb and wet bulb thermometers with aspirator, Gunn Bellani global radiation integrator; digital anemometer. Standard rain gauges will also be installed.

Establishment of a subdivision of agrometeorology, within the Soils Department of FOFIFA. This unit will be responsible for the collection of weather data for the six stations, the processing and distribution of weather records to the research staff of FOFIFA.

International Conference on "Soils and the Greenhouse Effect" (ISEC Project)

The Netherlands Ministry of the Environment finances a series of related projects which form a contribution to the International Geosphere-Biosphere Programme of the International Council of Scientific Unions (ICSU) and the World Climate Impact Assessment Programme of the United Nations Environment Programme (UNEP), World Meteorological Organization and ICSU.

One of these projects is the International Conference "Soils and the Greenhouse Effect" (ISEC project). It will be organized by ISRIC under the auspices of the International Society of Soil Science. Cooperation with other organizations is being sought.

The likelihood of significant changes in world climatic conditions taking place through increased emissions of so-called greenhouse gases (gases which can absorb infrared radiation and contribute to the global warming of the atmosphere) and changing patterns of evapotranspiration and reflectance (albedo) has received much attention in recent years.

The contribution of the world soils and their land cover to the atmospheric budget of a number of 'greenhouse' gases is considerable. However, their relative importance in a geographic context needs to be quantified. The improvement and widening of the knowledge base of the spatial distribution of the world soils and land cover types, of soil degradation and trends in land use on one hand, and of 'greenhouse' gas emissions, evapotranspiration and albedo on the other hand, can form an important contribution of soil and related sciences to the study of climatic change.

The aims of the conference are:

- to give estimates of the net fluxes of 'greenhouse' gases, of evapotranspiration and of albedo for the major soils of the world and their land cover;

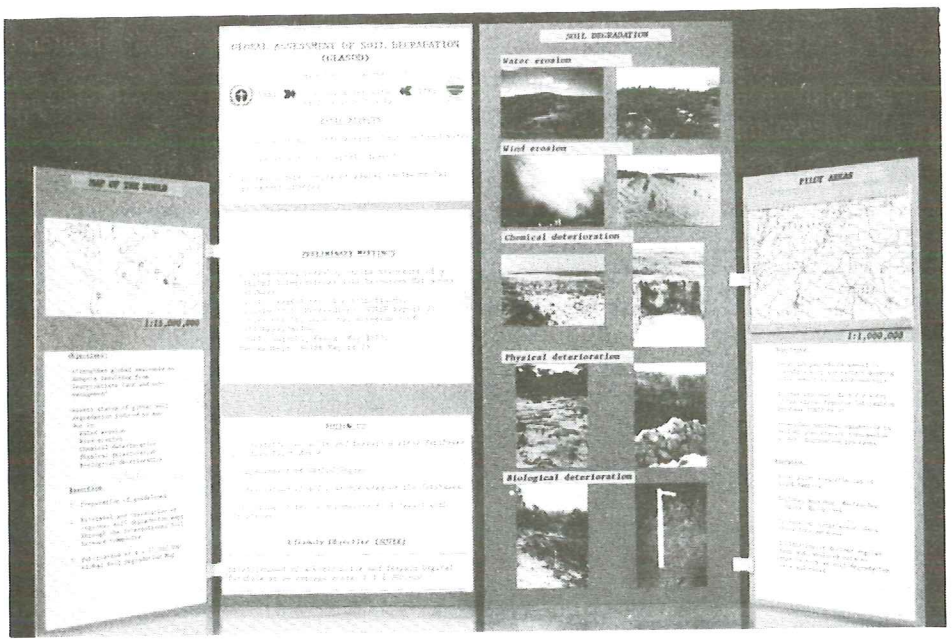
- to quantify the global land use changes and their effect on emissions of 'greenhouse' gases, on evapotranspiration and on albedo;
- to identify research gaps with regard to the global spatial data coverage, measuring techniques, model development, collection, collation, storage, dissemination and processing of baseline data and techniques and networks for monitoring.

The conference will be held in Wageningen from 14-18 August 1989. The preparations started in April 1987, when the Dutch Organizing Committee was established. The conference secretariat at ISRIC is formed by A.F. Bouwman, who is assisted by Dr. W.G. Sombroek and Dr. L.R. Oldeman. An International Advisory group was formed to assist in organizational and scientific matters.

A comprehensive conference outline was written and a preliminary report of a literature study on 'greenhouse gas emissions', albedo and evapotranspiration was prepared. The work on this literature review is ongoing and cooperation was sought with a number of scientists. The report will form the conference's background paper.

Global Assessment of Soil Degradation (GLASOD project)

Late September 1987 an agreement was signed between the United Nations Environment Programme (UNEP) and ISRIC for the execution of a "Global Assessment of Soil Degradation" (GLASOD) with a total duration of 28 months. ISRIC will be assisted by the Netherlands Soil Survey Institute (Stiboka) and the International Institute for Aerospace Survey and Earth Sciences (ITC), by the International Society of



Poster on Global Assessment of Soil Degradation (GLASOD)

Soil Science (ISSS) and the Food and Agricultural Organization (FAO).

GLASOD's Advisory Committee requested Dr. L.R. Oldeman to become project manager.

The project aims to strengthen global awareness of decision makers on the dangers resulting from inappropriate land and soil management, while it will at the same time improve the capability of regional and national institutions to deliver accurate information on qualitative and quantitative soil degradation processes, such as water and wind erosion, internal soil deterioration such as nutrient decline, salinization, sodication, and biological deterioration due to deforestation, overgrazing, etc. The project has two components: preparation of a global soil degradation status map at a scale of 1:15 million, and the generation and preparation of soil degradation risks and hazards map for a test area in Latin America (portions of Argentina, Brazil and Uruguay) at a scale of 1:1 million. A procedures manual is being prepared to ensure that uniform methods and descriptors are used to minimize problems of correlation and entry into the digital database and a regional workshop will be held at Montevideo in March 1988 to discuss the methodology with the local cooperators.

This project will therefore be a first step towards the realization of a World Soils and Terrain Digital Database (SOTER) programme.

Soil Map of East Africa (SMEA project)

During 1987, ISRIC has prepared a 1:1 000 000 Soil Map of East Africa. Countries concerned were Egypt, Sudan, Ethiopia, Somalia, Uganda, Kenya, Rwanda, Burundi and northern Tanzania, together covering about one-fifth of the African continent.

The project was funded by FAO and is meant as an updating for this area of the existing 1:5 000 000 FAO/Unesco Soil Map of the World (1977), and a tryout for a new soil classification system developed by FAO.

The Soil Map of East Africa (SMEA) project is closely related to the World Soils and Terrain Digital Database (SOTER) of the International Society of Soil Science (see Annual Report 1986 for details). The soil map was compiled from existing soil maps, geological maps and satellite image interpretation. About 180 satellite images were interpreted. The study resulted in detailed mapping unit descriptions with all data in digitized form. Map and mapping unit descriptions will be transferred to a digital database by FAO. In total, about 1800 mapping units are distinguished.

A second part of the SMEA project encompassed the preparation of soil suitability maps of the area for irrigated upland crops and wetland rice. This was established by developing a methodology to assess these suitabilities from the mapping unit descriptions of the soil map. The methodology was an adaptation of the one used by FAO to create a 1:10 000 000 irrigation suitability map for the whole of Africa, based on the existing FAO/Unesco 1:5 000 000 soil map. This newly developed methodology is more specific to make good use of the detailed information given in the SMEA mapping unit descriptions.

See also the article on this project, pages 7-18.

Installation of a soil laboratory in Indonesian Maluku Regional Development Project, University of Pattimura, Ambon

The consultancy, carried out for ITC/DGIS by ISRIC's laboratory analists Messrs. J.R.M. Huting and A.J.M. van Oostrum, had its first follow-up in January-March 1987. The soil and plant analysis laboratory was equipped with additional instrumentation. A start was made with a more in-depth training of the staff in the appropriate techniques and laboratory management.

5 GUEST RESEARCH

Soil Horizon Designations

Dr. E.M. Bridges, University College, Swansea, U.K.
Period: 4 March - 26 June 1987 and 20-26 September 1987
Funding: Fellowship of the Dutch Ministry of Agriculture and Fisheries - International Agricultural Centre.

It was the objective to formulate a discussion document on the historical development of systems of horizon designation, on systems currently in use with their areas of agreement or disagreement, and on proposals for unification based upon current practices and in line with the International Reference Base for soil classification of the ISSS.

A draft report for limited circulation was published as Working Paper and Preprint 87/3. An accompanying bibliographic list of books and articles relevant to the subject of soil horizon designations was published as no. 87/4 in the same series.

6 TRAVEL AND MISSIONS

(87/1) SCOPE/MAB Workshop on Biological Observatories, Paris, France, January 1987. *Participant: W.G. Sombroek*

To represent ISSS and ISRIC in this first workshop to discuss the biosphere-terrestrial aspects of the planned interdisciplinary research by ICSU on processes of past and future global change. The utilization of the existing network of Unesco/MAB biosphere reserves and the need for some additional major research locations and megatransects were discussed.

(87/2) Visit to FAO, Rome, Italy, February 1987. *Participants: W.G. Sombroek and R.T.A. Hakkeling*

The main objectives for this visit were centred around the preparation of a 1:1 million soil map of Northeastern Africa and an irrigation suitability assessment of this region (see section 4.2). Furthermore, the Fifth Working Meeting on the Revised Legend of the FAO/Unesco Soil Map of the World, the Fourth Working Meeting on an International Reference Base for soil classification (IRB) of the ISSS, and a meeting of the ISSS Commission V Executive were attended.

(87/3) Consultancy to Ambon, Indonesia, January-March 1987. *Participants: J.R.M. Huting and A.J.M. van Oostrum.*

During this follow-up visit to the Maluku Regional Development Project, University of Pattimura, the objective was to install part of the soil and plant analysis laboratory and give instruction and training to personnel in analytical methods and laboratory management (see section 4.2).

(87/4) Third Meeting of 'Eurolat', Freising-Weihenstephan, Fed. Rep. of Germany, March 1987. *Participants: W.G. Sombroek and M.L. Moura.*

'Eurolat' is a group of European scientists of different disciplines, who are engaged in the study of laterites and laterization processes. Dr. Sombroek, member of the Eurolat managing group, presented the case of CORLAT (see section 3.1), the paper 'Variation in contents and forms of sesquioxides in lateritic soils in relation to soil classification', and M.L. Moura's poster on the Trombetas bauxitic laterite profile.

(87/5) First NASREC mission to Ecuador, March-April 1987. *Participant: J.H. Kauffman.*

The first phase of the NASREC project in Ecuador consisted of several organizational activities and of a field programme. From four major ecological regions two series of soil profiles were taken: one for ISRIC's world soil collection and one for the national soil reference collection of Ecuador. For more details see Chapter 4.

(87/6) 7th Meeting of the Eastern African Sub-Committee for Soil Correlation and Land Evaluation of FAO, Gaborone, Botswana, March/April 1987. *Participant: J.H.V. van Baren.*

To represent Netherlands Soil Survey Institute (Stiboka) and ISRIC during meeting and subsequent field trip. Four short communications were given on Stiboka, LABEX, the World Soils and Terrain Digital Database (SOTER), and on the Contribution of Organic Carbon to CEC (on behalf of Dr. W.G. Sombroek and Mr. D. Legger). Much attention was given to the draft revised legend of the FAO/Unesco Soil Map of the World.

(87/7 and 87/16) Lecturing at the Swedish University of Agricultural Sciences, Uppsala, Sweden, May 1987; and **the International Centre for Theoretical Physics,** Trieste, Italy, November 1987. *Participant: J.H.V. van Baren (see section 3.6).*

(87/8) Meeting of an Ad-hoc Expert Group on the Feasibility and Methodology of Global Soil Degradation Assessment, UNEP, Nairobi, Kenya, May 1987. *Participant: W.G. Sombroek.*

During this meeting an effort was made to combine the immediate need of UNEP to have a small-scale world map of the status of soil degradation with the long-term plan of ISSS to set up Global Soils and Terrain Digital Database (SOTER project). One of the results is the GLASOD project carried out by ISRIC (see section 4.2). Proceedings of the meeting were published by the ISSS as SOTER Report 2.

(87/9) Meeting of the Technical Committee on Soil Quality of the International Standards Organization (ISO-TC 190), Milan, Italy, June 1987. *Participant: L.K. Pleijsier.*

To attend meeting as observer for ISSS and as member of the Dutch Normalization Subcommissions on soil chemical research and soil physical research of the unsaturated zone. Active ISRIC participation is envisaged in the fields of terminology and codification.

(87/10) Visit to FAO, Rome, Italy, July 1987. *Participant: W.G. Sombroek.*

To discuss the Revised Legend of the FAO/Unesco Soil Map of the World during this Sixth Working Meeting and the progress of the preparation at ISRIC of a 1:1 million soil map of Northeastern Africa and an irrigation suitability assessment of this region.

(87/11) Visit to Centre Technique Forestier Tropical (CTFT) in Nogent sur Marne, and **Unesco,** Paris, France, June 1987. *Participant: W.G. Sombroek.*

The first meeting was attended as a member of the Tropenbos Programme Commission to discuss a possible cooperation in research of tropical forests with several French institutions.

Unesco was visited to exchange views on a number of matters related to ISRIC and ISSS activities.

(87/12) Consultancy Agroclimatology, Madagascar, March-July 1987. *Participant: L.R. Oldeman.*

This project was carried out to install six agrometeorological stations, training of

research staff, and retrieval of information for the preparation of an agroclimatic map of Madagascar (see section 4.2).

(87/13) Visit to Japan, July-August 1987. *Participant: W.G. Sombroek.*
Ninth International Soil Classification Workshop of SMSS on Andisols and Paddy Soils.

Discussions by a group of 75 scientists led to a substantial improvement in the classification criteria of these soils.

The 87 Aomori International Soil Symposium.

This meeting was organized to promote national and international understanding of soils, their problems and potentials. An invited lecture on 'World Soils Policy and People's Life' was delivered.

Meeting of the Japanese Society of Soil Science.

The main issue was the preparation of the 1990 Congress of the ISSS in Kyoto.

(87/14) Visit to Poland, August-September 1987. *Participants: W.G. Sombroek and A.B. Bos.*
Annual Meeting of CASAFA, Warsaw, Poland. Contacts with other members of the standing Commission on the Application of Science to Agriculture, Forestry and Aquaculture (CASAFA) of ICSU were strengthened. A proposal for holding a meeting on research in the rehabilitation of anthropogenic savannahs of the humid tropics infested with obnoxious perennial grasses was discussed and accepted.
Discussions with members of the Polish Society of Soil Science and research institutions on Polish soil research, soil mapping etc.

Transport of 16 Polish soil monoliths collected by the Institute of Soil Science and Plant Cultivation in Pulawi for the world collection of ISRIC.

(87/15) Visit to U.S.A., October 1987. *Participant: W.G. Sombroek.*
Fourth International Soil Correlation Meeting on Aridisols, Texas, California.

Presentation of keynote paper 'Aridisols of the World: Occurrence and Potential'. Discussions during meeting and field trip on the improvement of criteria and the classification structure of the Aridisols.

Discussed were also some ISRIC programmes and projects with American and non-American scientists at the meeting. A visit to Oregon State University at Corvallis was made to discuss a possible joint programme of cooperation with ISSS in the framework of IGBP.

(87/16) First NASREC mission to Indonesia, October-November 1987. *Participant: J.H. Kauffman.*

The first phase of the NASREC project in Indonesia consisted of several organizational activities and of a field programme. The latter embraced the collection of representative soil profiles in the volcanic highlands and the humid tropical lowlands of Sumatra. Two series of profiles were taken: one for ISRIC's world soil collection and one for national soil reference collection of Indonesia.

(87/17) Visit to Denmark, November 1987. *Participant: W.G. Sombroek.*
Lecturing at the Botanical Institute, Aarhus University on soils, their capabilities and soil-vegetation relationships in the Amazon.
Visit to the Danish International Development Agency (DANIDA) in Copenhagen to inform about, and seek support for ISRIC's activities.

(87/18) Meeting of SCOPE-ICSU Scientific Advisory Group on Trace Gas Exchange, Tegernsee, Fed. Rep. of Germany, November 1987. *Participant: A.F. Bouwman.*

It was the aim to coordinate the contents of two conferences held by ISRIC and SCOPE in 1989 and, possibly, 1990 respectively on greenhouse gases. Coordination is required in order to benefit from the two related, almost simultaneous, activities.

(87/19) Working visit to University College of Swansea, U.K. *Participant: D. Creutzberg.*

To discuss with Dr. E.M. Bridges the micromorphological study of soils from Oman and preparation of a paper for the International Working Meeting on Soil Micromorphology, Texas 1988.

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)
- Further development of an improved legend for small-scale soil mapping, as a successor to the FAO-Unesco Soil Map of the World Legend.
- Collection of maps for the updating of the FAO-Unesco Soil Map of the World at scale 1:5 million, and for a digitized soil and terrain map at 1:1 million.
- Exchange of publications and documentation on soils and their management, agro-climatic zones, etc.
- Consultancy to apply the Revised Legend of the Soil Map of the World, and to assess the extent and quality of irrigable lands, both at scale 1:1 million, for several countries in north-eastern Africa (SMEA project).

United Nations Educational, Scientific and Cultural Organization (Unesco, Paris)
- Unesco's financial support and identification of candidates for ISRIC's International Course on the Establishment and Use of National Soil Reference Collections.
- Unesco's interest to have several associate experts ecology/soil science cooperate with the Dutch "Tropenbos" programme.
- Unesco's sponsorship of the International Advisory Panel for ISRIC.

United Nations Environment Programme (UNEP, Nairobi)
- Advise on the promotion of UNEP's World Soils Policy.
- UNEP/DGIS financial support, through its "Clearing House Facility", for ISRIC's programme to assist in the establishment of national soil reference collections in a number of developing countries (NASREC programme).
- Consultancy to assess the global extent of soil degradation at a scale of 1:15 million, and its quantification in a pilot area in South America (GLASOD project) at a scale of 1:1 million.

International Society of Soil Science (ISSS)
- Administrative assistance to the Secretariat-General of ISSS, housed at ISRIC.
- 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 documentation.
- Participation in the ISSS Working Group on the preparation of a digitized international soil and terrain map (WG/DM).
- Establishment of a reference collection of soil thin sections for the ISSS Subcommission of 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 (Brussels); submission and screening of research proposals; contacts on support for educational functions of ISRIC.
- International Service for National Agricultural Research (ISNAR, The Hague); exchange of programmes information.
- International Development Research Centre (IDRC, Ottawa); support for soil data centres.
- Institut français de recherche scientifique pour le développement en coopération (ORSTOM, Paris); exchange of information.
- Centre Technique de Coopération Agricole et Rurale of EEC/Lomé Convention countries (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, ICARDA); exchange of information.
- International Union of Biological Sciences (IUBS); cooperation on formulation of a proposal for network research on Tropical Soil Biology and Fertility (TSBF), and preparation of a manual for the project (site selection and characterization; methods

for chemical analysis of soil and water samples).
- National Soil Survey and Soil Research Institutes in many countries.

7.2 NATIONAL RELATIONS AND ACTIVITIES

- Royal Netherlands Academy of Arts and Sciences (KNAW, Amsterdam); continuation of cooperation programme with Nanjing Institute of Soil Science of the Academia Sinica; participation in a Dutch national committee for CASAFA.
- International Institute for Aerospace Survey and Earth Sciences (ITC, Enschede); management servicing of ISRIC; lecturing at ITC Soils Course; analysis of soil and water samples; soil data base development.
- Department of Science Policy of the Dutch Ministry of Education and Sciences (MOW-WB, The Hague); cooperation on the elaboration of a multidisciplinary research programme on tropical forests (Tropenbos).
- Centre for World Food Studies (SOW, Wageningen/Amsterdam); exchange of information.
- Department of Soil Science and Geology of Wageningen Agricultural University; cooperation on clay mineralogy; exchange of information; representation at international meetings; lecturing.
- 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 Wageningen Agricultural University; guidance of students at thesis work.
- Netherlands Soil Survey Institute (Stiboka, Wageningen); cooperation on micromorphology, including methodology of description; exchange of information; representation at international meetings.

8 PERSONNEL

8.1 BOARD OF MANAGEMENT

Members of the Board of Management on 31 December 1987 were:
- Dr. J.P. Andriesse, 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
- Dr.Ir. F. Sonneveld, Directorate for Agricultural Research, Ministry of Agriculture and Fisheries, Wageningen (Chairman)
- Dr.Ir. L. Fresco (personal member).

Mutations:

Dr. J.P. Andriesse is the successor of Prof.Dr.Ir. F.R. Moormann as Chairman of the Netherlands Advisory Council and thus also in the Board of Management. As a personal member, Prof.Dr.Ir. T. Wormer was succeeded by Ms.Dr.Ir. L. Fresco.

8.2 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).

8.3 NETHERLANDS ADVISORY COUNCIL

Members of the NAC on 31 December 1987 were:

- Ir. J.G. van Alphen, International Institute for Land Reclamation and Improvement, Wageningen
- Dr. J.P. Andriesse, ICRA, Wageningen
- Prof.Dr.Ir. N. van Breemen, Soil Science Society of the Netherlands, Wageningen
- 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. 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. W.B. Hoogmoed, Soil Tillage Laboratory, Wageningen Agricultural University
- Ir. E.R. Jordens, M.Sc. Course in Soil Science and Water Management, Wageningen Agricultural University
- Dr. F. Kadijk, Laboratory for Soil and Crop Testing, Oosterbeek
- Prof.Dr.Ir. H. van Keulen, Centre for Agrobiological Research (CABO), Wageningen
- Prof.Dr. Th.W.M. Levelt, Free University, Amsterdam
- Dr.Ir. T. de Meester, Department of Soil Science and Geology, Wageningen Agricultural University
- Ir. J. Schilstra, Euroconsult, Arnhem
- Prof.Dr. J. Sevink, University of Amsterdam
- Prof.Dr. A.W.L. Veen, State University Groningen
- Ir. W. van Vuure, Directorate for Agricultural Research, Ministry of Agriculture and Fisheries, Wageningen
- Drs. R.F. van de Weg, Soil Survey Institute, Wageningen
- Dr.Ir. A.L.M. van Wijk, Institute for Land and Water Management Research (ICW), Wageningen

8.4 ISRIC STAFF

Staff members of ISRIC on 31 December 1987 were:

Dr.Ir. W.G. Sombroek	: Director, soil classification and correlation, soil ecology
Drs. J.H.V. van Baren	: Curator, documentation and publications
Ir. A.F. Bouwman	: ISEC project
Drs. D. Creutzberg	: Soil micromorphology, educational matters
Drs. R.T.A. Hakkeling	: SMEA project
Ir. J.H. Kauffman	: NASREC programme
Dr.Ir. L.R. Oldeman	: GLASOD project
Ir. L.K. Pleijsier	: LABEX programme secretary
Dr.Ir. L.P. van Reeuwijk, M.Sc.	: Soil chemistry, mineralogy and physics
Ing. R.O. Bleijert	: Soil micromorphology, map documentation

W.C.W.A. Bomer	: Technician, photography and drawing
Ing. A.B. Bos	: Monolith preparation, technical services, soil documentation
Ing. J. Verhagen	: Monolith preparation, soil documentation
J. Brussen	: Internal administration*
J.R.M. Huting	: Laboratory analyst
B. van Lagen	: Laboratory analyst
A.J.M. van Oostrum	: Senior laboratory analyst
J.D. Schreiber	: Technician, thin-section preparation
R.A. Smaal	: Laboratory analyst
Ms. M.B. Clabaut	: Clerical services
Ms. Y.G.L. Karpes-Liem	: Clerical services
Ms. J.C. Jonker-Verbiesen	: Library assistant

* External administration by ITC, Enschede.

8.5 GUEST RESEARCHERS

Soil and other scientists working at ISRIC during (part of) 1987 as guest researchers were:

- Dr. E.M. Bridges, U.K.
- Mr. D.M. Endale, M.Sc., The Netherlands
- Ir. P. Kiepe, Netherlands
- Ir. J. Kuyper, Netherlands
- Drs. M.L. Moura, Netherlands
- Prof. W.L. Peters, Venezuela
- Dr. N.M. Pons-Ghitulescu, Netherlands
- Ir. J.Ph. van Staveren, Netherlands

APPENDIX 1 - GROUP VISITS IN 1987

Professional

Institutions	Approximate number of persons
Belgium	
Dept. of Agric. Science, University of Ghent	19
International Training Centre for Post-graduate Soil Scientists, Ghent	40
Fed. Rep. of Germany	
University of Bochum	20
University of Hamburg	2 visits of 40
University of Kiel	32
Fachhochschule Osnabrück	27
Italy	
Ist. Sup. Lattiero Caseario, Mantova	15
The Netherlands	
Free University, Amsterdam	3 visits of 6
University of Amsterdam	35
Royal Tropical Institute, Amsterdam	10
International Institute of Hydrologic and Environmental Engineering, Delft	40
National Agricultural College, Deventer	3 visits of 25
Agricultural College, Dronten	3
International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede	30
University of Groningen	15
Agricultural College, Kerk Avezaath	20
Agricultural College, Nijmegen	20
Teachers College Interstudy, Nijmegen	18
Agricultural College, Tiel	18
Agricultural Division DSM, Utrecht	2 visits of 40
Govt. Institute Environment and Health, Utrecht	50
University of Utrecht	2 visits of 30
College for Forestry and Land and Water Management, Velp	2 visits of 20
International Agricultural Centre Fertilizing Course, Wageningen	20
International Course for Development-oriented Research in Agriculture (ICRA), Wageningen	25
International Institute for Land Reclamation and Improvement (ILRI), Wageningen	30
Netherlands Advisory Council ISRIC, Wageningen	15
Wageningen Agricultural University	16 visits of 25
Sweden	
University of Agricultural Sciences, Uppsala	15
United Kingdom	
University of Leeds	3 visits of 23
Portsmouth Polytechnic	3 visits of 15
University of Reading	20
Various	
IBSRAM Workshop	7
Royal Geological and Mining Society of the Netherlands	10

Furthermore, five non-professional groups visited the exhibition, in total about 70 persons.

APPENDIX 2 - LABORATORIES PARTICIPATING IN THE LABORATORY METHODS AND DATA EXCHANGE PROGRAMME (LABEX)

Instit. de Evaluacion de Tierras
Laboratorio de Suelos CIRN-INTA
1708 Castelar Pcia Buenos Aires
ARGENTINA

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

Div. of Trop. Crops and Pastures
306 Carmody Road
St. Lucia QLD 4067
AUSTRALIA

Institut für Bodenforschung
Gregor Mendelstrasse 33
A-1180 Wien
AUSTRIA

Bodemkundige Dienst van Belgie
De Croylaan 48
B 3030 Leuven
BELGIUM

Mision Brit. en Agricult. Trop.
Casilla 359
Santa Cruz
BOLIVIA

Department of Agric. Research
Private bag 0033
Gaborone
BOTSWANA

Bureau National des Sols
B.P. 7028
Ouagadougou
BURKINA FASO

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

Departamento de Solos-FA-UFRGS
Av. Bento Goncalves 7712
91.500 Porto Alegre, RS
BRAZIL

IRA/CNS Ekona
PMB 25
Buea
CAMEROON

Canadian Forestry Service
5320 122 Street
Edmonton, Alberta
CANADA T6H 3S5

Direction de la Recherche
2700, rue Einstein
Sainte-Foy, Quebec
CANADA G1P 3W8

Land Resource Research Inst.
Neatby Bldg. Centr. Exp. Farm
Ottawa, Ontario
CANADA K1A OC6

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P.O. Box 821
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APPENDIX 3 - ACRONYMS USED IN ANNUAL REPORT 1987

ACSAD	Arab Centre for the Studies of Arid Zones and Dry Lands, Syria
CABO	Centre for Agrobiological Research, The Netherlands
CASAFA	Commission on the Application of Science to Agriculture, Forestry and Aquaculture, ICSU
CATIE	Centro Agronomico Tropical de Investigacion y Ensenanza, Costa Rica
CGIAR	Consultative Group of International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical, Colombia
CORLAT	International Collection of Reference Laterite Profiles, ISRIC
CTA	Centre Technique de Cooperation Agricole et Rurale, The Netherlands
CTFT	Centre Technique Forestier Tropical, France
DGIS	Directorate-General for International Cooperation, Ministry of Foreign Affairs, The Netherlands
DLO	Directorate for Agricultural Research, Ministry of Agriculture and Fisheries, The Netherlands
EEC/EC	European Economic Community
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuaria, Brazil
EUROLAT	European Network on Laterite, France
FAO	Food and Agriculture Organization of the United Nations
FOFIFA	Centre national de la recherche appliquée au développement rural, Madagascar
GLASOD	Global Assessment of Soil Degradation project, ISRIC
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit, F.R.G.
IAC	International Agricultural Centre, The Netherlands
IBSNAT	International Benchmark Sites Network for Agrotechnology Transfer, U.S.A.
ICARDA	The International Center for Agricultural Research in the Dry Areas, Syria
ICRA	International Course for Development-oriented Research in Agriculture, The Netherlands
ICSU	International Council of Scientific Unions
ICW	Institute for Land and Water Management Research, The Netherlands
IDRC	International Development Research Centre, Canada
IITA	International Institute of Tropical Agriculture, Nigeria
ILRI	International Institute for Land Reclamation and Improvement, The Netherlands
IRB	International Reference Base for soil classification, ISSS
IRRI	International Rice Research Institute, The Philippines
ISEC	International Conference "Soils and the Greenhouse Effect", ISRIC
ISIS	ISRIC Soil Information System
ISNAR	International Service for National Agricultural Research, The Netherlands

ISO-TC190	International Standards Organization, Technical Committee on Soil Quality
ISSS	International Society of Soil Science
ITC	International Institute for Aerospace Survey and Earth Sciences, The Netherlands
IUBS	International Union of Biological Sciences
KNAW	Royal Netherlands Academy of Arts and Sciences, The Netherlands
LABEX	Laboratory Methods and Data Exchange Programme, ISRIC
MAB	Man and the Biosphere Programme, Unesco
NASREC	National Soil Reference Collections, ISRIC
ORSTOM	Institut français de recherche scientifique pour le développement en coopération, France
PPT	Centre for Soil Research, Indonesia
PRONAREG	Programa Nacional de Regionalizacion Agraria, Ecuador
SCOPE	Scientific Committee on Problems of the Environment of the ICSU
SCS	Soil Conservation Service, USDA, U.S.A.
SMEA	Soil Map of East Africa project, ISRIC
SMSS	Soil Management Support Services, SCS, U.S.A.
SNLCS	Serviço Nacional de Levantamento e Conservaçao de Solos, Brazil
SOTER	World Soils and Terrain Digital Database, ISSS
SOW	Centre for World Food Studies, The Netherlands
STIBOKA	Netherlands Soil Survey Institute
TSBF	Tropical Soil Biology and Fertility Programme, IUBS/Unesco
UFRGS	Universidade Federal do Rio Grande do Sul, Brazil
UNEP	United Nations Environment Programme
UNESCO	United Nations Education, Scientific and Cultural Organization
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WDDES	World Digital Database for Environmental Sciences
WG/DM	Working Group Digitized International Soil and Terrain Map, ISSS
WG/HP	Working Group History, Philosophy and Sociology of Soil Science, ISSS
WG/RB	Working Group International Reference Base for soil classification (IRB), ISSS

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. Chernozem calcique *(Vermustoll Typique)* Romania, 1986
8. Ferric Luvisol *(Oxic Paleustalf),* Nigeria, 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 (exhausted, superseded by TP 11)
4. Field extract of "Soil Taxonomy", 1980, 4th printing 1986
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, 3rd printing 1984
7. Field extract of "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
9. Procedures for soil analysis, 1986; 2nd edition, 1987
10. Aspects of the exhibition of soil monoliths and relevant information (provisional edition, 1985)
11. A simplified new suction apparatus for the preparation of small-size porous plate clay specimens for X-ray diffraction, 1986
12. Problem soils: their reclamation and managment (copied form ILRI Publication 27, 1980, pp. 43-72), 1986
13. Proceedings of an International Workshop on the Laboratory Methods and Data Exchange Programme: 25-29 August 1986, Wageningen, The Netherlands, 1987
14. Guidelines for the description and coding of soil data, revised edition, 1988
15. ISRIC Soil Information System - user and technical manuals, with computer programme, 1988
16. Comparative classification of some deep, well-drained red clay soils of Mozambique, 1987
17. Soil horizon designation and classification, 1988
18. Historical highlights of soil survey and soil classification with emphasis on the United States, 1899-1970, 1988

Soil Monographs

1. Podzols and podzolization in temperate regions, 1982
   with wall plate: Podzols and related soils, 1983
2. Clay mineralogy and chemistry of Andisols and related soils from diverse climatic regions, in prep.
3. Ferralsols and similar soils; characteristics, classification and limitations for land use, in prep.

Wall charts

- Podzols and related soils, 67 × 97 cm, 1983 (see Monograph 1)
- Soils of the World, 85 × 135 cm, 1987 (Elsevier, in cooperation with ISRIC, FAO and Unesco)

AIMS OF ISRIC

- to serve as a documentation centre on land resources - through its collection o soil monoliths and reports and maps on soils of the world; with emphasis on th developing countries

- to improve methods of soil analysis - through research and international correla tion; with emphasis on soil characterization and classification

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

- to stimulate and contribute to new developments in soil genesis and classificatio soil mapping and land evaluation - through active participation in internationa scientific working groups

- to carry out consultancies in the aspects of soil science and agro-climatology an give training - by employment of ISRIC staff in developing countries and givin education and training at ISRIC and elsewhere

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