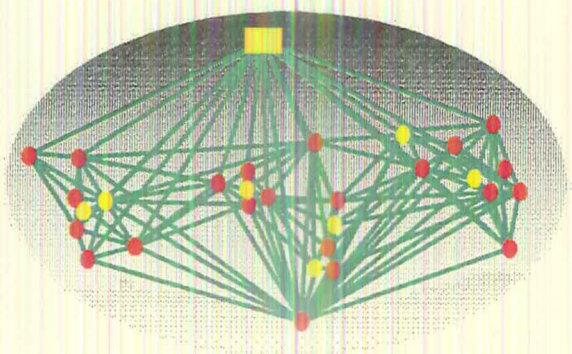

Workshop on

NATIONAL SOIL REFERENCE COLLECTIONS AND DATABASES (NASREC)

Wageningen, The Netherlands
November 6-17, 1995

Proceedings:
Volume 1 — Background and summary of discussions

Edited by
O.C. Spaargaren

ISRIC

INTERNATIONAL SOIL REFERENCE AND INFORMATION CENTRE

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Sponsorship for the NASREC workshop was received from the Netherlands Directorate General for International Cooperation (DGIS), the International Service for National Agricultural Research (ISNAR), the Centre Technique de Coopération Agricole et Rurale (CTA), The European Community (EC), and the Food and Agriculture Organization of the United Nations (FAO).

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TABLE OF CONTENTS

FOREWORD

The workshop held at ISRIC from 6 to 17 November 1995 was a milestone in the National Soil Reference Collections and Databases (NASREC) programme, which started on an ad-hoc basis in Colombia in 1980. The NASREC programme included a series of courses with participants from about 40 countries attending. During its first phase, training and major supporting activities took place in 3 countries, while 3 other countries were provided with minor support. In the second phase, from 1990 to 1994, the NASREC activities were expanded with the establishment of 11 soil reference collections in Africa, Asia and Latin America. NASREC activities were carried out in the framework of a technical assistance programme with major financial support from the Netherlands Directorate General for International Cooperation (DGIS) and complementary support from Unesco, the European Community — Life Sciences and Technologies for Development Programme (STD2) and the Royal Dutch Academy of Arts and Sciences (KNAW).

The workshop is considered a milestone because it is the first occasion in which 36 soil scientists, from 30 countries, could share their experiences on soil reference collection projects completed in the last 15 years. It provided a unique opportunity to identify, discuss and propose follow-up actions at the national, regional and global level. The consensus of the workshop was that the scope of the NASREC programme should be broadened, in a possible third phase.

Firstly, it was recommended that a global communication network of national institutions should be established, aiming at an information and reference service facility on natural resources. Secondly, regional training facilities should be established at recognized national centres, aiming at an improved transfer of information about soil and terrain resources and on their sustainable use, to a wider range of users. Thirdly, it was recommended that the original scope of NASREC activities should be broadened to include geographic information systems for rural and environmental planning, soil laboratory information management systems, and library information services. We hope that, with the workshop, a sufficient basis has been created to implement these proposed activities.

Dr L.R. Oldeman
Director, ISRIC

J.H. Kauffman
NASREC Programme Coordinator

GLOSSARY

Acronyms

AEZ	Agro-Ecological Zonation
ALES	Automated Land Evaluation System
AMCEN	African Ministerial Conference on Environment and Nature
ASCP	Appropriate Soil Conservation Package
DGIS	Directorate General for International Cooperation
DIAGNISIS	Assessment programme for Diagnostic Horizons and Properties of the FAO Revised Legend, using ISIS
EIA	Environmental Impact Assessment
EC-STD	Science and Technology for Development Programme of the European Community
FAO	Food and Agriculture Organization of the United Nations
GEMS	Global Environmental Monitoring System
GIS	Geographical Information System
GLP	Good Laboratory Practices
GRID	Global Resource Information Database
ICSU	International Council of Scientific Unions
IFPRI	International Food Policy Research Institute
ILEIA	International Linkages for Ecologically Informed Agriculture
ISIS	ISRIC Soil Information System
ISNAR	International Service for National Agricultural Research
ISRIC	International Soil Reference and Information Centre
ITC	International Institute for Aerospace Survey and Earth Sciences
KNAW	Royal Dutch Academy of Arts and Sciences
NARO	National Agricultural Research Organization
NASREC	National Soil Reference Collections and Databases
NGO	Non-Governmental Organization
NRM	Natural Resource Management
NSI	National Soil Institutions
OAU	Organization of African Unity
SOFERNET	Soil Fertility Network for Africa
SOILIMS	Laboratory Information System for Small- and Medium-sized Soil and Plant Laboratories
SOLGRAPH	Soil and Climatic Data Presentation and Assessment Programme
SOTER	World Soils and Terrain Digital Database
STRESS	Land quality assessment programme
STRING	Soil and Terrain Resources Information Network Generation
SWEAP	Soil Water Erosion Assessment programme
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USDA	United States Department of Agriculture
WISE	World Inventory of Soil Emissions Potentials
WOCAT	World Overview of Conservation Approaches and Technologies

Other symbols

Bd	Bulk density
COLE	Coefficient of linear extensibility
CRI	Cumulative rating index
ESP	Exchangeable sodium percentage
K	Hydraulic conductivity
PTF	Pedo-transfer function

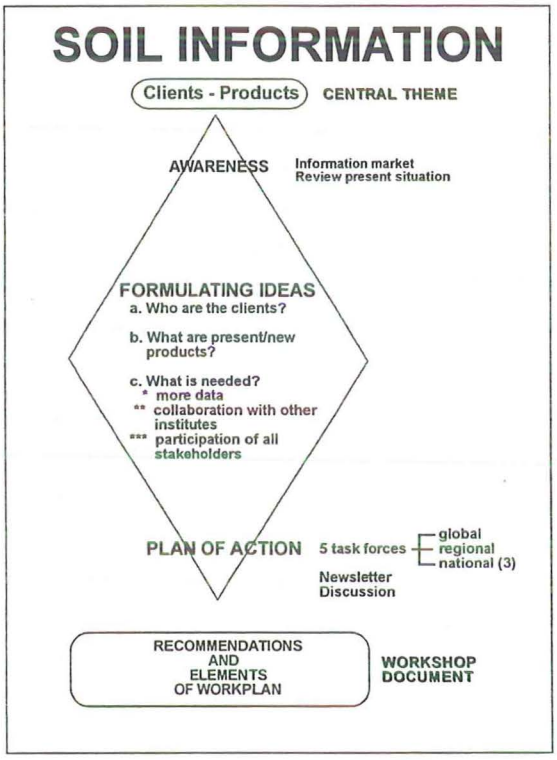
1 INTRODUCTION AND THEME OF THE WORKSHOP

The theme of the workshop on National Soil Reference Collections and Databases (NASREC) is centred around users and their demands for information. The ultimate goal was to identify products of soil information which satisfy the demands and needs of users.

To achieve this a framework was established during the workshop whereby awareness was created on user needs and demands through an information market. On this market participants presented their ideas and views on products of soil information. This creation of awareness has led to the formulation of a wide variety of ideas from the participants on 'who are our clients?', 'what are our present products?', 'what are potential new products?', and 'what is needed to satisfy the demand of users of soil information (more data, data relevance and quality, collaboration with other institutions such as those dealing with water resources, climatic data and socio-economic studies, and active participation of all stakeholders)?'

These ideas have formed the backbone of the work of 5 task forces, inventorizing and streamlining them on a global, regional and national scale, to arrive at a plan of action. This plan of action has finally helped to formulate the recommendations of the workshop and elements of a future workplan on NASREC activities.

The process described above is pictorized in the diagram below.



2 PROGRESS OF NATIONAL SOIL REFERENCE COLLECTIONS AND DATABASES (NASREC), 1980-1995

Results of a questionnaire

J.H. Kauffman, *NASREC programme coordinator*

2.1 INTRODUCTION

The National Soil Reference Collections and Databases programme (NASREC) of ISRIC aims to strengthen the capability of National Soil Institutions (NSIs) to disseminate information about the major soils of their country to a wide range of user groups.

A soil exposition contains monoliths of major soil types, which are representative of ecological zones in a country. Ideally a soil exposition should contain those soil types which are of interest for agriculture and environment. Presentation should be simple and clear. Despite over-simplification of the distribution of soil types in a country for the purpose of display, the aim should be also to convince non-soil scientists of the value of soil information and to stimulate their interest in the subject. The soil database includes information on the profiles of the exposition as well as that of other profiles, representing the major soil types of a country and their variations. The field and analytical information stored in the database can be made available to land resource scientists in both digital and printed format in a Country Report. In addition to information on soil/land properties, a soil reference collection should present information on (the assessment of) soil/land qualities and management aspects. Questions such as 'what can be done with a specific soil?', 'what kind of measures or improvements have to be taken for its sustainable use?' and 'how to cope with the resilience of the soil/land for specific land-uses?', could be answered in a publication. For this purpose, ISRIC has developed the Soil Brief.

Since 1980, joint NSI-ISRIC projects have resulted in the establishment of soil expositions and the development of soil databases with related documentation in 19 countries. These projects can make a significant contribution to bridging the communication gap between the soil science community and a variety of user groups. By the beginning of 1995, 23 institutions in 19 countries had cooperated with ISRIC in the NASREC programme. Most institutions finalized their projects by the end of 1994. The programme was executed in the framework of a technical assistance programme, with major support from the Netherlands Directorate General for International Cooperation (DGIS) within UNEP's Action Plan of National Soil Policies, and complementary support from the European Community, Unesco and the Royal Dutch Academy of Arts and Sciences (KNAW).

The Workshop on National Soil Reference Collections and Databases, held at ISRIC from 6 to 17 November 1995, was an appropriate moment to review the achievements of NASREC's at the NSIs through a questionnaire. This section outlines the procedure followed and gives a summary of the results. It also includes information of soil reference collections of NSIs in

China-Taiwan, Ethiopia and the Philippines, countries that were not part of the current NASREC network, yet independently implemented similar activities.

2.2 PROCEDURE

In May 1995 a questionnaire was sent to all potential participants of the International Workshop on National Soil Reference Collections and Databases (see Appendices 1 and 3). Questions were related to the soil exposition, soil database and published documentation accompanying the reference collections. Results of 25 collections in 21 countries are presented in Table 1. They are based on 20 completed questionnaires which were received by ISRIC at the end of October 1995, and additional information given by the participants during the workshop. The results of questions aiming at the identification of present and future user groups are presented in the overview in section 2.3.2 "User groups". A summary of plans, proposed future actions and additional comments are listed in section 2.3.3 "Future actions".

2.3 RESULTS AND DISCUSSION

2.3.1 Status of expositions and documentation

Questions related to soil expositions included the number of reference soils in an exposition, the structuring of the exposition, the explanatory information posters and the number of visitors. Questions related to soil databases and documentation included the availability of a Country Report, Soil Briefs and popular brochures. The results on these questions are summarized in Table 1.

The median number of reference soils of a NASREC exposition is 20 (minimum 8 and maximum 161). The need for expansion is expressed by nearly all coordinators of reference collections, so that the soils from the various areas can be represented.

A few collections have soil classification, parent material or topography as a first entry to the soil exposition. The dominant lay-out of soil expositions is according to the major ecological zones of a country, which improves the accessibility of the collection for interested persons not acquainted with soil classification.

All reference soils in the expositions are accompanied by posters and photographs. Accompanying published documentation includes:

- *Country Reports*, aiming at soil scientists
- *Soil Briefs*, aiming at land resource and agricultural specialists.

Popular leaflets, intended for a wide group of users, and seen as indispensable by all coordinators, are not yet available for most countries.

The number of visitors of national soil expositions ranges between 30 to 1200 per year. A wide array of present and potential user groups were indicated, which are grouped in 5 categories:

Table 1 Information on (NASREC) expositions and documentation by country

	Number soils	Exposition structure[a])	Poster info	Number visitors	Country Report[c])	Soil Briefs[d])	Popular brochure[e])
Brazil	28	?	?	?	28	-	-
China	161	ECO	+	?	51	13	-
China-Taiwan	44	PARENT	+	50/100	(44)	(24)	2
Colombia	64	ECO	+	?	18	-	-
Costa Rica	23	ECO	+	?	11	2	-
Cuba	23	CLAS	+	500	22	8	+
Ecuador	20	ECO	+	?	20	2	-
Ethiopia	48	CLAS	+	200	(48)	-	-
Ghana	27	ECO	+	1200	-	-	-
India (TNAU)	15	ECO	+	(3/4000)[b])	(15)	(7)	-
India (KAU)	16	ECO	+	(3/4000)[b])	(16)	(5)	f)
India (UAS)	15	ECO	+	(3/4000)[b])	(15)	(10)	g)
Kenya	45	NO	+	?	60	2	-
Indonesia	20	ECO	+	500	46	-	g)
Mali	8	ECO	+	?	8	-	-
Mexico	?	CLAS	+	200	-	-	-
Nicaragua	10	?	+	?	11	3	-
Nigeria	26	ECO	+	120	26	8	-
Pakistan	8	PARENT	+	200	-	-	-
Peru (INRENA)	22	ECO	+	?	22	?	-
Peru (UNAP)	15	GEO	+	?	15	?	g)
Philippines	11	TOPO	video	1000	11	-	-
Venezuela (Zulia)	14	ECO	+	300	(14)	3	+
Venezuela (Mar)	16	ECO	+	200	(16)	?	g)
Zimbabwe	16	CLAS	+	20/30	16	?	g)

a) Expositions are structured according to: ECO = ecological region, CLAS = classification, PARENT = parent material, TOPO = topography, or NO = no apparent structure.
b) Envisaged.
c) Figure indicates the number of reference profiles in a Country Report. A figure between brackets refers to a Country Report in preparation. A Country Report includes basically the printed version of the comprehensive data in the soil database.
d) Figure indicates the number of Soil Briefs issued. A figure between brackets indicates the availability of a draft version. Soil Briefs are written for both soil scientists and other interested people and provides the description, classification and evaluation of a reference soil for a specific agro-ecological zone (by country).
e) Popular brochures aim at a wide audience using easy to understand explanations of the soil major characteristics, ecological constraints and uses.
f) NASREC brochure
g) Institute brochure

- *Universities*, notably staff and students of agronomy and geography departments
- *Schools*, mainly staff and students of agricultural and secondary schools
- *Farmers, members of farmers training centres, farmers associations and visitors of agricultural fairs*
- *Governmental organisations*, such as ministry of agriculture, agricultural provincial or district organisations
- *Research institutions*, such as national soil (and water) institutes, crop oriented institutes, consulting firms and fertiliser companies.

Most reference collections are not yet reaching all these user groups and the number of visitors of soil expositions could be raised. Possible reasons for this situation are insufficient publicity and the observation made by nearly all coordinators that little interaction took place with these user groups prior or during the establishment of the reference collection. Thus, a number of actions are envisaged to attract more interested persons.

2.3.2 User groups

A wide range of national user groups interested in soil expositions, soil database information and presently available documentation (Country Reports and Soil Briefs) were identified. Nearly all NASREC project participants indicated that **little interaction** took place with these potential user groups prior or during the NASREC project execution. The user groups can be generalized in 5 broad categories:

Farmers: individual farmers and farmers organisations, agricultural shows

Governmental organisations: planners/local government/policy makers, Ministry of Agriculture, Ministry of Environment and Natural Resources, Provincial/State Department of Agriculture, Agricultural Extension Services, natural resource management agencies, such as forest and wildlife services, irrigation and other water authorities, public works departments (roads and town planning)

Schools: agricultural schools, polytechnical schools, secondary schools

Universities: Agronomy Department, Geography Department, Agricultural University

Research institutions: soil institutions (National Soil Research Institution, Soil & Water Conservation Service, Institute of Forest Soils, Institute of Desert Soils, Provincial soil institution), specialized institutions (National Agriculture Research Institute, Tropical Crops Research Institute, Institute of Remote Sensing), commercial organisations (consultancy firms, fertilizer companies, individual specialists: agronomists, environmentalists, ecologists, earth scientists, vocational engineers)

2.3.3 Future actions

Questions on possible follow-up activities resulted in a wide array of comments and envisaged actions. These concern communication in general, exposition, soil information systems and soil evaluation studies.

Communication

There is a need expressed by universities and ministries for a better understanding of the soil as a non-renewable natural resource. It is recognized that communication between scientists and the many users of soil information is inadequate. For example, soil reports are not or not fully utilized, because too much technical jargon is used, impeding access to these reports outside the soil science community. Simple publications must be tailor-made, using common language, popular terminology and local soil names where possible. Other suggestions include the translation into local/national language of the information accompanying the soil exhibits, including the documentation, and to use indigenous soil classification.

Other possible actions mentioned included an audio-video library, a map sale counter and the use of electronic mail.

Exposition

Generally, the soil exhibits are experienced as being too small. An expanded collection should include all major soils. Furthermore, it is proposed that Soil Courses and Workshops should be organized using the exposition to popularize soil knowledge. Especially for large countries the set up of regional soil collections is favoured.

Several comments were made on information accompanying the displayed soils:

- the commonly used international soil taxonomic nomenclatures (the USDA Soil Taxonomy and the FAO-Unesco Soil Map of the World) are considered too technical for laymen and scientists not trained in soil science. In addition the use of local soil names instead of the international systems is encouraged
- text posters in national or local languages are attractive
- pragmatic soil management techniques, including information of soils and management practices of other countries should form part of the exposition
- a multi-media PC is preferred for a vivid soil exhibit.

The following constraints were specified:

- insufficient funds
- lack of a formal soil museum status
- inadequate exposition possibilities
- inadequate illumination
- insufficient communication in/outside the country
- lack of trained personnel, transport facilities, photographs of collected soils
- difficulties in obtaining soil impregnating and conserving materials such as lacquers and dermoplast.

Soil information systems

As a first step an expansion of the database with data of other national soil profiles and, at a later stage, with soil profiles of other countries was indicated. In relation to this the exchange of information with other databases in/outside the country was mentioned.

Frequently, the need to use data processing programs are indicated. To facilitate this, the development of interfaces between databases and land evaluation and crop modelling programmes was proposed. In addition, it was stated that available software should be user-friendly. The constraints mentioned include: lack of trained staff to transfer available analog data into digital data. At the hardware side, the upgrading of PCs and fluctuating electricity supply were mentioned.

Soil evaluation studies

In the framework of land evaluation several topics were mentioned, such as:

- environmental impact assessment
- crop production grades assessment
- soil erosion tolerance assessment
- crop variety zonation
- development of soil based technologies for major field crops
- to depict several soil management techniques for the improvement of problem soils, such as: strongly acidic soils, soils with low organic matter, low available nutrients, poor drainage, saline soils and degraded soils
- to investigate the reason of lower productivity of second crops of rice.

2.4 CONCLUSION

At present 25 soil reference expositions are operational in 21 countries. In some of these countries accompanying documentation, such as Country Reports and Soil Briefs, is available for potential user groups trained in natural resources. The preparation of Popular Leaflets should get priority in order to reach also the non-trained user groups. To make soil reference collection more effective it is recommended that better interaction should take place with user groups before and after the establishment of such collections. This is in line with the general recommendations of the NASREC workshop (p. 45).

Acknowledgements

The comments of several ISRIC staff members on a preliminary version of the questionnaire were much appreciated. Hans van Baren, Niels Batjes, Roel Oldeman and Otto Spaargaren are gratefully thanked for their comments on the draft text.

3.1 POINTS OF DEPARTURE

1993: Evaluation Report of the National Soil Reference Collections and Databases Programme

An Expert Panel, convened by the Netherlands Directorate General for International Cooperation (DGIS) to evaluate the second phase of ISRIC's programme on National Soil Reference Collections and Databases (NASREC), concluded that the objectives of this programme have largely been achieved. The Panel recommended to convene an international workshop bringing together existing and potential collaborators and other resource persons to review the past performance, present their results, exchange information and share experiences. Workshop participants should develop a workplan for the third phase of the NASREC programme with the following objectives:

- to promote information transfer and dialogue with different groups of users of soil and land information, particularly the non-specialist professionals, farmers and the public at large *("participatory approach")*
- to identify a few new collaborating institutes in strategically placed countries to improve geographic balance and coverage
- to provide support to selected activities at established collaborating institutes, rather than continued overall support.

1994: Soil Survey Perspectives and Strategies for the 21st Century - J.A. Zinck

Soil survey is at crossroads through such factors as:

- under-usage or even neglect of soil information, base maps, legends and reports as these are generally not presented in an accessible, purpose-oriented, user-friendly language and format
- frequent inaccuracy of soil boundaries delineating map units when compared to ground truth, and map units which are often not homogenous enough for either general or specific interpretation purposes
- prohibitive high costs of surveys and budget restrictions
- more and better quality soil data are required for proper application in geographic information systems and models.

1995: Global trends in Food Production, Nutrition and Natural Resources - IFPRI

In achieving the 2020-Vision of the International Food Policy Research Institute (IFPRI), which states that every person in the world should have economic and physical access to sufficient food to sustain a healthy and productive life, some specific challenges are posed to soil scientists. These include:

- strengthening of the agricultural research and extension system in developing countries
- promotion of sustainable agricultural intensification and sound management of natural resources, with emphasis on areas with fragile soils, limited rainfall, and widespread poverty
- prevention or minimizing of environmental degradation.

3.2 WORKSHOP FOCAL POINTS

The workshop focussed on four main topics for discussion:

- creation of awareness of the demand for and products of soil information by prospective clients through an "Information Market" approach (review of the results of past NASREC activities)
- assessment of the adequacy of land resource information to provide solutions to development problems such as *soil fertility decline*, *salinization and waterlogging*, *water scarcity*, *soil compaction*, *soil erosion*, etc.
- demonstration of the use of databases and their applications to produce user-oriented and effective information
- formulation of ideas and possible follow-up activities to improve the efficiency of the NASREC programme, a.o. to establish collaboration with other natural resource institutes; global networking, linking national reference centres, regional focal points and the International Soil Reference and Information Centre (ISRIC).

4 REPORTS AND DISCUSSION RESULTS OF THE WORKSHOP SESSIONS

4.1 SESSION 2: GENERAL REVIEW AND INFORMATION MARKET

During session 2 an introductory lecture was given by Prof. N. Röling (Wageningen Agricultural University) on knowledge transfer and user groups. Subsequently an "information market" was organized. Participants were asked to present a poster where they could advertise their products to potential clients, played by other participants. By taking turns, all participants had the opportunity "to sell" their products and "to buy" products available on the market. A summary of the posters is given in Table 2. The market approach led to lively discussions amongst the participants on how to present their products to clients, and on the usefulness of their products. It also showed that some participants were better "salesmen" by attracting a larger number of interested persons than others.

The experiences gained during this information market were then discussed, focusing on ethnopedological studies, environmental impact assessment for policy makers, consulting services for commercial companies, NASREC as a facilitating group for meetings, and technology transfer to farmers on a future commercial basis.

Participants presenting their posters during the information market

Table 2 Summary of posters presented during the information market

AFRICA	ASIA	LATIN AMERICA
Provided information in land resources through KENSOTER, KENASREC. Achievements, present challenges focused on KSS's innovative methods of soil information dissemination *(Kenya — Kenya Soil Survey, B.K. Waruru)*	Developments and potential uses from soil survey databases. How to get databases? Inventory, interpretation, application. How to get techniques? Mention of gaps, functions and interactions. *(Taiwan, Rep. of China — National Taiwan University, Zueng-Sang Chen)*	Comprehensive soil information for each user type in order to be more practical and useful *(Colombia — Instituto Geografico Agustin Codazzi, A. Correa Salazar)*
Water harvesting, combatting erosion, drought assessment *(Lesotho — Ministry of Natural Resources, M. Williams)*	Display of NASREC activities in China: a) NE China; b) SE China; c) on the roof of the World (Tibet); d) management in arid regions. The questions posed are: - What is the next step for NASREC? - How to use NASREC data for non soil scientists? *(P.R. China — Institute of Soil Science, Luo Guobao)*	Available stored soil information and effective dissemination and use of this data *(Brazil — Centro Nacional de Pesquisa de Solos/EMBRAPA, H. Gonçalves dos Santos)*
Utilization of Remote Sensing and Land Information System for land use planning; need for NASREC and SOTER activities to make use of the huge amount of soil data available *(Egypt — National Research Centre, S.I. Abdel Rahman)*	Reaching the user groups — planners, policy makers, extension, education and research. Used by farmers, university students, school students, soil scientists and persons not specialized in soil science. *(India — Kerala Agricultural University, T. Varghese)*	Soil reference collection for education and how to present the information for different users *(Brazil — University of Viçosa, C. Muggler)*
Soil today, food for tomorrow: Sustainable food security through information and networking *(Ghana — Soil Research Institute, R.D. Asiamah)*	Demonstrated the methods of soil information dissemination a) Locations and kind of information; b) Media for soil information dissemination; c) People participation *(India — Tamil Nadu Agricultural University, S. Natarajan)*	Establishment of Regional Soil Reference and Information Centres in Latin America, Africa and Asia in order to obtain more practical, cheaper, common and more integral experience exchange, training, information and solutions to the regional and national problems in the network of NASRECs *(Ecuador — PRONAREG/MAG, G. del Posso)*
Productivity and land use system for sustainable land use through databases, workshops and training: Goals, Constraints *(Senegal — Bureau Pédologique du Sénégal, R.D. Fall)*	Utility of soil exposition — extension, education, research and farmers, students of farm and traditional universities *(India — University of Agricultural Sciences, M.S. Badrinath)*	Ethno-pedological studies for management problems for small farms *(Mexico — Colegio de Post-graduados Montecillo, C.A. Ortiz Solorio)*
Information on the National Soil Service Laboratory (NSSL) Objectives: collection of soil information; collection and display of soil monoliths *(Ethiopia — National Soil Service Laboratory, S. Sertsu)*	Problem: What is the technology farmers require? Are you sure what you supply is suitable for them? *(Thailand — Department of Land Development, A. Pothinam)*	Base environmental information of natural resources for any user type *(Peru — Instituto Nacional de Recursos Naturales, J. Quispe H.)*

Table 2 Summary of posters presented during the information market

AFRICA	ASIA	LATIN AMERICA
Soil survey in Zambia: present and future activities. Examples in soil mapping and land evaluation *(Zambia — Soil Survey Unit, R. Msoni)*	Soil survey of Pakistan. The questions asked were: a) How to get Dermoplast; b) How to reach the user group (experience); c) Usefulness of thematic maps, GIS and software packages; d) How to tackle soil salinity *(Pakistan — Soil Survey of Pakistan, M.A. Tahir)*	Soil collection showing hydric erosion problems and solutions in rainforest regions *(Peru — Universidad Nacional de la Amazonia Peruana, G. Paredes Arce)*
Supply and demand for soil information in Nigeria. Background, contribution from UISREC. Needed: strategies for disseminating information to politicians and farmers *(Nigeria — University of Ibadan, A. Gbadegesin)*	NASREC for Soil Conservation. a) Objectives; b) Methodologies; c) Results; d) Uses were displayed and question on transfer of technology to farmers *(Vietnam — National Institute for Soils and Fertilizers, Thai Phien)*	Acid soils management in the tropical humid forest. One package for a better production level towards policy makers, planners, extension service, farmers, etc. *(Venezuela — Universidad del Zulia, N. Noguera P.)*
Displays of the soil and natural resource information and database available. Expresses the ability to interpret resource information; products; stable funding source required *(South Africa — Institute for Soil, Climate and Water, D.P. Turner and L. Rust)*	Soil classification system focused on the relevance of: a) National; b) FAO; c) Soil Taxonomy; d) The question of what next? The development of classification systems from 1957 to 1994 *(Indonesia — Centre for Soil and Agroclimate Research, D. Subardja)*	Soil survey generated information for multi purpose and to be used by farms, planners, policy makers and extension services *(Venezuela — Universidad Central de Venezuela, S. Torres P.)*
General activities of the Land and Water Department (DTA), INIA, Mozambique. Collection of soil, soil fertility management and agro-hydrology water management data. Use of databases and GIS for assessment of land suitability maps and different scenarios. Constraint: How to reach the users? *(Mozambique — INIA, M.F. Vilanculos)*	Soil Research and Development Centre devoted twenty years work on national soil database. Outputs are now used for: a) Strategies and services; b) Information technology; c) Information marketing *(Philippines — Bureau of Soils and Water Management, R.N. Concepcion)*	Establishment and results for promoting the participation of the general population in soil courses and other services *(Cuba — Instituto Nacional de Investigación de la Caña de Azucar, R. Chang Ravelo)*
		Why not a regional soil collection at CATIE (Centro Agronomico Tropical de Investigación y Enseñanza — Tropical Research and Training Center), Turrialba, Costa Rica, which has 7 member countries: Mexico, Guatemala, Costa Rica, Panama, Venezuela, El Salvador, and Brazil *(Costa Rica — CATIE, D.L. Kass)*

4.1.1 REPORTS OF THE WORKING GROUPS ON THE INFORMATION MARKET

Working group 1: **Ethnopedological Studies** *(Chair: C.A. Ortiz-Solorio - Mexico; Reporter: H. Gonçalves dos Santos - Brazil)*

Recommendations

- Communication with clients can be enhanced by using native or indigenous soil classification systems and knowledge on soils. Native classification systems have practical purposes related to crop adaptation, management and improvement of lands
- For ethnopedological studies it is important for scientists to change mentality. It is important to go to the field to learn, not to teach
- Native knowledge should be coupled with scientific knowledge.

Working group 2: **Environmental Impact Assessment (EIA) for Policy Makers** *(Chair: R.N. Concepcion - Philippines; Reporter: R.D. Asiamah - Ghana)*

Problem

- Soil and natural resource information is often lacking in project development plans

Products

- Facilitate assistance for major project development, especially funding
- Methodology for natural resource information in EIA, including risk analysis
- Prediction of possible positive and negative impacts
- Provision of mitigation measures and alternative development options.

Working group 3: **Consulting Services for Commercial Companies** *(Chair: N. Noguera Peña -Venezuela; Reporter: R.M. Chang Ravelo - Cuba)*

Products

- Analytical services for soil, water and plant analyses (chemistry, physical, micromorphology, mineralogy, microbiology), water quality and plant nutrition
- Sale of the technical information: soil maps, books etc. according to the different user groups
- Training courses for non-technical people eg. the preparation of soil samples in the field and for commercial companies.

Working group 4: **NASREC as a Facilitating Group for Meetings** *(Chair: D.P. Turner - South Africa)*

Problem

- Information is not reaching users

Products

- Workshops are recommended to organize and facilitate the dissemination of information
- Demonstration plots
- Facilitate ethnopedology
- Facilitate simplified pedology
- Use SOTER and GIS
- Develop scientific models
- Develop and maintain "NASREC" centres of expertise
- Create awareness of potential products.

Working group 5: **Technology Transfer to Farmers on a Future Commercial Basis** *(Chair: D.L. Kass - Costa Rica; Reporter: M.S. Badrinath - India)*

Products

- Various services such as: farm planning, soil analyses to make recommendations for better fertilizer use, to suggest means for soil reclamation, management, and improvement
- Soil fertility maps could be prepared and made available to farmers
- Thrive to develop soil-based agro-technology transfer so that NASREC activities could be put to the service of sustainable agriculture
- A mechanism for setting up a control board made up of NASREC personnel, professionals, farmers, NGO's, and government representatives to decide what services are of most interest. The activity would thus be participatory and depend on farmers' interest
- Publications could be sold
- Other forms of communication such as videos could also be produced for sale
- The activities of this expanded NASREC should be well publicized so that people would be aware of the services it provides.

4.2 SESSION 3: PHYSICAL LAND QUALITIES

During session 3 an introductory lecture was given by Prof. J. Bouma (Wageningen Agricultural University) on physical land quality assessment. Additional presentations were given on structural properties of soils in Indonesia (D. Subardja), experiences on water use efficiency in Mali (O. Doumbia), on erosion problems in Ethiopia (S. Sertsu), and soil conservation practices in Lesotho (M. Williams). Working groups subsequently discussed items related to physical degradation of surface soils, on water use efficiency, on soil erosion, on soil conservation, and on physical engineering properties. The working groups were asked to assess the various topics as being a main constraint and to define possible products as outcome of the NASREC activities.

4.2.1 REPORTS OF THE WORKING GROUPS ON PHYSICAL LAND QUALITIES

Working group 1: **Physical Degradation of Surface Soils** *(Chair: D. Subardja - Indonesia; Reporter: Zueng-Sang Chen - R.O.C. Taiwan)*

Identification of the main problems on physical land degradation

There are several problems related to physical degradation which can be identified as follows:

- cracking and swelling
- sealing and crusting
- compaction
- slacking
- specially highly or lower hydraulic conductivity (or infiltration)
- poaching or puddling.

How to develop and identify a reliable, tested and commercialized soil database

The main problems related to physical degradation listed above are difficult to assess and not easily measured in the field or laboratory, such as the COLE value (coefficient of linear extensibility), exchange sodium percentage (ESP), hydraulic conductivity (K), bulk density (Bd), porosity, infiltration rate, and dry condition state.

The properties above need to be transferred into another "soil physical indicator" or calculated using pedotransfer functions (PTF), such as:

- rooting depth
- soil strength
- soil texture type
- soil structure type
- available water capacity
- water transmission (or permeability grade).

These soil physical indicators are easily obtained and observed in the field or measured in the laboratory. Each of them may be related to one or more of the physical degradation problems.

Evaluation of these physical indicators allows databases to be commercialized and directly transferred to the users, e.g. farmers.

Methods and guidelines of assessment for physical land degradation

Suggested critical levels for each physical indicator

Appropriate criteria for establishment of critical levels for the soil physical indicators need to be defined, and the group made some proposals. The critical levels must be chosen based on the local specific situation in different environmental conditions, and the soil attributes used in different countries. An approximate rating of these physical indicators is proposed as follows:

Physical degradation	Grade (code)	Rooting depth (cm)	Soil texture	Soil structure	Water stable aggregates (%)	Available water capacity (cm)	Permeability
None	1	>100	L	strong SBk	>15	>30	rapid
Slightly	2	80-100	SiL, Si, SiCL	SBk	50-75	20-30	mod. rapid
Moderate	3	40-60	CL, SL	mod. SBk	25-50	10-20	moderate
Severe	4	20-40	SiC, LS	weak SBk	5-25	2-10	slow
Extreme	5	<20	C, S	massive; single grain	<5	<2	very slow; very rapid

Key: *USDA Soil texture:* L=loam; SiL=silt loam; Si=silt; SiCL=silty clay loam; CL=clay loam; SL=sandy loam; SiC=silty clay; LS=loamy sand; C=clay; S=sand.
Soil structure: SBk=subangular blocky.

Database analysis or interpretation

Possible ways of combining and interpreting or rating of the individual indicators were discussed. An approach is to combine the indicators into a "Cumulative Rating Index", such as:

Indicator	Grade (or weighting factors)
Rooting depth (cm) (R)	2
Soil texture (T)	3
Soil structure (S)	5
Water stable aggregates (%) (A)	4
Available water capacity (cm) (W)	3
Permeability (P)	5
Cumulative Rating Index (CRI)	Σ (2+3+5+4+3+5) = 22

If the value of CRI is <15 for six indicators, soils may be regarded as having no or only slight physical degradation. If the value of CRI is >25 for six indicators, then soils can be regarded as severely or extremely degraded.

Weighting factors for six physical indicators	Cumulative Rating Index (CRI)
None	<12
Slightly	12-15
Moderate	16-20
Severe	21-25
Extremely degraded	>25

Another approach is to list all weighting factors for each indicator, such as:

(1) R4 T3 S2 A4 W5 P3 (CRI=21)
(2) R5 T3 S1 A2 W5 P1 (CRI=17)
(3) R2 T2 S2 A1 W2 P1 (CRI=10)

The results then show the weighting factors and limiting indicators, such as:

(1) severe degradation: limiting indicator is available water capacity (W5)
(2) moderate degradation: limiting indicators are rooting depth and available water capacity (R5 and W5)
(3) no degradation

Basic strategies and technical options for enhancing the physical land degradation indicators

Physical land degradation indicators can be used to develop land management strategies to ameliorate the limiting factors. Examples of these are as follows:

Indicators of physical degradation	Strategy	Technical options
Compaction, rooting depth	Reduce compaction	- conservation tillage - ploughing
Sealing, crusting	Salinity management	- appropriate cropping system - rotation system - control of leaching process - soil amendments
Poor soil structure	Enhance soil structure	- mulch farming - conservation tillage - cover crops

Working group 2: **Water Use Efficiency** *(Chair: O. Doumbia - Mali; Reporter: D.L. Kass - Costa Rica)*

Problems

- Imbalance of water resources
- Limited availability of data with respect to water availability and quality
- Water is used inefficiently by farmers and planners - little awareness of the problem
- Little/no data on farmer perception of water management problems.

Products

- An assessment of the market for water use management packages and an investigation on the application of existing models (e.g. models to predict hydraulic properties and management practices from available ISRIC data - in some cases, more data may be needed)
- Water management recommendations for soil in NASREC data set
- Water management practices for more efficient use of water can be sold
- Economic analyses of benefits from better water management could be presented to farmers and planners
- Training courses for farmers and policy makers.

Working group 3: **Soil Erosion** (Chair: S. Sertsu - Ethiopia)

Problems

- Water and wind erosion
- Farmers and planners are not informed on the consequences of soil erosion.

Products

- Water/wind erosion risk assessment
- Negative effects of erosion expressed in terms of yield decrease
- Alerting the policy makers about the impact water/wind erosion on food production and land deterioration
- Popularizing the different techniques to combat erosion
- Future research needs:
  * Generating data for the development and validation of models
  * Farmer participation aspects
  * Physical data for erosion must be strengthened
- Awakening the farmers and planners about the consequences through:
  * Education
  * Training
  * Media

Working group 4: **Soil Conservation** *(Chair: M. Williams - Lesotho)*

Need for soil conservation

Soil conservation is necessary and very much in demand all over the world because there is:

- Widespread land degradation in both the developed and developing world
- The need to maintain and increase soil productivity for various uses, and
- The need to provide food security for both the present and future generations.

Constraints

Although soil conservation is not a new term, it has faced many constraints over time, including:

- Most recommendations concerning soil conservation have been very difficult to implement because of:
  * different socio-economic conditions prevailing in different parts of the world and which are not usually taken into consideration in soil conservation packages;
  * policy makers are not usually interested in implementing soil conservation measures because it will not bring financial gains.
- Current soil conservation techniques are data demanding and conservation approaches often do not take into account the end-users, especially their cultural differences.

Solutions

A three-level soil-conservation package is suggested. These are to be at:

- National level, in which ecological and cultural considerations will be given priority;
- Regional level, where ecological packages will be the main focal aim; and
- Global level, where a global package needs to be provided.

Products

A new conservation package is being proposed, named "Appropriate Soil Conservation Package" (ASCP), aiming at the following benefits:

- Improvement of quality of life at less social costs to policy makers; and
- Improvement of farmers' income.

Working group 5: **Physical Engineering Properties** *(Chair: T. Varghese - India; Reporter: M.A. Tahir - Pakistan)*

Problem

- Information is not readily available for stakeholders engaged in the construction of buildings, housing colonies, roads, railways, irrigation, drainage as well as those involved in public health and engineering.

Products

- Information supply, which can be utilized by the above mentioned groups such as: soil depth, terrain constraints, texture, structure, porosity, drainage class, shrink-swell potential, hydraulic properties and presence of pans in the soil profile
- Parameters desired by engineers obtained during routine investigations of pedologists such as bulk density and Atterberg limits.

4.3 SESSION 4: CHEMICAL LAND QUALITIES

During session 4 an introductory lecture was given by Mr. H. van Reuler (Wageningen Agricultural University) highlighting some of the results of his study on nutrient dynamics and supply in the Taï Forest region of Côte d'Ivoire. Additional presentations were given on soil acidity in Brazil (H. Gonçalves dos Santos); organic matter management in Costa Rica (D.L. Kass); salinization problems in Pakistan (M.A. Tahir); and soil mining in Ghana (R.D. Asiamah). In addition, R.D. Asiamah gave a presentation on the Soil Fertility Network (SOFERNET) in Africa, an initiative of the African Ministerial Conference on Environment and Nature (AMCEN) of the Organization of African Unity (OAU). Working groups subsequently discussed items related to these presentations, as well as on the effects of growing wetland rice on soil chemical properties.

4.3.1 REPORTS OF THE WORKING GROUPS ON CHEMICAL LAND QUALITIES

Working group 1: **Soil Acidity (including acid sulphate soils)** *(Chair: H. Gonçalves dos Santos - Brazil; Reporter: D.P. Turner - South Africa)*

Problems

- Large extent
- High aluminium toxicity leads to high cost of production and low outputs
- Yields are decreasing
- Land owners cannot diversify thus high risk and limited number of crops.

Products

- Acid-tolerant varieties
- Agroforestry. Legumes may not capture nitrogen
- Promotion of common crops and more investment in acid-tolerant crops
- Creation of awareness with policy makers on the extend of acid areas
- Use of lime in combination with green manure
- Use of lime where accessible.

Working group 2: **Organic Matter Management** *(Chair: D.L. Kass - Costa Rica)*

Problems

- Different behaviour of organic matter according to agro-ecological zone and soil mineralogy
- Alternatives for organic matter can contain toxic materials
- Nutrients often unavailable
- Inadequate specific analysis (eg. alphates, aromatics).

Products

- Management recommendations for reference soils
- Specific studies on reference soils
- Scope for research: laboratory determinations, decomposition rate and heavy metal content
- Greenhouse gas emissions
- Simple indices of organic matter stability.

Working group 3: **Soil Salinity** *(Chair: M.A. Tahir - Pakistan)*

Problems

- Salinization is a problem throughout the world
- Salinity results in low yields
- Inadequate quantification of salinity; how important is the constraint?
- Far reaching practical implications.

Products

- Reclamation studies and projects
- Development of salt-resistant crops
- Use of traditional methods of reclamation by manure and water
- Drainage.

Working group 4: **Nutrient Dynamics** *(Chair: R.D. Asiamah - Ghana)*

Problems

- Loss of nutrient through plant removal, leaching, erosion, fixation, volatilization and burning
- Data is scattered over institutes of the regions
- No inventory of available data
- Are only pedological data collected in the NASREC framework?
- Nutrient imbalances
- Pollution
- Soil deterioration
- Poverty of people
- Political instability and insufficient infrastructure development.

Products

- Farmers are encouraged to practise better organic matter management
- Encouragement of better land management techniques
- Networks of institutes to collect a wide variety of data
- Additional soil fertility data in addition to the pedological data normally collected in the NASREC context.

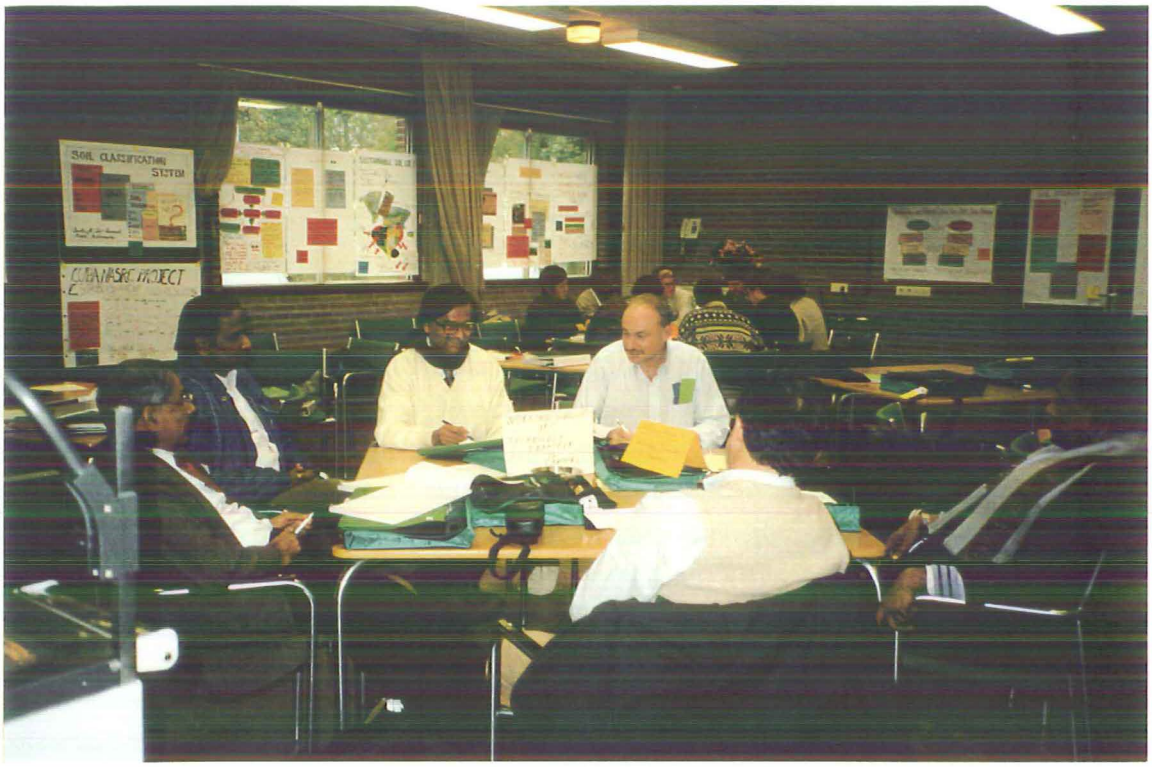
Working group 5: **Effects of Growing Wetland Rice on Soil Chemical Properties** *(Chair: Zueng-Sang Chen - R.O.C. Taiwan)*

Problems

- Changed chemical properties
  * pH, redox potentials
  * Nutrient dynamics: base saturation percentage, available nutrients, EC, C/N ratio
  * Toxic substances (H_2S, heavy metals, ions)
  * Greenhouse gas (CH_4, N_2O, CO_2 ....)
- Soil databases give insufficient data on
  * Redox potentials
  * Toxic substances
  * Greenhouse gasses
  * Nutrient status

Products

- Soil restoration techniques for contaminated soils
- Monitoring or modelling of ground water pollution
- Soil management techniques (soil prescription).



Working group session in ISRIC's lecture hall

4.4 SESSION 5: CONSULTATION ON SOURCES AND QUALITY OF ENVIRONMENTAL DATA

P.R. Goldsworthy and S.W. Duiker
International Service for National Agricultural Research (ISNAR), The Hague

This session was entirely organized and handled by the International Service for National Agricultural Research (ISNAR). The objective was to identify major constraints to the collection and management of environmental data and to recommend to different stakeholders measures to alleviate these constraints.

4.4.1 BACKGROUND

The one-day consultation was organized to increase the awareness of the constraints of national institutions involved in environmental data collection and management. The consultation took place at a moment when there is increasing realization of the importance of environmental data at a global level for monitoring of the natural resources. At the same time, however, there is also a neglect of the needs of national level institutions which are collecting the data. These institutions are often facing increasing financial constraints.

The consultation focused on different categories of environmental data:

1) Land use and vegetation
2) Climate
3) Soils
4) Water
5) Socio-economic data

The consultation focused on more than only soil data, although the participants were primarily soil scientists. This was felt necessary because the users of the information, who in this case will often be policy makers need more than only soil data. They need information on different environmental processes to formulate interventions like policies, laws, projects etc. The information has also often to be integrated for their use, for example soil degradation has often socioeconomic causes and analyzing links between these is crucial to formulate policies to forestall degradation.

A few months before the NASREC workshop ISNAR had sent out questionnaires containing a number of questions on each of these categories of data. Some 15 questionnaires had been returned. The constraints as mentioned in the questionnaires were incorporated in the discussions on the 10th of November. An overview of the results, listing institutions involved in environmental data collection in different developing countries, is given in Table 3.

Table 3 Results of the ISNAR questionnaire:
Overview of institutions involved in environmental data collection in different developing countries

Country	Land use and vegetation	Climatological	Soils	Water	Socio-economic
Brazil	* Instituto Nacional de Pesquisas Espacias (INPE) * Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA) * Superintendência do Desenvolvimento da Amazônia * Instituto Agronomico de São Paulo * Fundação Instituto Brasileiro de Geografia e Estatistica	* Instituto Nacional de Meteorologia * Fundação Cearense de Meteorologia * Departamento Nacional de Aguas e Energia Elétrica * Centro de Previsão de Tempo e Climatologia	* Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA) * Instituto Agronômico de São Paulo * Fundação Instituto Brasileiro de Geografia e Estatistica	* Departamento Nacional de Aguas e Energia Elétrica * Instituto de Pesquisas Hidráulicas * Companhia de Pesquisa de Recursos Minerais * Companhia de Desenvolvimento do Vale de São Francisco	* Fundação Instituto Brasileiro de Geografia e Estatística * Instituto Estadual de Desenvolvimento Econômico e Social
Burkina Faso	?	* Direction de la Météorologie National	* BUNASOLS	* Service de l'Hydrologie/ Direction de l'Inventaire des Ressources Hydrauliques	* Direction des Statistiques Agro-pastorales, Ministère de l'Agriculture et des Ressources Animales
Cuba	* Instituto de Planificación Física (Ministry of Economy) * Instituto de Ecología y Sistemática (Ministry of Sciences, Technology and Environment)	* Instituto de Meteorología (Ministry of Sciences, Technology and Environment)	* Instituto de Suelos (Ministry of Agriculture) * Instituto Nacional de Investigaciones de la Caña de Azucar (Sugar Ministry)	* Centro de Hidrologia y Calidad de Aguas	* Oficina Nacional de Estadística
Ecuador	* National Direction of Natural Resources/Ministry of Agriculture and Livestock * National Institute of Statistics and Census	* National Institute of Climatology and Hydrology * National Direction of Natural Resources/Ministry of Agriculture and Livestock * National Direction of Civil Aviation	* National Direction of Natural Resources/Ministry of Agriculture and Livestock * ORSTOM * CRM * CEDEGE * PREDESUR * CREA * NASREC	* Institute of Hydraulic Resources * National Direction of Natural Resources/Ministry of Agriculture and Livestock	* National Institute of Statistics and Census
Ethiopia	?	?	?	?	?

Table 3 Results of the ISNAR questionnaire:
Overview of institutions involved in environmental data collection in different developing countries *(continued)*

Country	Land use and vegetation	Climatological	Soils	Water	Socio-economic
India	* Min. of Agric. and Cooperation * Nat. Remote Sensing Agency * Department of Agriculture * Forest Survey of India * State Forest Department	* India Meteroligical Department * Regional Meteorological Centre * Tamil Nadu University	* National Bureau of Soil Survey and Land Use Planning * State Soil Survey and Land Use Organization	* National Water Commision (Min. of Irrigation) * National Remote Sensing Agency	* Census of India * Directorate of Census Operation
Kenya	?	?	* Kenya Soil Survey (KSS)	?	?
Lesotho	* Forestry Division * Land Use Planning Division * Range Management Division	* Meteorological Services	* Soil and Water Conservation Division * Agricultural Research Division	* Lesotho Highlands Development Authority * Department of Water Affairs * Water and Sewage Authority	* Dept. of Economics and Marketing * Nat. Employment Serv. * Min. of Education * Min. of Home Affairs * Min. of Trade and Ind. * Bureau of Statistics
Niger	* Niger Nat. Inst. of Agr. Res. * Rural Development Projects * Internat. Development Agencies * Min. of Agric. and Livestock	* National Direction of Meteorology * Agrhymet * ASECNA	* Niger National Institute of Agronomic Research * University of Niamey	* Direction of Water Resources * Direction of Water Inventory * Ministry of Environment	* Direction of Population * Direction of Statistics
Senegal	* Min. of Agric. and Envir.: - Dir. of Agric. - Soil Service - Direction of Forestry - Agric. Res. Inst. of Senegal (ISRA) * ORSTOM * Ecological Monitoring Center	* National Service of Meteorology * Soil Service of Senegal * Ecological Monitoring Center	* Soil Service of Senegal * ORSTOM * ISRA * Earth Sciences Institute	* Direction of Rural Engineering (Min. of Hydrology) * Direction of Hydrology * OMVS/OMVG (Organization of Senegal/Gambia River Management)	* Direction of Planning * Direction of Statistics * Direction of Territory Management * Soil Service of Senegal * Trade Direction * Food Security Agency * Hydrology Project
Sri Lanka	* Survey Department * Land Use Division, Irrigation Department	* Meteorological Department	* Land Use Division, Irrigation Department	* Hydrology Division, Irrigation Department	* Department of Census and Statistics * Central Bank of Sri Lanka

Table 3 Results of the ISNAR questionnaire:
Overview of institutions involved in environmental data collection in different developing countries *(continued)*

Country	Land use and vegetation	Climatological	Soils	Water	Socio-economic
R.O.C. Taiwan	* Ministry of the Interior * Taiwan Forest Bureau * Taiwan Provincial Soil and Water Conservation Bureau	* Central Weather Bureau * Agricultural Experimental Stations	* Department of Agricultural Chemistry, Taiwan Agricultural Research Institute * Taiwan Provincial Soil and Water Conservation Bureau * Taiwan Forestry Bureau * Department of Soil Sciences * Department of Agricultural Chemistry, Nat. Taiwan Univ.	* Water Resources Planning Committee * Taiwan Water and Irrigation Bureau	* Directorate General of Budget, Accounting and Statistics
Uganda	* National Biomass Study, Forest Department	* Meteorology Department	* Kawanda Agricultural Research Institute * Department of Soil Science, Makarere University * Farm Planning Unit, Namalere	* Water Development Department	* Kawanda Agricultural Research Institute * Ministry of Planning
Vietnam	* National Institute for Soils and Fertilizers (NISF) * National Institute of Agricultural Planning and Projection (NIAPP) * National Institute of Agricultural Sciences (NIAS)	* General Department of Meteorology and Hydrology * National Institute of Meteorological Research	* NISF * NIAPP	* Institute of Economic Water Resources * Department of Agricultural Hydraulics, Ministry of Water Resources	* General Department of Statistics * Institute of Social Sciences * State Planning Committee
Zimbabwe	* Land Use Planning Branch, Dept. of Agricultural Technical and Extension Services * National Herbarium and Botanic Gardens, Dept. of Res. and Specialist Services * Forest Research Centre, Forestry Commission * Dept. of Natural Resources, Min. of Env. and Tourism * Dept. of Surveyor General * Environmental Remote Sensing Institute, Scientific and Industrial Research and Development Centre	* Department of Meteorological Services, Ministry of Transport and Energy	* Chemistry and Soil Research Institute * Land Use Planning Branch, Department of Agricultural Technical and Extension Services * Department of Soil Science, University of Zimbabwe	* Hydrology Branch, Department of Water Development, Ministry of Lands and Water Development	* Farming Systems Research Unit, Department of Research and Specialist Services * University of Zimbabwe, Department of Agricultural Economics * Centre of Applied Social Studies, Institute of Development Studies

4.4.2 RESULTS

Five discussion groups had been established, each of some 7 participants. The groups discussed constraints to environmental data collection, and used a framework of constraints to agricultural research. Based on this a tree of constraints to environmental data collection and management was constructed, which was then translated into a tree of objectives. The final output of the day were recommendations, which are presented in the tables. Two discussion groups considered research policy constraints, one group discussed constraints in the organisation and structure of the research system, and two groups discussed management constraints to environmental data collection and management.

4.4.3 RECOMMENDATIONS

Recommendations to alleviate research policy constraints

Directed primarily to policy makers

Commitment by governments to the conservation and sustainable use of the natural resources:

- Formulate a long-term national strategic development plan for the sustainable utilization of natural resources in consultation with natural resources experts and other stakeholders
- Create a policy environment which will allow implementation of development programmes consistent with the national strategic plan
- Provide adequate funds to meet the physical and financial needs of data collection and management
- Create a forum for review of national and regional natural resources development policy to avert any conflicts between all stakeholders.

Directed to research managers and scientists

To improve the management of research:

- Develop a human resources and infrastructural facilities development plan, among others to achieve a balance between researchers from different disciplines
- Establish a remuneration scheme for personnel consistent with the institution's needs
- Apply an integrated approach to research management
- Maintain inter-institutional collaboration

To stimulate informed policy making:

- Formulate a clear policy on information dissemination and pricing through the creation of a National Resource Management (NRM) council, GIS and networks
- Provide information that meets the needs of planners to stimulate the conservation of the natural resources
- Regularly invite key policy makers to research information days and institutes management forums
- Prepare simplified materials for policy makers
- Guarantee easy access to data.

To provide information to the general public:

- Set up workshops, seminars and field days to disseminate information to key public figures
- Be responsive to changing circumstances and interests in society
- Raise awareness to stimulate sustainable use of natural resources.

To establish better links with donors:

- Create a donor's consultation platform to facilitate funding according to the priorities of the national natural resources development plan.

Recommendations to alleviate organization and structure constraints

Directed primarily to policy makers

- Establish a national agricultural research advisory council for proper coordination
- Give more flexibility in project/program funding
- Pool resources of different projects or groups to solve specific research problems.

Directed to research managers and scientists

- Encourage inter-disciplinary research collaboration
- Create a system for easy and accessible information flow
- Increase the mobility of staff in the institutions
- Increase the awareness of policy makers of the vital services provided to the nation
- Form strategic alliances
- Supervise graduate students jointly by universities and National Agricultural Research Organizations (NARO's)
- NARO's need to define more clearly the needs for collaboration in research
- Improve the interpretation of basic data for to the needs of users
- Coordinate efforts to avoid duplication
- Establish a system of systematic data exchange for easy accessibility
- Create a system for easy compatibility of data.

Recommendations to alleviate research management constraints

Directed to policy makers

- Establish a policy and strategy for research (including data collection) in accordance with the long-term national priorities.

Directed to research managers and scientists

- Establish a national research plan to address the nations' needs
- Design and include measures for monitoring, evaluation and quality control of the data that are gathered
- Develop an integrated plan to make an inventory of the natural resources
- Establish national, regional and local level data base centres for the collection, storage, supply and monitoring of natural resources data
- Raise external and internal financial support to implement the integrated plan

- Develop a long-term human, financial and physical resources development plan
- Develop a system to manage the human, financial and physical resources
- Create a communication system to answer to the information needs of policy makers at different levels of aggregation
- Create a network of national, regional and local institutions to become acquainted with the different needs of clients at local, regional and national levels
- Create interdisciplinary research groups to address specific natural resources problems
- Create guidelines for standard data collection techniques
- Provide special incentives for people working in rural areas.

4.5 SESSIONS 6, 7, 8, 9: COMPUTERIZED DATA HANDLING

During three days the participants were familiarized with database management systems, models, statistical software and GIS techniques related to natural resources. In particular, participants were introduced to the FAO Agro-Ecological Zonation (AEZ) methodology, the ISRIC database systems ISIS (ISRIC Soil Information System), SOTER (Soils and Terrain Digital Database) and WISE (World Inventory on Soil Emissions Potentials Database), associated software such as SOLGRAPH (a Soil and Climatic Data Presentation and Assessment Program), DIAGNISIS (an assessment program for DIAGNostic horizons and properties of the FAO Revised Legend, using ISIS), SWEAP (a computer program for water erosion assessment applied to SOTER), including a validation and calibration of erosion assessment, ALES-STRESS (Automated Land Evaluation System with emphasis on stress factors affecting plant growth) and WOCAT (World Overview of Conservation Approaches and Technologies). The participants were facilitated to exercise with these programs, and were provided with copies to install in their own countries.

In addition, short introductions and demonstrations were given on computerized slide, map and library databases, and on a laboratory information management system for small- and medium-size soil and plant laboratories (SOILIMS) and good laboratory practices (GLP). Also recent developments in communication technology (E-mail, Internet) were highlighted.

Messrs. Chen (R.O.C., Taiwan) and Vilanculos (Mozambique) examine their results of a computer exercise

4.6 SESSION 10: FORUM DISCUSSION ON USER-ORIENTED INFORMATION TRANSFER

A panel, consisting of Dr. W.G. Sombroek (Chair; Director, Land and Water Development Division, FAO), Dr. C. Lightfoot (Director, ILEIA), Prof. Dr. N. Röling (Wageningen Agricultural University), Prof. Dr. A. Zinck (ITC, Enschede) and Mrs. R.D. Fall (Director, Bureau de Pédologie du Sénégal; workshop participant), reviewed the outcome of the discussions during the workshop, with special emphasis on user-oriented information transfer. A summary of the views of the panel members follows.

Sombroek

How to increase public awareness about the crucial role of soil science? Potential users need to be better informed about what soil scientists are doing. Soil scientists should not work in isolation but cooperation between the soil scientists must be intensified. Also a common language among soil scientists is needed. Biophysical and socio-economic information should be linked.

The recommendations of the workshop should be related to Agenda 21, in particular to Chapter 10.

Lightfoot

Is NASREC developed as a strategic target of work for a fixed time period (5-10 years) or more as a general service for a long-term? What should ISRIC's position be in the institutional landscape? Decentralisation (regionalisation) will provide new space for ISRIC. Agricultural development should not be focused on the farmer alone but on the entire community within the landscape (watershed approach is important). ISRIC and NASREC partners should try to bring some clarity into the discussion on the green revolution and future potentials of land. What are the economic/socio-economic conditions/prospects in restoration. How can soil science contribute?

Röling

NASREC's offer a service to clients. Within this context learning opportunities should be created. How can NASREC be responsive to demands and how can it make a proper diagnosis of the problem?

In the future focus will be more on water, which is becoming a scarce resource, and less on nutrients.

Problems should not be solved at farmer's level but at a catchment level. People should be supported to construct a sound environment. Presently we are misusing our environment. Science must be made visible, so that people can draw their own conclusions. Only then action can be expected.

Zinck

There is a plurality of users. Information should therefore be provided tailor-made. How good is our information? The quality of the information on soils we want to disseminate depends on the quality of data we collect and enter in our databases. Networking should be encouraged and public awareness created. Proper positioning of natural resources institutions is important. The World Soils Policy should be promoted.

Reactions of the panel members on the findings of the task forces

1. Final recommendations should be properly arranged, starting with national, regional and global levels. Recommendations related to ISRIC's role should come at the end.
2. Innovative ideas as developed at the information market session should be inserted. The concept of ethnopedology should get more attention and efforts are needed to correlate local soil names to scientific ones. Ethnopedology is to be conceived as a living thing, not only historic.
3. Utility of information must be related to different levels of aggregation. Clients at these different levels (farmer, watershed, national, regional, global) should be identified. It must constantly be remembered that our final target is the end-user.
4. A common durable (sustainable) product in the NASREC context must be defined.
5. The agenda of the task forces is complicated and difficult, and is not only the domain of NASREC's. Efforts are needed not only to establish networks amongst soil people, but more importantly with other resource institutions within countries, be it biophysical or socio-economic institutions. A joint effort is needed and a Resource Management Domain concept should be considered.
6. Water resources is an important item and should not be neglected in the final recommendations.
7. The comparative advantages of the NASREC concept should be determined.

4.7 REPORTS OF THE TASK FORCES

During the workshop five task forces have been active to list opinions amongst the participants on part and present performance of NASREC on global, regional and national level, and to formulate elements for a plan of action on future activities within a "NASREC at large".

4.7.1 On Global Organization and Networking

(Chair: K. Nyamapfene - South Africa)

ISRIC's role in the past and future

ISRIC has played an important and useful role in:

- Creating awareness of the nature and importance of soil resources in the various countries where NASREC's were set up
- Generating a database for local use that can be accessed internationally
- Facilitating correlation of various classifications with international ones
- Providing a soil analytical facility that serves as useful benchmark and reference point for NASREC and others
- Building human resource capacity in the NASREC countries.

There are some gaps in the data so far generated, especially because focus has been on soil data for agricultural purposes only. Data sets that have a bearing on the relationship between soils and other possible uses need to be developed. There is also a need to extend the benefits of NASREC-type experience to other places in order to create balance in data distribution. In particular more Asian countries should be involved.

The foregoing clearly suggests that still an important role exists for ISRIC to play in the future. However, before continuing the NASREC activities, ISRIC, assisted by present NASREC's and others, needs to do an audit to firmly establish where and what sort of gaps exist in the current data sets and what sort of needs are felt that are demanding additional data. In addition, a future role for ISRIC is perceived to include the following:

- Extension of the NASREC work to other parts of the globe and facilitate networking of the NASREC partners
- Identification of new focus areas to generate data that can be used in environmental (as opposed to only agricultural) issues. This should include development of pedo-transfer Functions for practical applications in the field, especially by non-soils people
- Continuation of its correlation function
- Establishment of regional focal points to achieve the foregoing objectives, in particular the first one.

4.7.2 On Regional Focal Points

(Chair: R.D. Fall - Senegal)

Reasons and needs for regional focal points

Regional focal points will be important for the following reasons:

- Decentralization of ISRIC's work[1], especially on
  - * Increasing attention on information transfer and dialogue with different groups of users of soil information
  - * Focusing on the issues of environmental quality and sustainable use of soil
- Economization of resources by promoting exchange and use of information and experiences between countries as well as centralizing capacities of training, teaching and fund raising
- Facilitatation of the grouping and awareness of regional problems
- Contribution towards Environmental Impact Assessment of soil problems
- Strengthening of interest of policy makers to soil problems in a specific region. Solutions of land degradation often depend on decisions of policy makers of different countries inside a region
- Bridging national and international levels and establishment of a base for international cooperation
- Development of more dynamic exchange of expertise, transfer of technology between countries and share of information and techniques
- Reinforcement of national centres.

Tasks of the regional focal points

- Serve as regional training centre
- Interest donors and raise funds for regional activities
- Initiate and maintain soil monoliths, databases and publications generated in the region
- Be an information centre for the region, especially with respect to keeping an record of regional soil scientists
- Formulate soil application activities in the region and assess environmental impacts of soil problems in the region
- Organize periodic workshops for NASREC
- Create working groups on specific soil problems in a region and their environmental impact
- Maintain linkages with international centres, NGOs, etc. active in the region.

[1] Decentralization of ISRIC work must not lead to discontinuation of ISRIC support to selected items of activities depending on the region.

Criteria to implement regional focal points

The selected centre must:

- Be an innovative and progressive institute on soil science and related disciplines
- Have sufficient infrastructure especially in communication to facilitate training, workshops etc.
- Be accessible and convenient to all members with respect to geographical location
- Be located in a country with a relative political stability.

Organisational matters

Three main points were made concerning organisational matters:

- Specific working groups must comprise members working at regional and international centres
- Training courses and workshops have to be rotated among member countries provided criteria, as indicated under above are satisfied
- Regional focal points are to be coordinated by internationally renown soil scientists from the region.

Number of regional focal points per continent/region

Identification of regional focal points based on agro-ecological zones was not ideal. Grouping on a continental basis seems to be more rational.

Two scenarios can be developed for the distribution of regional focal points, considering a continental base:

Africa	2	3
Latin America	2	3
Asia	2	2
Indonesia-Australia	2	2
North America	1	1
Europe	1	1

Translation of ethnopedology

Considering that in several regions soils and ethnics do not respect country boundaries, the item of ethnopedology (see Working Group 1 of Session 2, p. 13) and correlation must be researched. With respect to languages English must be used to translate the different ethnopedological classifications.

4.7.3 On Simplification of Soil Science Language at National Level

(Chair: O. Doumbia - Mali)

Clients

NASREC clients are:

- Universities
- Agricultural research institutions
- Agricultural extension
- Environmental agencies
- NGO's
- Engineers (roads, irrigation)
- Planners, administrators, policy decision makers, politicians
- Educational institutions
- Tourists
- Farmer training centres
- Farmers
- General public
- Donors
- Local and institutional consulting agencies
- International institutions (e.g. UNEP, IFPRI, ISNAR).

Products

At present, NASREC products can be considered:

- Training packages (courses)
- Application software packages (SOILIMS, GIS, SOLGRAPH)
- Publications (Soil Briefs, Country Reports, Maps)
- Audio visual aids (slides, videos, posters)
- Soil monolith exhibition
- Databases (with site & profile data, e.g. SOTER, ISIS).

Constraints

Among the constraints identified which affect the communication with the user, are:

- Training language (at ISRIC level)
- Training (national level) of our target groups
- Information (data) as offered by NASREC is too technical for some of the user groups
- Very limited dissemination of information from NASREC to users due to the relative high costs of the information
- Lack of collaboration with other institutions with similar or additional data sets
- Too technical/scientific information
- Limited or no budget allocation
- Communication gap among soil scientists and clients (especially policy/decision makers, farmers).

Recommendations

1. Each NASREC centre has to deliberately target a specific category of users (soil scientists, non-soil scientists, or non-professionals). A university NASREC, for example, may not target farmers and the general public.

2. NASREC centres need to have an official recognition and status at the institutional level.

3. NASREC coordinators have to meet regionally once in two years and internationally every four years to exchange experiences and to catch up with new developments (notwithstanding networking). ISRIC is to facilitate such regional and international meetings.
   Regions proposed are:
   - East, West and Southern Africa (Anglophone)
   - Central, West and Northern Africa (Francophone)
   - South and Central America (Spanish)
   - Asia, including the Indian subcontinent.

4. Regional NASREC coordinators need to be trained regularly in ISRIC software packages, communication skills, networking, public relations, and research-extension liaison.

5. For those NASRECs targeting farmers and the general public, NASREC resource persons should get acquainted with the grassroot level and the lower levels of local organizations. Of importance is participation during community gatherings and activities. These include:
   - farmer field agricultural demonstration days
   - soil and water conservation activities
   - agricultural farming training courses
   - NASREC organized workshops with local administrators, progressive farmers, opinion leaders ("Training for Trainers").

6. NASRECs can be better considered as "Service" rather than "Research Centres". They should make use of the knowledge and information available, and also make use of services and contacts of national, regional and international organizations and networks (eg. SOFERNET, GRID, GEMS).

7. Simplified information is to be used to disseminate soil awareness messages through:
   - brochures, posters, etc., both in national and local languages
   - audio-visual media (radio, television, video, Internet, etc.)
   - training workshops at district/local level.

   Technical details are to be avoided. A participatory approach is advocated ("Do not attempt to discuss soil issues with farmers by lecturing or teaching. They either know better or you may not win their confidence. Remember the age generation gap.").

8. A budget should be made available and allocated by the government (national, district or local level), or by international institutions or donor agencies for continuation of the NASREC programmes.

4.7.4 On Institutional Collaboration at National Level

(Chair: D.P. Turner - South Africa)

The NASREC location

Before establishing NASREC activities, the location of such an institution should be identified and negotiated so that it is accessible to all the natural resource institutions.

Cooperating institutions

- Identify all national institutions with natural resource data, expertise and facilities
- Negotiate for joint agreement for transfer, exchange, joint participation or sale of relevant national resource data.

  Possible co-operating institutions could be:
  * Water
  * Forestry
  * Environment
  * Earth sciences
  * Botanical Research
  * Universities
  * Socio-economics and statistics
  * Meteorology
  * Land tenure affairs
  * Municipalities and Local Authorities
  * Institutes for Agricultural Research
  * Agricultural extension

Activities of NASREC

- Building soil expositions with supporting materials including bulletin materials
- Developing soil profile data bases
- Training services
- Basic training courses
- A national NASREC could also be linked to activities such as:
  * SOTER
  * Soil reference collections
  * STRING
  * Soil and land related databases (this implies soil and land data bases related to subjects such as soil fertility, engineering, regional and town planning, hydrology, salinity, meteorology and others as the national NASREC may consider necessary)
  * Soil laboratory methods and management
  * Data source and facilitation centre for modelling and solution of specialized problems
  * Education centre
- Increasingly act as a facilitation centre to disseminate information

- Centres may well have to shift focus towards communicating:
    * National awareness of environment and soil
    * Sustainable soil use research, debate and implementation
- Special attention should be paid to ethnopedological studies.

Mode of collaboration

- There are several areas for collaboration namely:
    * Data collection, storage and maintenance aspects
    * Data processing aspects
    * Data dissemination aspects
- To achieve a desired product; data, expertise, facilities and funding may be outside the NASREC centre and collaboration may be necessary. Collaboration could be as follows:
    * Free release of data, expertise and provision of facilities
    * Exchange of data
    * Joint participation and sharing of results and costs
    * Exchange with recognition of the source of data expertise or facilities
    * Sale of data and interpretations

Organization

- The national NASREC should be located as an institute which meets minimum criteria and is thus a recognized national centre. The criteria could be from:
    * Staff
    * Equipment
    * Office accommodation
    * Longer term commitment to NASREC and soil or national resource research
    * Well accepted by the National Soil Research Institute, Universities, Government/ Provincial Ministries and other influential institutes.

Figure 1 gives an organizational chart and possible linkages.

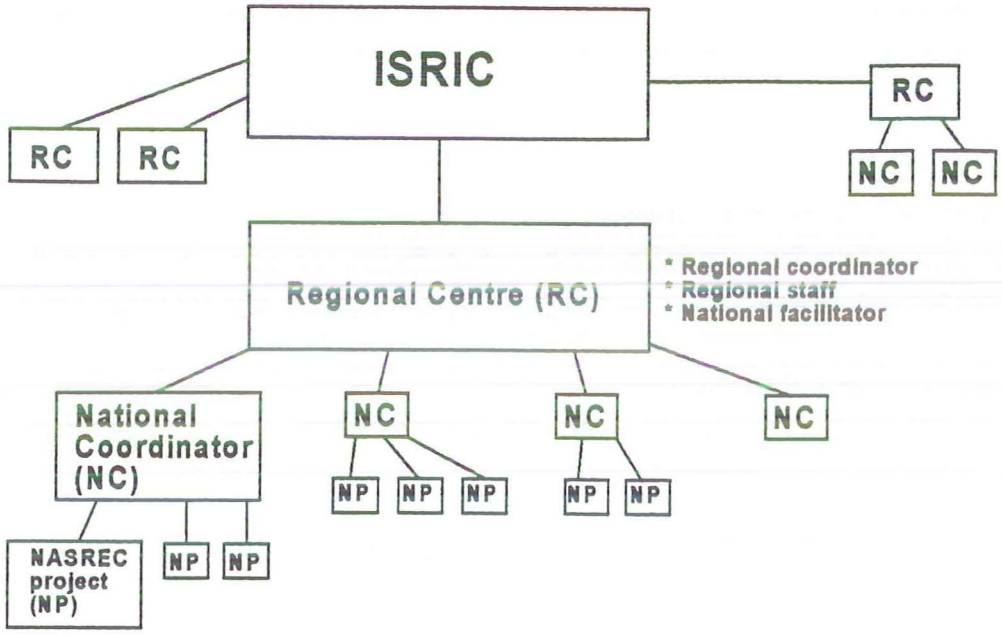


Figure 1 Organizational chart and possible linkages with national, regional and global soil reference and information centres

4.7.5 On Client-Product Development

(Chair: R.D. Concepcion - Philippines)

The product development mission

Improvement of soil productivity and creation of a land use system and rural environment that sustains better quality of life and reasonable family incomes.

Understanding the clients

- Who are they?
- What are their living environments?
- What forms of products are acceptable and accessible?
- Where are they located?

Principles of product development

- Before any product development takes place, potential clients must be contacted to survey their needs and to accommodate their wishes. Otherwise no product will sell!
- The product must convey and contain the following messages:
    * Prevent and/or reduce further incidence of resource scarcity in:
        . Water
        . Food
        . Income
    * Topic and problem-specific
    * Client-sensitive
    * Reactive to development policies
    * Adopt a common knowledge approach
- Appropriate marketing medium/vehicle
    * Soils and its environment are the key information for successful Environmental Impact Analysis (EIA)
- The product supply and market analysis results in the following overview:

Potential users	Potential products (forms and types)
Government / Rural Development Workers * small farmers * low productivity areas	Resource information, maps, data, technologies
Private entrepreneurs	Location and decision map, indicating rich soil sites and suitable sites for the development of specific crops and livestock, housing and other development infrastructures
NGO's	Appropriate training and site specific technology packages, thematic information and indigenous practices
Farmers	Appropriate soil management technologies, cropping systems, practical indicators of soil fertility
Policy makers	Site and culturally specific soil utilization and land use management; location of high risk soil areas; simplified decision maps that will assist them in making legislations to improve the low-income farmer situation and decide on properly support infrastructure * Soil management and suitability map * Land use map * Risk assessment map . Flood prone soil areas . Acid soils, saline-salinity prone areas * Drought-prone areas * Unstable soil areas

The product

The product will have to consist of a package of practical, useful, transferable, affordable information, data, knowledge and technologies on the proper utilization and management of soils and its environment.

4.8 SESSION 11: PLAN OF ACTION

4.8.1 Conclusions

1. The apparent gap between users of land and producers of information on natural resources may be bridged by correlating indigenous knowledge with internationally and nationally accepted scientific know-how (*concept of ethno-pedology*), and by stimulating a "participatory development technology approach" as learning medium for land users and scientists alike.

2. Recommendations on sustained utilization of land should be based on high quality data on geo-referenced databases on land and water resources. Cooperation between natural resource data centres must be promoted to enhance optimal use of existing data and to avoid duplication. Collaboration between land resource, social and economic institutions is required to address adequately present complex sustainable agriculture and environmental issues.

3. Techniques and methodologies should be inventoried and/or developed to translate scientific knowledge about land degradation, rehabilitation and conservation into recommendations which are tailored to the different groups of users.

4. Strategically located land resource data centres with an established record can act as regional focal points for training and exchange of information in order to better focus on regional environmental aspects and needs and to strengthen South-South cooperation. Such focal points should link up with appropriate networks and maintain strong ties with ISRIC as the coordinating and backstopping centre.

5. ISRIC as ICSU's World Data Centre on Soils should: facilitate world-wide networking of present and future national and/or regional soil reference and database centres; identify and address focus areas on environmental issues; continue correlation, harmonization and standardization of soil and terrain data sets; develop database applications for land use planning and environmental research; and enhance public and global awareness of the nature and importance of soil as non-renewable natural resource.

4.8.2 Recommendations

1. Land resource institutions should initiate participatory approaches with the user of soil and terrain data to maintain and upgrade their role as a service centre for providing user-oriented information at different levels of aggregation.

2. Training opportunities should be provided for natural resource scientists in land resource information technologies, such as the establishment and use of soil reference collections, development of databases, application of geographic information systems to soil and terrain related issues, and use of soil laboratory management systems to improve data quality.

3. Strategically placed land resource centres should be mandated to serve as regional focal point for more efficient and cost-effective facilitation of data collection, of information dissemination and for training regional scientists. Where possible, such regional focal points are to establish links with appropriate present and future networks.

4. The role of ISRIC as a global coordinating and supporting centre, as a training centre on information technology, and as a research centre for the development of user-oriented application programmes for the optimal utilization of the land and water resources should be strengthened.

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ISRIC STAFF MEMBERS INVOLVED IN THE WORKSHOP

M. Ahmad (monolith preparation)
J.H.V. van Baren (Deputy Director)
N.H. Batjes (Organizing Committee)
K.J. Berendsen (computer support)
W.C.W.A. Bomer (graphical designer)
A.B. Bos (ISIS, slide/map database)
E.M. Bridges (exhibition)
J. Brussen (finances)
J.A. Dijkshoorn (SWEAP)
V.W.P. van Engelen (SOTER)
J.R.M. Huting (correlation laboratory data)
J.C. Jonker-Verbiesen (Librarian)
Y.G.L. Karpes-Liem (Workshop secretary)
J.H. Kauffman (Organizing Committee)
G.W.J. van Lynden (ASSOD, SWEAP)
S. Mantel (land evaluation)
L.R. Oldeman (Director)
L.P. van Reeuwijk (SOILIMS)
J.W. Resink (GIS)
H. Soekhram (general services)
O.C. Spaargaren (Organizing Committee)
P. Tempel (ISIS, SWEAP)

APPENDIX 2: PROGRAMME

Su Nov. 5 Arrival of participants. Accommodation in WICC/Residence, Wageningen.

1600 Information/Registration
(J. Brussen, Y.G.L. Karpes-Liem and J.H. Kauffman)

Mo Nov. 6 0830 Registration

0900 **OPENING SESSION**
Chair: L.R. Oldeman
Welcoming of participants

0945 Introduction to the workshop *(J.H. Kauffman)*

1030 Coffee/tea break

SESSION 1: Introduction and general experience
Chair: J.H.V. van Baren

1100 Data needs for sustainable agriculture *(P.R. Goldsworthy, ISNAR)*

1130 Soil survey: perspectives and strategies for the 21st century *(A. Zinck, ITC)*

1200 ILEIA's programme on ecological-informed agriculture
(C. Lightfoot, ILEIA)

1230 Lunch

1330 Establishment of soil reference collections: reports from
- India (KAU)
- Cuba (INICA)

1500 Coffee/tea break

1530 Preparation for general review (session 2) *(G. Muller)*

1700 ISRIC exposition *(O.C. Spaargaren, J.H.V. van Baren and E.M. Bridges)*

1730 Welcome drink

1900 Break

Tu Nov. 7 **SESSION 2: General review: Reaching user groups**
Chairs: G. Muller and N. Röling

0900 Introduction

0915 General review: use of, and demand for soil information

1030 Coffee break

1100 Introduction to user groups and technology transfer *(N. Röling)*

1145 Plenary discussion

1230 Lunch

1330 Summary of general review *(J.H. Kauffman)*
1345 Briefing on procedures for working group discussions
1400 Formulation of discussion points and formation of working groups
1515 Coffee/tea break
1545 Working groups (*continued*)
1615 Reports by the working groups in plenary session
1700 Summary of session 2
1730 Break

We Nov. 8 **SESSION 3: Physical land qualities**
Chair: selected from participants
0900 Introduction lecture on physical land qualities *(J. Bouma)*
0930 Assessment of physical land qualities: reports from
- Indonesia (structural properties)
- Mali (water use efficiency)

1030 Coffee/tea break
1100 Visit to Wageningen market
1300 Assessment of physical land qualities (*continued*): reports from
- Ethiopia (erosion)
- Lesotho (soil conservation)

1400 Formulation of discussion points and formation of working groups
1430 Working groups
1530 Coffee/tea break
1600 Working groups (*continued*)
1630 Reports by the working groups in plenary session
1730 Break

Th Nov. 9 **SESSION 4: Chemical land qualities**
Chair: selected from participants
0900 Introduction to chemical land qualities *(H. van Reuler)*
0930 Assessment of chemical land qualities
- Brazil (soil acidity)
- Costa Rica (organic matter management)

1030 Coffee break
1100 Assessment of chemical land qualities (*continued*)
- Pakistan (salinization)
- Ghana (nutrient depletion, "soil mining", Soil Fertility Network)

1200 Plenary discussion
1230 Lunch

1330 Formulation of discussion points and formation of working groups
1400 Working groups
1500 Coffee/tea break
1530 Working groups (*continued*)
1630 Reports by the working groups in plenary session
1730 Break

Fr Nov. 10 **SESSION 5: Consultation on sources and quality of environmental data**
Chairs: P.R. Goldsworthy and S.W. Duiker (ISNAR)
0900 Introduction to the topic and formation of working groups (ISNAR representative)
0945 Working groups: Inventory and comparison of data sets available per country
1030 Coffee break
1100 Working groups (*continued*)
1230 Lunch

1330 Presentation and discussion on the UNEP-GRID project *(C. Heberlein, UNEP-GRID Arendal)*
1430 Working groups: The data needs of National Agricultural Research Systems (NARS) and their access to environmental databases
1530 Coffee/tea break
1600 Working groups (*continued*)
1630 Plenary session: Formulation of recommendations to national governments and institutions, to CGIAR centres and to GRID on quality of base-line data and measures needed to improve the current situation
1730 Break

Sa Nov. 11 Possibility for individual discussions on project proposals with ISRIC staff members; otherwise free

Su Nov. 12 Free

Mo Nov. 13 **SESSION 6: Computerized data handling-I: FAO-AEZ, ISIS 4.0, DIAGNISIS and SOLGRAPH**
Chair: O.C. Spaargaren
0900 Introduction to FAO Agro-Ecological Zonation (AEZ) *(J. Antoine)*
1030 Coffee break
1100 Demonstrations using AEZ
1200 Introductions to ISRIC databases: ISIS, SOTER and WISE *(N.H. Batjes)*
1230 Lunch

Chair: N.H. Batjes

1330 ISIS 4.0 *(P. Tempel and A.B. Bos)*
SOLGRAPH *(J. Brunt and J.H. Kauffman)*
DIAGNISIS *(O.C. Spaargaren)*

1530 Coffee/tea break

1600 Hands-on exercises using ISIS 4.0, SOLGRAPH and DIAGNISIS

1730 Break

Tu Nov. 14

SESSION 7: Computerized data handling-II: E-mail/Internet, SOTER, SWEAP, ALES-STRESS, WOCAT and WISE

Chair: N.H. Batjes

0900 E-mail/Internet *(staff I&D, M. Polman, Antenna)*

1030 Coffee break

1100 SOTER including SWEAP *(V.W.P. van Engelen)*
WOCAT *(G.W.J. van Lynden)*
ALES-STRESS *(S. Mantel)*

1230 Lunch

Chair: O.C. Spaargaren

1330 Demonstrations using ALES-STRESS

1500 Coffee/tea break

1530 Demonstrations using SWEAP *(P. Tempel)*

1615 Validation and calibration of erosion assessment
(J.A. Dijkshoorn and B.G.J.S. Sonneveld, SOW-VU)

1700 WISE *(N.H. Batjes)*

1730 Break

We Nov. 15

SESSION 8: Computerized data handling-III: Crop simulation models

Chair: J.H. Kauffman

0900 Introduction to crop yield simulation models *(H. van Keulen)*

1030 Coffee break

1100 Demonstrations using crop growth models *(F. Penning de Vries)*

1230 Lunch

SESSION 8: Computerized data handling-III: Evaluation
Chair: V.W.P. van Engelen

1330 Formulation of discussion points (upscaling and downscaling, use of databases, models, expert systems vis-à-vis clients, etc.) and formation of working groups
1400 Working groups
1530 Coffee/tea break
1600 Working groups (*continued*)
1700 Reports of the working groups in plenary session
1730 Break

Th Nov. 16 0900 **Optional activities**

- Establishment of national soil reference collections and discussions on individual project proposals *(J.H.V. van Baren and J.H. Kauffman)*
- Soil monolith preparation *(M. Ahmad)*
- Demonstrations of slide, map and library databases *(A.B. Bos)*
- Visits to various sections of ISRIC (library, laboratory, GIS section, etc.)

1000 Coffee/tea break

SESSION 9: Correlation studies and analytical procedures
Chair: L.P. van Reeuwijk

1030 Correlation study of analytical data *(J.R.M. Huting and L.P. van Reeuwijk)*
1100 Good laboratory practices (GLP) and laboratory information and management system for small- and medium-scaled soil and plant laboratories (SOILIMS) *(L.P. van Reeuwijk and J. Brunt)*
1200 Lunch

SESSION 10: Forum discussion on user-oriented information transfer

1330 Brief introductions by panel members *(W.G. Sombroek (chair), R. Fall, C. Lightfoot, N. Röling and A. Zinck)*
1415 Plenary discussion
1530 Coffee/tea break
1600 Plenary discussion (*continued*)
1700 Conclusions and recommendations
1730 Break

1800 Reception

Fr Nov. 17

SESSION 11: Plan of action
Chair: L.R. Oldeman

0900 Presentation of, and discussion on proposed follow-up activities
1000 Coffee/tea break
1030 Plenary discussion on summary of recommendations of NASREC's evaluation panel and planning of future NASREC activities, including possible role of ISRIC in follow-up activities
(introduction by L.R. Oldeman)
1230 Lunch

1400 Plenary discussion *(continued)* and formulation of workshop recommendations
1500 Coffee/tea break

1600 **CLOSING SESSION**
1700 End of workshop

Sa Nov. 18 Departure of participants

APPENDIX 3: NASREC QUESTIONNAIRE

1 INSTITUTE

Name and full postal and visiting address of the institute responsible for the NASREC project

Name :
Visiting address :
Postal address :
Telephone :
Fax :
E-mail :

National institution (e.g. Ministry) within which the NASREC project activities take place.

2 SOIL EXPOSITION

2.1 General

Visiting address:
[Give full name and address if the exposition is housed in a location different from the visiting address mentioned above]

Name of person(s) responsible for the exposition

Opening hours:

days: am: pm:

Are guided tours for individuals/group visitors available?

2.2 Materials/equipment

Are impregnation lacquers, dermoplast (=non-glossy lacquer used for the final spraying of the monolith surface) and other required materials/equipment available (if locally available include price per liter of lacquer and dermoplast, if no price is known, please give an estimated price in national currency and US $ equivalent).

2.3 Composition

Give the composition of the reference soil exposition:

number

No. soils Classifications Location Major ecological zones

[please attach this information separately in a table]

2.4 Organisation of the exposition

What is the first level grouping of the exposition? It is according to ecological zone, classification or otherwise. If otherwise, please specify. What is the second level grouping? Are there special topics, etc.? Please specify which classification system is used: FAO 1988, FAO 1974, Soil Taxonomy 1975, 1994 or other edition, or specify other system.

2.5 Poster information in the exposition

a What kind of explanatory information is linked to the reference soils?

b Is there a plan/sketch of the exposition? (if available please send a copy to ISRIC)

[Slides of the exposition are welcome for inclusion in the ISRIC slide collection]

2.6 Users of the exposition

a Specify anticipated user groups (before the NASREC project)

b Specify present visitors and, if known, specify names of main visiting institutions
[university students, agricultural schools, extension services, secondary schools, etc. etc.]

c Give number of persons visiting the exposition : [estimated total per year]

---

c list major wishes and suggestions of users for improvement of the exposition:

2.7 Constraints

Describe major constraints of present situation:

2.8 Future

1. Describe any expansion or other development plans.
2. Is there a plan for monitoring of changes in reference soils induced by land-use changes (re-visiting the original sampling sites)?

3 DATABASE AND APPLICATION PROGRAMMES

3.1 System

Which database program is currently used for the storage of reference soil information?
[ISIS version 3, FAO-SDB, or specify other]. *Please note that the current ISIS version 4 will be made available to all participants during the workshop, including the necessary transfer of data from version 3 to version 4 (assuming that dBase 4 is available or will be purchased by yoru institute).*

3.2 Applications

What kind of commercially available and in house developed dataprocessing program facilities are currently used:

3.3 Users

Specify present and potential users groups (mention institution names)

[reference can be made to question 2.6, specify here only additional users]

3.4 Constraints

Describe major constraints of present situation:

Future

Describe future developments [expansion, linkage or transfer to other databases, etc.]:

4 PUBLICATIONS/DOCUMENTATION

State type and present status of the information on reference soils:

4.1 Country Report
Give number of reference soils and status of report (in preparation, draft, 1st edition). See attached status of Country Reports, which was made according to our present information.

4.2 Soil Briefs
Give (a) number of Soil Briefs, (b) number of reference soils, (c) the criteria for selection/grouping, and other relevant information.
See attached status of Soil Briefs, which was made according to our present information.

4.3 Simplified brochures:
Specify type, number of pages, which language, status, etc.

4.4 Other documentation
Other publication/documentation/maps, with information on reference soils. E.g. museum guide, catalogue, soil survey reports, etc.

4.5 Users
Specify present and potential users groups.

[reference can be made to questions 2.6 and 3.3, specify only additional users]

5 GENERAL

5.1 User (group) contact

Have user groups been consulted before the setting up of the soil exposition and/or the preparation of publications/documentation about reference soils?

a If yes, summarize the major interests of user groups.

b If no, what are the reactions/wishes of the present users of the soils exposition and or publications/documentation?

5.2 General transfer of soil information

Describe/evaluate present problems encountered in the transfer of soil/land resources information in general and indicate possible solutions, other instruments/methods, etc.

5.3 Integration of soil/land information with other disciplines

Summarize important agricultural topics in your country/state/region where soil/land information may be of assistance or is required (and where reference soils may contribute in the field of extension, training or research).

5.4 Electronic mail/Internet

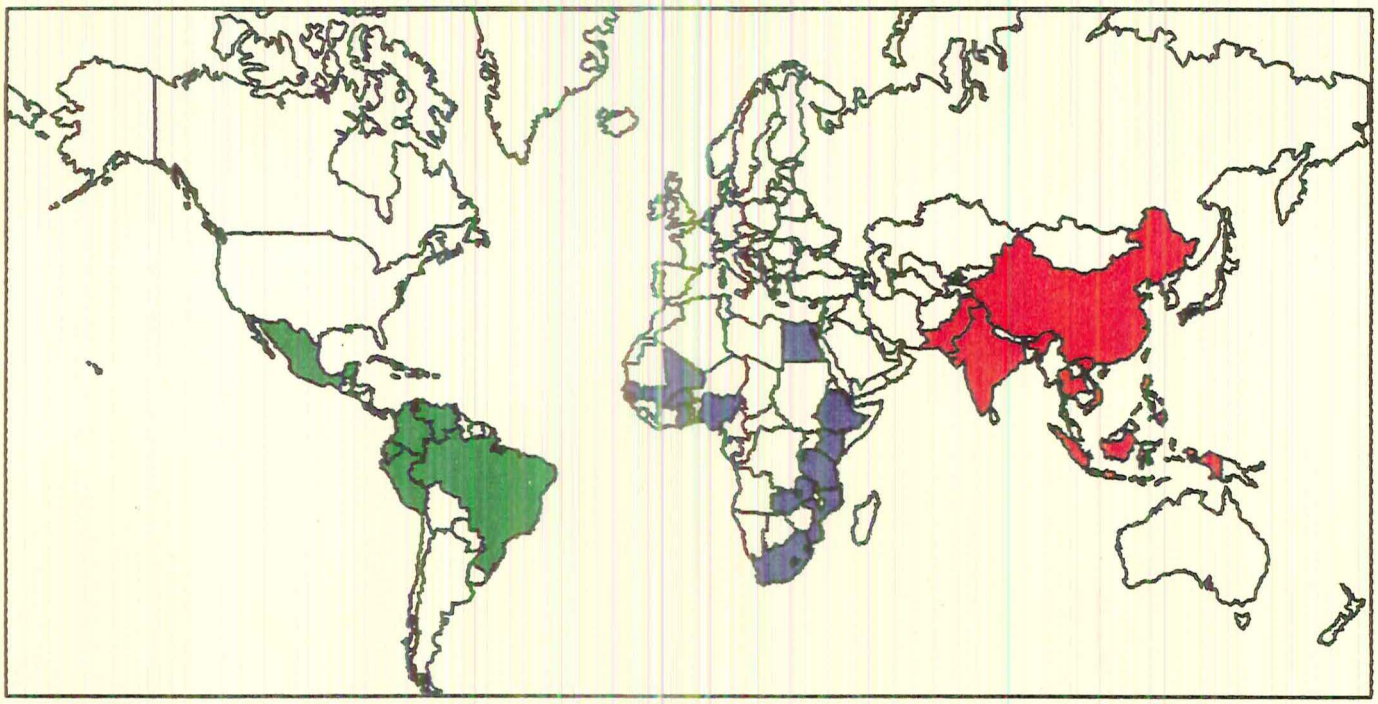
a Present status: your address code, if you do not have a connection planned, is one planned?
b Is there a national node where you could obtain relevant information?
c Summarize present uses.
d Describe wishes for future information transfer.

5.5 Other ISRIC activities/projects

a Do you receive ISRIC (bi)-annual reports?
b Are you aware of other ISRIC activities, e.g. SOTER, SOILIMS, WISE, ISRIC's library/map & slide collection *(please note that ISRIC is presently updating his map collection and will request you for assistance at a later date)*
c Are you interested to receive information on ISRIC activities?

A WORLD WIDE PLEDGE

We undertake to listen to the users demands for soil information and to develop user friendly products to satisfy their needs:



Brasil

Colombia

Costa Rica Donald L. Kass

Cuba

Ecuador

Mexico

Peru (1)

Peru (2)

Venezuela

Burkina Faso

Egypt

Ethiopia

Ghana

Kenya

Lesotho

Mali

Mocambique

Nigeria

Senegal

South Africa (1)

South Africa (2)

Tanzania

Zambia

China

Indonesia

Pakistan

Philippines

Taiwan

Vietnam

India (1)

India (2)

India (3)

Thailand