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LAND RESOURCES INFORMATION SYSTEMS IN THE NEAR EAST

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Preface

A Regional Workshop on Land Resources Information Systems in the Near East was held in Cairo, Egypt, 3 to 7 September 2001. The meeting was organized by FAO Land and Water Development Division (AGL) and Near East Regional Office, in cooperation with Egypt's Executive Authority for Land Improvement Projects (EALIP), Cairo.

The purpose of the meeting was to promote Land Resources Information Systems and their application in the assessment, mapping and monitoring of land in relation to food security and sustainable development in the Near East countries. The workshop was attended by 11 countries of the Region and four Regional Organizations – Arab Organization for Agricultural Development (AOAD), United Nations Economic and Social Commission for Western Asia (ESCWA), League of Arab States, and United Nations Environment Programme (UNEP) Regional Office, Bahrain. Developments in Land and Water Information Systems, preparation of national/regional land and water reports and future collaboration in the AGL Gateway global network were discussed.

The resources persons contributed by sharing their experiences from their respective countries and organizations and assisted in the preparation of the plan of action to promote future reporting and exchange of information in the region. Preliminary country reports on the state of land, water and plant nutrient resources based on the Gateway **guidelines** and **checklist** were presented and discussed. A plan of action was established to finalize the country reports. The reports will be available on-line in the Gateway web page in due course.

The meeting recommended the translation into Arabic of the AGL multilingual soil database software for Windows (SDBm) for distribution and use by soil and land management institutions in the region. The meeting also recommended the preparation of a regional project on capacity building for the application of LRIS systems in drought mitigation programmes in the region.

Acknowledgements

This report was compiled by Mr S. Masui and Mr Jacques Antoine and edited by Mr R. Brinkman. Thanks are offered to the persons who made valuable contributions to the workshop report, particularly Mr G. Hamdallah and Mr M. Gomaa.

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Acronyms

AEZ	Agro-ecological Zoning
AGL	Land and Water Development Division, FAO
ALES	Automated Land Evaluation System
AOAD	Arab Organization for Agricultural Development
APT	Agricultural Planning Tools
CDE	Centre for Development and Environment, University of Bern
ESCWA	United Nations Economic and Social Commission for Western Asia
DEM	Digital Elevation Model
EALIP	Executive Authority for Land Improvement Projects, Egypt
FAO	Food and Agriculture Organization of the United Nations
GIS	Geographic Information System
LRI	Land Resource Inventory
LRIS	Land Resource Information Systems
LWRIS	Land and Water Resources Information Systems
MNRAUP	Mapping of Natural Resources for Agricultural Use and Planning
MCMA	Multi-Criteria Model Analysis
NSWA	National Sewerage and Water Authority, Egypt
RNE	FAO Regional Office for the Near East
SARD	Sustainable Agricultural and Rural Development
SDBM plus	Multilingual Soil Database software
SOTER	Soils and Terrain Database
TCP	Technical Cooperation Programme, FAO
UNDP	United Nations Environment Programme
WAICENT	World Agricultural Information Centre, FAO
WOCAT	World Overview of Conservation Approaches and Technologies

Summary report and recommendations

Member Countries of the Near East vary in the type, quantity and format of the inventories of their land resources. Quite often, these data are sporadic, incomplete, out of date or based on diverse systems of land and soil classification and mapping. There is a need for the establishment of a user-friendly database on Land and Water Resources for each country, in a "capsule" form, to be available at the desktop of land use planners and decision makers.

Several countries have made significant progress towards having an up-to-date land inventory and map, such as Jordan, Morocco, Oman, Saudi Arabia, Syria, Tunisia and Yemen. Egypt, with FAO assistance, carried out a pilot project whereby a friendly website/gateway on land and water resources was established.

The purpose of these efforts is to enhance the capacity of countries to monitor the state of land and freshwater resources in terms of availability or scarcity, quality and trends in use, in order to facilitate sound decisions on their sustainable use worldwide. The Reports are to be prepared by country and by region. They are to be compiled in the form of a digital atlas to be made available through the Internet and on CD-ROM. The national report is addressed to planners and decision-makers in Government ministries, to donor agencies, researchers and University students, but also to the public at large.

This Workshop benefited from the Egyptian experience gained in creating this database and in establishing its Internet linkages. The Workshop has facilitated initiatives by the Countries in the Near East to harmonize the type, content and format of their land resources inventories, improve the quality of the land use and soil classification and mapping systems, and make further advances towards establishing a reporting system providing up-to-date information on the use and trend in the development of land resources.

Objectives

This workshop was the first meeting on this subject in the Near East region. It was organized by FAO's Land and Water Development Division and Near East Regional Office in collaboration with the Executive Authority for Land Improvement Projects (EALIP) of Egypt. The objectives of the Workshop were to:

- Exchange knowledge and experience among officials involved in land and water resources management and land use planning; in the collection, analysis, dissemination and use of land resources information; and in the assessment and monitoring of land in relation with food security.
- Inform participants on modern land resources information tools, in particular the FAO/AGL Gateway and its use for producing land information and statistics; as well as disseminating them, via the Internet.
- Discuss future participation of the interested countries in the FAO/AGL Internet-based network Gateway on Land and Water Information.

- Discuss ways to better harmonize the collection and presentation of land resources data at the regional level.
- Discuss the needs of countries in the Near East Region in capacity building of their national land resources institutions.

WORKSHOP ATTENDANCE AND VENUE

Senior land and water resources specialists from Egypt, Iran, Jordan, Lebanon, Libya, Morocco, Oman, Sudan, Syria, Tunisia, Turkey and Yemen participated in the meeting. Besides representatives from these countries, natural resources management specialists from four Regional Organizations (AOAD, ESCWA, League of Arab States, and UNEP Regional Office/Bahrain) attended the meeting. Mr G. Hamdallah, Regional Soils Officer (FAO/RNE), Mr S. Masui and Mr J. Antoine (FAO/AGL) formed the secretariat of the workshop. Egypt was chosen as the site of the meeting because EALIP has one of the best infrastructures in the region, including a national LRIS system and excellent meeting facilities.

The list of participants is given in Annex 3.

WORKSHOP ACTIVITIES

The opening session was presided over by Eng. Dawoud, Chairman EALIP, who delivered the welcome address (Annex 1). Welcoming and introductory remarks were presented by Mr G. Hamdallah on behalf of Dr Bukhari, ADG, and RNE (Annex 1). At the end of the workshop, Mr Hamdallah also gave the vote of thanks to EALIP and the persons responsible for the workshop organization.

The workshop focused on existing Land Resources Information Systems (LRIS) in the region. It demonstrated their operation and practical application in the assessment, mapping and monitoring of land in relation to food security as well as in the preparation of reports on the state of agricultural land and water use and development. The workshop discussed the methodology for preparation of the reports, the techniques of information dissemination for practical use in food security programmes and actions in the field, as well as the use of modern electronic communication tools, including the Internet. It also discussed ways to promote future exchange of information, data expertise and experiences in land information in the region using Technical Cooperation among Developing Countries (TCDC), and the preparation and updating of national reports and a regional report for the Near East countries. The workshop programme is given in Annex 2.

The workshop technical sessions addressed the following main topics:

- Development and Application of Land Resources Information Systems in FAO and EALIP
- National Information on Land, Water and Plant Nutrition
- Guidelines for National Land, Water, and Plant Nutrition Report Preparation
- Agreements and resolution regarding the action plan as a follow-up activity of the workshop

Development and Application of Land Resources Information Systems

Three papers were presented on this topic as well as demonstrations in the EALIP GIS unit and in the field.

Jacques Antoine gave an overview of the land and water resources information systems in FAO (Technical paper, page 9). AGL manages the land and water resources information systems. AGL has developed computer-based systems to analyze data and generate information to support decisions on various land and water issues. AGL uses the following five (5) kinds of tools as a means to store and analyze information and generate and disseminate information products for land and water resources management:

- Database tools
- Model tools
- Decision support tools
- Documents and Publications
- Multimedia tools.

Details of the information systems can be found at the following internet site: http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/Aglhomep.htm.

Ghassan Hamdallah discussed the status of development and application of LRIS systems in the region, highlighting the constraints and problems and the perspectives for the use of such systems in the Near East region (Technical paper, page 27).

S.I. Abdul Rahman gave an overview of the use of geoinformation technology for agriculture application in Egypt (Technical paper, page 35). Sachimine Masui gave a demonstration of the Gateway Web site: http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/swlwpnr/swlwpnr.htm (Technical paper, page 43). This includes the Near East templates, which can be viewed at the following address: http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/swlwpnr/y_nr/nr.htm

A visit to the EALIP LRIS Unit was organized by Dr Gomaa of EALIP. EALIP GIS staff presented EALIP's soil management information system including the GIS laboratory. The system is used as a key information and decision support tool in the management and monitoring of EALIP's country-wide land improvement and conservation programme. This was followed by a field visit to Kafr El Sheikh district in the Nile Delta to see the implementation of the various activities involved in the land improvement programme in irrigated areas. These activities include:

- Gypsum application for improving the productivity of sodic soils.
- Subsoiling to improve soil physical properties, break up hard pans, correcting soil compaction and all indurated layers in the root zone.
- Land levelling and reshaping for better water management, and improvement of the field drainage and canal system for the control of salinity and waterlogging.

Issues raised during the visits related to:

- Integration, interfaces and complementarity with existing systems or those being developed by local and regional institutions.
- The requirements of the technology itself such as the use of common software and tools including mapping tools, database management and modeling, GIS, Remote Sensing, and GPS.
- Network and communication facilities, distributed networking and development of an Internet site.

Open discussions on these issues addressed the need for coordination between institutions regarding LRIS; the scale of mapping, criteria in mapping; data standardization, data resolution, quality and documentation, data sharing; the need for a way of thinking that recognizes LRIS as being integrated, multi-disciplinary, interagency and spatial.

However, optimism was expressed with regard to the increasing demand and wide acceptability of GIS-based LRIS technology, which could open up opportunities for grants and financial support.

National Information on Land, Water and Plant Nutrition

After introductory remarks tracing the role of the AGL Gateway of FAO in the development and application of computer-based systems to analyze data and generate and disseminate information to support decisions on various land and water issues, country reports were presented by Egypt, Jordan, Lebanon, Libya, Morocco, Syria, Tunisia, Turkey and Yemen.

The Egypt presentation summarized the report available through the AGL Gateway. The Turkey, Yemen and Morocco presentations summarized complete National reports prepared for inclusion in the AGL Gateway via links with Home pages in the respective countries. Presentations by Tunisia, Syria, and Lebanon addressed the state of the countries land, water and plant nutrient resources and could be used as a basis for preparation of full National reports utilizing the FAO Guidelines. Presentations by Jordan and Libya participants focused on the status of GIS-based Land Resources Information Systems in these countries.

Guidelines for Country reports on land, water, and plant nutrition resources

Jacques Antoine gave an overview of the AGL guidelines and the Internet template (Annex 5, p.82) explaining how the AGL Gateway of FAO is intended as a central node of a distributed network for the dissemination of land and water information via the Internet. A standardized methodology for reporting on the state of land, water and plant nutrient resources incorporated in guidelines was presented. The guidelines are exhaustive and are presented in the form of a checklist of items, which can be followed depending on their relevance and availability of information in any country specific situation. The guidelines are available as an Internet template downloadable from the AGL Gateway.

Agreements and resolution regarding the action plan as a follow-up activity of the Workshop

An inventory of the status of the preparation of the reports was carried out. (Summary table in Annex 4)

Finalization of the reports was discussed. The main points raised by the participants concerning the completion of the reports included:

- Identification of resource persons.
- Identification and access to information and information sources.
- Information extraction, preparation and presentation.
- Accuracy and verification of information.
- Timing of completion.

- Gaining national and regional support.
- Report updating capability.
- Creating awareness at all levels.
- Hosting of the Report (Internet access).

The meeting recognized the need for a plan of action, as a follow-up, to prepare or complete the country reports. The participants agreed to be responsible for the task and incorporate it in their work programme for the following months. In order to address the above issues and collect the necessary information to complete the reports the following procedures and methods were recommended:

The participants will develop a work programme including the following:

- Contact the various stakeholder organizations so as to get other persons involved.
- Sensitize decision-makers and give copy of guidelines and Gateway template to relevant organizations in the country.
- Establish a national Gateway website and identify related Internet sites within the countries and establish links to the site.
- Compile information based on the templates provided by Gateway team in Rome (where maps or data are not available areas can be left blank and other methods or maps used to illustrate the items).
- Foster ownership of the system by hosting available information on the national Gateway site in linkage with the AGL Gateway web site.

The Regional Soils Officer, FAORNE, will follow up with Iran and Oman to encourage them to produce country reports.

The meeting also discussed prospects for follow-up action at the regional level since not all of the countries in the region were represented at the Workshop. (The invited participant from Iran could not attend due to unavoidable circumstances).

The following points were considered in the discussion:

- Need to consolidate country information into a Regional Resource Information database.
- Adoption of the AGL Gateway as a common framework and tool to develop country LRIS, and upscale to a regional LRIS.
- Establishment of an informal network of LRIS in the Near East with access at national and regional levels. (Countries now represented can form a core group).
- Need to assemble the country reports into a regional compilation.

Recommendations

In the light of the above discussions the following was recommended:

- Preparation of a regional project on Capacity Building in LRIS for Drought Vulnerability Assessment and Mitigation for possible TCP funding (Action: G. Hamdallah).
- FAO assistance to the countries in finalizing the country reports in English and Arabic for the Gateway. Reports from countries that do not have access to a local website will be posted on

the AGL Gateway site pending establishment of a local site. Reports will also be distributed on CD-ROM to overcome problems of Internet access in most countries (Action: Antoine).

- Preparation by FAO of a version in Arabic language of the SDBM Plus software for distribution and use in the Near East countries (Action: Antoine).
- Compilation of a regional report (Action: Hamdallah).

Technical papers

Overview of land and water resources information systems (LWRIS) in FAO

Over the last two decades the Land and Water Development Division (AGL) has been at the forefront of the development and application of computer-based data analysis and information systems to support decisions on various land and water issues. Soil and land as well as water systems have been developed. The soil and land systems focus on methodologies and tools for the assessment of global, regional, national and sub-national land resources potentials. The water systems concern irrigation water use and management at field level and regional and national water resources assessment.

AGL has been cooperating with various units within FAO and numerous international agencies and national institutions in developing and applying the systems.

Initially, in the late seventies and early eighties, the systems were developed for mainframe and mini-computers. From the late eighties they were gradually adapted to microcomputers. At the same time computer tools for managing spatial data, including geographic information systems (GIS), remote sensing and global positioning systems (GPS) were introduced. Since the last few years the availability of networked PC workstations, rapid application development and multimedia tools and the Internet have opened an era of new possibilities in the development and application of the systems.

Table 1 summarizes some of the main issues related to sustainable land and water resources management which concern FAO.

Currently AGL systems comprise a set of tools to store and analyse information and generate and disseminate information products for land and water decision. The systems integrate tools of essentially five kinds (Figure 1):

1. Database tools

These include database programme shells for the creation of soil, water, climate, crop and land use databases; and also some databases that have been created using the programmes. Geographic Information Systems (GIS) databases and analytical and visualization tools for rapid production of information products are used to an increasing extent. GIS are useful because of three main qualities:

- the physical computing capacity to manipulate data, including overlay, join, disaggregate;

Jacques Antoine, Land and Water Development Division,
Food and Agriculture Organization of the United Nations (FAO),
Rome

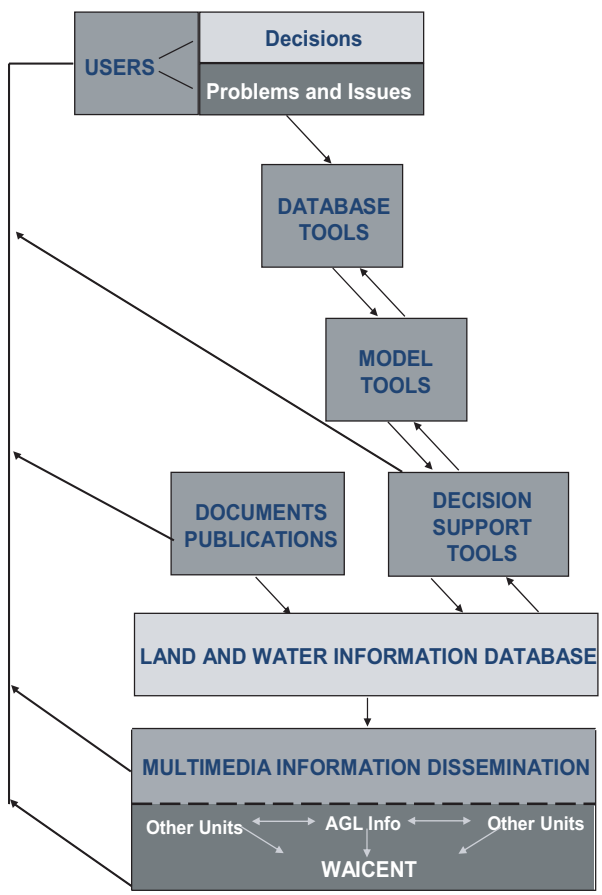
TABLE 1
Scales of land and water use planning and management

Level of analysis	Scale[1]	Issues
Field/production unit (site specific)	<1:5 000	Productive crops and animals; conservation of soil and water; high levels of soil fertility; low levels of soil and water pollutants; low levels of crop pests and animal diseases.
Farm or village (local)	1:1 000-1:50 000	Viable production systems; food requirements, economic and social needs satisfied; awareness by farmers.
Country (national or sub-national)	1:25 000-1:2 500 000	Judicious development of agro- ecological potential and use of irrigation water resources; drought and flood risks; food production and food security; conservation of natural resources and bio-diversity; land degradation; public awareness.
Continent/world (regional or global)	1:1 000 000-1:5 000 000	Land degradation and desertification; preservation of bio-diversity; water sharing; water pollution; population development and food security; climate change and agricultural potential; awareness of regional and global institutions.

[1] A range of scales is indicated at each level of analysis. In practice the scale of an application is selected according to the extent of the area and the availability of maps.

- the related capacity to query the data by formulating hypotheses for testing assumptions defining potential relationships and developing theoretical constructs;
- the capacity to relate two- and three-dimensional locations of earth features with dynamic (time) four-dimensional processes.

FIGURE 1
Information and decision-support systems in AGL



2. Model tools

Models for crop growth and estimation of both potential and actual yields. Crop modeling has proved a valuable and multipurpose tool in land resources management, which can assist in the estimation of crop yields and the prediction of crop shortfalls due to environmental hazards.

Models for water balance, crop water requirements and irrigation requirements. Water modeling is an essential tool of quantitative assessment of water resources for the purpose of planning and managing the efficient use of the resource.

Remote sensing techniques to characterize and map land cover, and land use patterns and to evaluate and

monitor soil and water resources. Remote sensing techniques offer a unique way of quickly assessing land cover and the situation and trends in implementing land management plan. In particular, they can be used to detect biophysical degradation of the land due to improper use or mismanagement. Remotely sensed data can be integrated with other data layers stored in a GIS to derive various kinds of maps, such as of soil moisture condition or land degradation.

3. Decision support tools

Expert systems tools to provide advice on deciding on land and water use and management options, based on available information and knowledge.

Multi-Criteria Decision Support (MCDS) to analyse optimal land and water use scenarios. MCDS tools facilitate interactive negotiations on land and water use. This is because feasible real-world solutions in interactive negotiations are compromise solutions resulting from trade-offs between various conflicting objectives, in order to find an efficient and acceptable balance between the requirements of the different stakeholders in the land and water resources.

4. Documents and publications

AGL has a documentation centre that collects and maintains two kinds of documents:

- a collection of FAO and non-FAO technical documentation (country information, field documents). This includes monographs (acquired or received through exchange);
- a map collection containing thousands of maps that were used in the compilation of the FAO-UNESCO Soil Map of the World, and continuously enriched with new maps. These include maps published by FAO field projects, maps in technical reports, maps published by national institutions or development agencies. The subjects covered are mainly soils, land use, land suitability, agro-ecology, geology, hydrogeology, topography and administrative units for the developing countries and generalized and other maps for the industrialized countries.

The AGL Documentation Centre uses an adaptation of the ISIS software to manage its database. The Centre has a direct link with FAO's main Library databases (FAOBIB and SERIAL) and uses on-line Virtual Library databases (AGRIS, CABI, etc.) for more comprehensive searches; lends and internally circulates documentation, books and serials; and disseminates information and publications produced by AGL.

5. Multimedia tools

AGL uses Internet and Intranet facilities to disseminate information under the umbrella of the World Agriculture Information Centre (WAICENT), FAO's corporate information dissemination system. In this way AGL reaches its target audiences more effectively at reduced processing costs in all phases of receiving, treating and disseminating land and water information.

AGL takes advantage of the three principal interactive and complementary components of WAICENT:

FAOSTAT, for the storage and dissemination of statistical information,

FAOINFO, which covers hypermedia information (text, images, audio and video), and

FAOSIS covering specialized information systems.

In particular AGL uses the services of the FAOINFO Group of WAICENT to prepare the textual, graphic, statistic and tabular information to be placed on the Web.

Description of main information and decision-support system tools used by AGL

There are three kinds of systems, corresponding to the three areas of applications mentioned above:

1. land resources assessment systems;
2. water resources assessment systems;
3. irrigation water management systems.

Details of the information systems are provided at the following internet site:

URL: http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/Aglhomep.htm

Six systems are selected and described below.

1. SDBm Plus: Multi-Lingual Soil Database

Background

The SDBm Plus: FAO-CSIC Multilingual Soil Profile Database is being developed by the Consejo Superior de Investigaciones Cientificas/ Instituto de Recursos Naturales y Agrobiología de Sevilla (CSIC/IRNAS) with the collaboration of Land and Plant Nutrition Management Service (AGLL) through a joint project. Its development is funded mainly by the Spanish Ministry of Environment through the programme SEIS.net: Sistema Español de Información de Suelos sobre Internet. Some financing is also provided by AGL through a letter of agreement with CSIC/IRNAS. SDBm Plus is a component of AGLL computer-based decision support tools for land resources analysis. This new database draws on the SDBm database previously prepared jointly by FAO, CSIC and ISRIC (International Soil Reference and Information Center, the Netherlands). SDBm itself was based on a programme called SDB, the original version of which was developed by FAO and ISRIC in the late 1980s.

Description

SDBm Plus is a collection of programmes incorporated into a Windows menu-based interactive user interface to enter data and manage the database. Data storage is greatly facilitated by the multilingual function providing help menus in English, French and Spanish. SDBm Plus is a database tool useful for storage of primary soils information assembled at national level, or data collected in subnational or local soil surveys. SDBm Plus data are used in the computerized AEZ and MicroLEIS land evaluation systems.

Target Audience

Soil scientists, land evaluators, agricultural extension officials and environmental modellers.

Functions

Calculation of weighted averages or dominant values of selected variables by soil unit, depth range and group of soil profiles; graphic presentation of soil analysis data, such as x-y chart image of relative percentages of selected groups of attributes in a given soil profile.

Data Content

Soil profile data: site location, soil physical and chemical properties, and derived variables.

Updating Procedure

AGLL in collaboration with CSIC/IRNAS, through letters of agreement

Quality Assessment

SDBm Plus has been extensively tested in the field and quality assessment carried out through user feedback.

Database software

Paradox and Borland C++ Builder

Hardware platform

Intel Pentium or equivalent microprocessor

Software platform

Windows 95, 98 and NT

Accessibility of data

CD-ROM

Number of users

About 100 worldwide

Usage rate (CD's sold/hits on Web site)

At least 500 copies on diskette sold or distributed by FAO. New Windows version distributed on CD-ROM and downloadable from FAO and CSIC/IRNAS Web sites.

Maintained by

AGLL in collaboration with CSIC/IRNAS

Date created

1990-2002

Language versions available

English, French and Spanish

Future enhancements

Provide spatial interpolation and mapping capability, and Web-based version

Responsible Officer

Jacques Antoine, AGLL, FAO

URL:http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/agll/infotech.htm#sdbm

2. WOCAT – World Overview of Conservation Techniques and Approaches

Background

WOCAT's mission is to provide tools that allow Soil and Water Conservation (SWC) specialists to share their valuable knowledge in soil and water management, that assist them in their search for appropriate SWC technologies and approaches, and that support them in making decisions in the field and at the planning level.

WOCAT was established as a global network of SWC specialists. It is organized as a consortium of national and international institutions and operates in a decentralized manner.

Management Group members are: *CDE – Centre for Development and Environment, University of Bern; LDD – Land Development Department, Ministry of Agriculture and Cooperatives, Thailand; FAO – Food and Agriculture Organization of the United Nations; ISRIC – International Soil Reference and Information Centre, The Netherlands; INSAH – Institut du Sahara et Sahel, Bamako Mali, OSS – Observatoire du Sahara et du Sahel, Tunisia; RELMA – Regional Land Management Unit, Kenya), and BSWM: Bureau of Soils and Water Management, Department of Agriculture, Quezon City, Philippines.*

A set of three comprehensive questionnaires and a suite of databases have been developed to document all relevant aspects of SWC technologies and approaches, including area coverage. These tools have been tested in many workshops worldwide, and they have been systematically optimized for five years through application in a context of international expertise. WOCAT results and outputs are accessible via the Internet, in the form of books and maps, or on CD-ROM.

The WOCAT knowledge base is in the public domain, i.e. everyone is invited to share it and use it. The WOCAT network is open to all individuals and organizations with a mandate or an interest in SWC.

System name

WOCAT Technologies Database (this is the major part of a suite also including the WOCAT databases: *WOCAT Approaches Database, WOCAT Images Database, WOCAT Addresses Database)*.

Description

At the field level, SWC specialists work under very different bio-physical, socio-economic and institutional conditions. They search for SWC technologies successfully practised elsewhere under a set of similar conditions. Querying the WOCAT Technology database will first of all get

a better understanding of SWC technologies practised in similar conditions and receive information and knowledge that help them in making decisions on which technologies and which adaptations are most likely to suit their to the local situations and needs.

Target Audience

Soil and Water Conservation (SWC) specialists and decision makers searching for appropriate SWC technologies and approaches supporting them in making decisions in the field and at the planning level

Functions

The query system provides access to SWC technologies at various points. The 27 search criteria (21 criteria in the www-version) comprise, for example, agro-ecology, climatic and slope conditions, degradation processes to be tackled, farming systems, cost and input levels. Thus, a choice can be made among relevant SWC options.

Data Content

The results of approx. 50 SWC Technology questionnaires (mid 2000).

Updating procedure

Soil and Water Conservation Technologies data are gathered by SWC specialist after having been introduced to the WOCAT methodology and tools during training workshops. Data is collected by means of a. 56 pages questionnaire on SWC Technologies and a 39 page questionnaire on SWC approaches. These data are then verified and entered into the WOCAT Technologies Database (MS-ACCESS version) and subsequently uploaded into Oracle via an automated procedure, thus becoming available in the www version.

Database software

CD-Version: MS-ACCESS 97
www-Version: Oracle

Hardware platform

CD-Version: IBM compatible PCs
www-Version: FAO web server environment

Software platform

CD-Version: MS-ACCESS 97
www-Version: HTML and ASP (Active Server Pages)

Usage rate (CD's sold/hits on website)

Five hundred WOCAT CD-ROMs (version I) were produced in 1998 and distributed within weeks; distribution of over 1000 copies of the new version II 2000. Web access of the www.wocat.net website is being monitored. Total hits for the first half year of 2001 were: 29 400.

Maintained by

AGL in Cooperation with the Centre for Development and Environment of the University of Berne, Switzerland

Date created

Data collection of SWC questionnaire data started in 1995 as a set of MS-WORD documents. The first WOCAT database was presented in 1998. The www version was introduced in 2000. Data are being regularly updated

Language versions available

CD-version: Trilingual, English, French, Spanish
Web-version: English only

Future enhancements

Trilingual web version
Data quality improvements
Mapping of Degradation and Conservation

Responsible officers

Rod Gallacher and Wolfgang Prante, AGLL, FAO.

URL: http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/agll/wocat.htm

3. AQUASTAT - Information system on water in agriculture and rural development

Background

In 1993, FAO initiated an activity to meet the considerable demand for data on rural water use from national governments and development agencies. This resulted in the AQUASTAT Programme, the objective of which is to generate data at country and sub-country level in a systematic and standard form. The programme currently contains data on Africa, the Near East, Former Soviet Union, Asia, and Latin America and the Caribbean.

System name

AQUASTAT

Description

The system presents a description of the rural water situation in Africa, Near East, Former Soviet Union, Asia and Latin America and the Caribbean. The information is presented as regional surveys and country profiles in 5 FAO-publications containing charts, tables, graphs and maps. All information, except for the survey on Latin America and the Caribbean is also available on the World Wide Web.

Target audience

FAO and other international agencies, academic institutions and general public.

Functions

Provides information on the state of water resources and use at global, regional and country level in relation to agriculture and food security

Data content

More than 100 variables on water resources, irrigation and drainage

Updating procedure / quality assessment

Ad-hoc by AGLW officer and feed-back from the field.

Database software

HTML / Oracle (planned)

Hardware platform

Web server

Software platform

HTML

Accessibility of data

Through FAO publications and on the Internet

Maintained by

AGLW

Date created

1995

Language available

English, French and Spanish (planned)

Future enhancements

Global directory on institutions dealing with water in agriculture; coverage of OECD-countries; statistical and query functions; expansion of the system through on-line map viewing and map query facilities.

Responsible officer

Jean-Marc Faurès, Water Resources, Development and Management Service (AGLW), FAO.
URL: http://www.fao.org/ag/AGL/aglw/aquastat/aquastat.htm

4. Gateway to Land and Water Information

Background

The World Food Summit in November 1996 and the 15th session of the FAO Committee on Agriculture (COAG), in January 1999, emphasized the importance of land and water resources assessment and monitoring at all levels for food security and Sustainable Agricultural and Rural Development (SARD).

FAO needs to monitor and project the capacity to produce the food required in the future at regional and global levels, and also the domestic potential in the least developed countries with inadequate food supplies and limited market demand. Member countries and the international community need consistent and easily accessible information for assessment of the situation, projections and decisions. Country-level information on land and water is the foundation for national planning and also provides the building blocks for regional and global systems monitoring food security and the health of the planet.

This information must not only be gathered but also transferred to the users, including decision makers, planners, scientists and rural land users. The COAG committee recognized the need for periodic reporting on the State of The World's Land and Water Resources, synthesizing information from the vast amounts of existing data, maps, statistics and documents. Such reporting should enhance awareness about land and water development problems and facilitate decisions on the sustainable use of land and water.

It is the primary responsibility of Member Nations themselves to collect information and prepare the reports. FAO has a role in supporting methods and data standards, ensuring consistency of information and promoting the exchange and dissemination of information.

This is the context within which the Land and water Development Division of FAO (AGL), as part of its normative programme, is collaborating with other FAO units, national institutions and other partners in building up this land and water information Gateway.

Description

The Gateway is designed as a globally networked information base on the present use and the trends in use of land and water resources in relation with food security.

It is meant to contain national and regional reports on the state of land, water and plant nutrition resources management in FAO member countries. The reports are compiled in the form of a digital atlas to be made available through the Internet and on CD-ROM.

Target Audience

The reports are addressed to FAO Governing bodies, planners and decision makers in Government ministries, donor agencies, researchers and University students, but also to the public at large.

Functions

The Gateway has two functions:

1. An access point to global, regional and national reports compiled by FAO and participating institutions worldwide
2. An entry point to the World Wide Web of information on land, water and plant nutrition and related subjects.

Data Content

Text, maps, charts, tables and photos.

Updating Procedure

AGLL organizes and maintains FAO internal links, the global links and database links. The network institutions are responsible for updating the national and regional information, and together with users are expected to participate in amplifying possible new links by using the feedback function of the site.

Quality Assessment

AGLL assists in reviewing reports prior to posting on the sites. The feedback function of the AGLL site is also intended for gathering comments and suggestions on improving the quality of the reports.

Database software

Various

Hardware platform

IBM compatible PCs

Software platform

Windows NT and Windows 95/98
HTML 4.0

Accessibility of data

Internet

Number of users

Potentially: 10 000–20 000 worldwide

Usage rate (CD's sold/hits on website)

Number of hits at FAO site: 500/month

Maintained by

AGLL in collaboration with participating network institutions

Date created

1999

Language versions available

English, Spanish and French. Country reports in several languages

Future enhancements

The Gateway site has recently been redesigned and is continually being upgraded to increase interactivity and access to information and improve information quality standards. It is planned to gradually expand the network to include most countries in Africa, the Near East, Latin America and the Caribbean, Asia and the Pacific Islands.

Responsible Officer

Jacques Antoine, AGLL, FAO.
URL: http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/swlwpnr/swlwpnr.htm

5. AEZWIN: Agro-Ecological Zoning System

Background

Since the early 1980s, FAO and the International Institute for Applied Systems Analysis (IIASA) have been collaborating on expanding FAO's Agro-Ecological Zones (AEZ) methodology of land resources appraisal by incorporating computer-based decision support tools for optimizing the use of land resources. Agro-ecological zoning involves the inventory, characterization and classification of land resources for assessments of the potential for agricultural production systems.

This effort culminated in the publication in 1994 of AEZ software for MS-DOS PCs for national and sub-national applications, based on a Kenya AEZ study. The decision support tools included in the software consisted of the application of linear optimization techniques for analysing land use scenarios with regard to single-objective functions, such as maximizing agricultural production or minimizing the cost of production under specific physical environmental and socio-economic conditions and constraints.

AEZWIN is an upgraded, multi-objective version for Windows 95, 98 and NT of the Kenya AEZ software.

Description

AEZWIN is an interactive multi-objective and multi-criteria analysis tool for land resources appraisal. When evaluating the performance of alternative land utilization types, often the specification of a single objective function does not adequately reflect decision-makers' or stakeholders' preferences, which are of a multi-objective nature in many practical problems

dealing with resources. AEZWIN implements interactive multi-criteria model analysis (MCMA) in the analysis of AEZ models.

The software package is a specialized tool meant primarily for two kinds of use:

1. Land resources appraisal studies for land use planning and management.

   Capability to adapt the system to the user's needs and to develop the required databases and scenarios is a prerequisite to use the software in projects and studies.

2. To teach and research the AEZ methodology of land resources appraisal.

   Good knowledge of the FAO AEZ methodology, as described in the Kenya AEZ reports, is required in order to use the system.

Target Audience

Land use specialists, agricultural and environmental planners in Government ministries and research institutions, University teachers, students and researchers.

Functions

The software incorporates the FAO AEZ methodology, a Linear Programming package and a multi-criteria analysis tool. The AEZ models are applied on a land resources database to analyse potentials of land for various kinds of use. The main functions include: database management, calculation of length of growing period, irrigation requirements, crop biomass, land suitability and productivity analysis, multi-objective and multi-criteria optimization.

Data Content

AEZWIN databases integrate various kinds of geo-referenced data sets generated using a GIS, and which can include the following:

- topography; administrative boundaries; road and other communications; towns and settlements; rivers and water bodies; geology; soils; physiography; landforms; erosion; rainfall; temperature; moisture regime; watersheds; irrigable areas; land use/land cover and forest reserves; population, fertilizers, seeds, labour and other inputs, production cost, crop prices, income, etc.

Updating procedure

AGLL in collaboration with IIASA, through letters of agreement

Quality Assessment

The software has recently been reviewed by two visiting scientists and is continually assessed through user feedback.

Hardware Platform

IBM compatible PCs

Software platform

Windows NT and Windows 95/98
FORTRAN and C++ and GIS (IDRISI)

Accessibility of data

Off-line

Number of users

Over 100 worldwide, but number continuously increasing

Usage rate (CD's sold/hits on website)

At least 700 CDs sold or distributed by FAO. Number of hits at FAO and IIASA sites from where the software can be downloaded still to be determined

Maintained by

AGLL in collaboration with IIASA

Date created

1991

Language versions available

English

Future enhancements

It is envisaged to gradually phase out AEZWIN and replace it by customized commercial or public domain softwares with similar functions in the future.

Responsible Officer

Jacques Antoine, AGLL, FAO.

URL: http://www.fao.org/ag/agl/lwris.htm

6. GAEZ – Global Agro-ecological Zones 2000

Description

Documented methodology to evaluate the productive capacity of the land resource based on its soil, terrain and climatic characteristics, applied to the whole world. Many data, maps, pictures etc.

Target Audience

Climatic change and crop growth simulation modellers, Universities and other educational institutes, regional and environmental planners. Perspective studies on agriculture, food security, global climatic change.

Functions

Provides a global inventory of (agro) climates, soil and terrain conditions and evaluates land resources potential and constraints and productivity possibilities for more than 250 combinations of crop and management level.

Data content

Global Soil and terrain constraints for agriculture. Global Climatic data parameters. Potential productive land by country. Suitability for each crop considered by country. More than 100 maps and tables downloadable and compatible with report and GIS (IDRISI/ARC/INFO) requirements.

Updating procedure

Jointly with IIASA. Will only be undertaken if one of the major layers is updated (climate or soil most likely).

Quality Assessment

Feedback from users. Earlier models tested. Quality depends partly on resolution and base material, which can only be improved slowly. Warnings included.

Database software

Most maps are in bnm format and can be viewed on screen, all tables are in EXCEL. All maps also come in Arc/Info and IDRISI compatible formats.

Hardware platform

Pentium PC with Windows 95/98/NT with browser installed.

Software platform

GIS software (IDRISI or Arc/Info for maps)

Accessibility of data

On CD-ROM and via web, both IIASA and FAO:
URL: http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/agll/gaez/index.htm
http://www.iiasa.ac.at/Research/LUC/GAEZ/index.htm

Number of users

Potentially 5 – 10 000 scientists plus organizations such as World Resources Institute, IFPRI, World Bank.

Usage rate (CD's sold/hits on website)

1 500/month (IIASA website since August 2000)

Maintained by

AGLL and IIASA

Date created

August 2000 on the web. December 2000 on CD ROM

Language versions available

English only

Future enhancements

A number of related products are being prepared for additional data release and for publication as a FAO and IIASA Research Bulletin.

Responsible Officer

Freddy Nachtergaele, AGLL, FAO.

7. Global Soil and Terrain database (SOTER)

Description

A digital geographic data base containing information on landform, lithology and soil units and soil profiles arranged in an orderly fashion. The final aim of the project is to replace the FAO-UNESCO Soil Map of the World. Several regional SOTER studies have been published at scales between 1:1 M and 1:5 M, covering Latin America and the Caribbean, Eastern and Southern Africa, Central and Eastern Europe and North and Central Eurasia.

Target Audience

Modellers, Universities, regional and environmental planners. Perspective studies on agriculture, food security, global climate change.

Functions

Provides a global inventory of soil and terrain conditions and for some areas evaluates land degradation status and vulnerability of soils to pollution. Has been used to evaluate land suitability (GAEZ) and to estimate regional and national soil carbon stocks.

Data Content

Soil, lithology and terrain characteristics, inventoried as geographical databases in GIS (Arcview/ Arc/INFO) and in reports.

Updating procedure

Jointly with International Soil Reference and Information Center (ISRIC). First priority is completion of the global inventory.

Quality Assessment

Feedback from users. Earlier models tested. Quality depends partly on resolution and base material which can only be improved slowly. Warnings included.

Database software

All maps come in Arc/Info or Arcview format. Tabular information in Excel or DBF files.

Hardware platform

Pentium PC with Windows 95/98/NT with browser installed.

Software platform

GIS software (Arc/Info or Arcview for maps)

Accessibility of data

On CD-ROM (FAO) and some regions downloadable from the web (ISRIC).
URL: http://www.fao.org/ag/agl/agll/soter.htm
http://lime.isric.nl/index.cfm?contentid=67

Number of users

Potentially 5 – 10 000 scientists plus organizations such as World Resources Institute, IFPRI, World Bank.

Usage rate (CDs sold/hits on website)

CD-ROMs sold, depending on the region vary between 200 (north and central Eurasia) and 1 000 (Latin America, Northeastern Africa)

Maintained by

AGLL and ISRIC

Date created

Since 1998 on CD ROM

Language versions available

English only

Future enhancements

A number of regional SOTER studies are being prepared for release this year (southern Africa, western Europe, northern Africa).

Responsible Officer:

Freddy Nachtergaele

8. Country application of AEZ/LRIS

The AEZ/LRIS system has been applied in various countries in the last decade. Two examples of recent applications in Latin America and Bangladesh projects can be viewed in slide shows on the AGL web site at the following address:

http://www.fao.org/ag/agl/lwrisdoc.htm

Land information systems in the Near East Region: an overview

Inventory of land resources is a requisite for the proper utilization and sustainable management of the natural resource base of any country. The intensive agricultural activities in many Near East countries during the past three decades have had impact on the land and water resources. However, many nations, particularly in developing countries, had little choice but to increase food outputs through intensification and a considerable spatial expansion, resulting in deployment of more land for farming. If these agricultural activities are to be sustained in order to meet the increasing demands for food and fiber, accurate inventories become imperative for the assessment of available natural resources (arable land and renewable water resources) within reach in each country.

Soil survey (whether reconnaissance, semi-detailed, or detailed) becomes increasingly expensive and time-consuming. The same is the case for water resources studies, particularly the groundwater resources assessment and monitoring. Therefore, there is increasing acceptance and use of automation and remote sensing tools, which tend to reduce costs per unit area and facilitate data storage, retrieval and analysis.

FAO, as an international provider of technical assistance and updated information related to food and agriculture, has long realized the pivotal role of acquiring adequate information related to land and water resources. From 1972, FAO has been active in building a global soil map and GIS-based soil information system, starting with the FAO-UNESCO Soil Map of the World at 1:5 M scale. Numerous documents such as: FAO Soils Bulletins, Irrigation and Drainage Papers, as well as World Reports on Land and Water were issued. In addition, many countries have received FAO technical help to support national efforts for inventories of land and water resources and for establishing their national specialized information tools and data bases such as GIS, SOTER, ALES, Water Data Bank etc. The Egyptian experience in establishing the Gateway for Land and Water Resources, which proved to be a useful information tool, is encouraging other countries in the Region to follow this example.

LAND RESOURCES INFORMATION SYSTEMS AND SOTER ACTIVITIES IN THE REGION

One of the recently developed land resources assessment tools, the Soil and Terrain Database (SOTER) was introduced in 1993 through the joint efforts of FAO, ISRIC, UNEP and the International Soil Science Society (ISSS). Because it gives a comprehensive and integrated approach to soil resources assessment, SOTER was widely accepted. FAO/AGL, through its

Ghassan Hamdallah,
Regional Soils Officer,
FAO Regional Office for the Near East (RNE), Cairo, Egypt

global SOTER facility, is contributing to the update of the 1972 Soil Map of the World. This was achieved in northeastern Africa, north and central Asia as well as Latin America and the Caribbean. Similar efforts are being made to complete this step for East Africa and for central and eastern Europe.

In the N.E. Region, the following achievements were made.

Regional SOTER training activities

The first regional training seminar on SOTER methodology for landuse planning was held 10-16 May 1997 at ACSAD, Syria, with land resources and soil specialists from 10 countries. The Second regional training seminar on SOTER applications for monitoring of land degradation was held 20-27 Sept. 1998 at ACSAD, with 10 countries attending. Both Seminars were held jointly with ACSAD, CEDARE and ISRIC.

National efforts related to land information systems

Egypt: The total agricultural land of Egypt is about 3.28 million ha, of which 3.02 million ha are in the Nile Valley, which are almost entirely dependent on irrigation. Around 840 000 ha in Egypt are classified as salt-affected, covering 60 percent of the cultivated lands in the north Delta, 20 percent of the South and Middle Delta, and 25 percent of the soils in Upper Egypt.

Between 1907 and 1999, the arable area increased by only about 1million ha, while the country's population increased nearly six fold, from 11.2 to 65 million. The area of arable land available per person declined by 75 percent during this period (currently it is 0.05ha per capita).

The most detailed survey of land resources of Egypt was completed in 1986 under the Land Master Plan. Based on this survey, the total land that could be reclaimed, subject to water availability, was estimated at 1.43 million ha. It is essential that the Government give due attention to curb the loss of arable land to urbanization and preserve the country agricultural soils, through considering these three principles:

- ban the allocation of agricultural lands for urban expansion;
- enact legislation to protect agricultural lands, as the land reclamation process is an expensive operation, and the arable land lost cannot be replaced by reclaimed land;
- strictly enforce the arable land protection regulations because in many cases the land lost to urbanization is more productive than the reclaimed land.

Jordan and Syria: Through an EU-funded project Jordan and Syria have established a soil resources database and produced a national soils map for each country. The technical staff from both countries worked together towards standardizing and harmonizing the terminology and legends used and jointly produced a unified map, covering the two countries, called MESOTER at a scale of 1:500 000.

The National Soil Map and Land Use Project in Jordan estimated that some 0.94 million ha were suitable for irrigation and about 0.65 million ha were potentially fit for rainfed agriculture. Maps for the whole country at a scale of 1:250 000 are available, in addition to a land use map at 1:50 000 scale (covering 0.9 Mha); and a detailed soil map at 1:10 000 scale (covering about 100 000 ha) in areas of high potential for agricultural investment projects.

Lebanon: Lebanon was assisted through a small fund from the RNE Soil sub-programme to establish a SOTER map for Lebanon, in October 1999. Due to the small land area of the country the scale used for Syria and Jordan (1:500 000) would not have been adequate. A larger scale of 1:200 000 was used and resulted in identifying 51 SOTER units in Lebanon. The country is also part of similar efforts by the European Soils Bureau, covering the East Mediterranean countries. The staff of the National Scientific Research Institute in Beirut are working an update of a soil map, and hope to refine and validate the SOTER map of the country.

Libyan Jamahiriya: Like many countries in the Region, Libya had conducted several soil surveys over the past 30 years, following various survey methods (USDA Taxonomy, French, Russian, FAO/UNESCO). Some available soil data exists in scattered governmental institutions and departments, including Ministry of Agriculture, Surveying Authority, and the Libyan Center for Remote Sensing and Space Sciences. Topographic maps at 1:50 000 and 1:100 000 scales exist, covering northern and northwestern areas, which are the more significant for their agricultural potential. The new Land Resources Information Management System and Soil Inventory Project (UTF /LIB/004) is bound to establish a Land Information System for the country. It is expected to produce land capability classification maps, SOTER and landuse maps; as well as to conduct more in-depth soil studies for the main agricultural region in the country, the Jifarah Plain in the northwest.

Mauritania: With the help of RNE the country produced a SOTER map identifying 20 SOTER units (at 1:200 000 scale) identifying 20 SOTER units, in October 1997.

Morocco: The country has established a national SOTER unit with assistance from RNE and in cooperation with King Hassan II University, and a soil map at 1:5 million scale was prepared.

Saudi Arabia: In a vast country like Saudi Arabia - land area about 225 million ha - an inventory of land resources becomes essential to the agricultural investments, which reached monumental rates of growth during the 1980s. Although the horizontal expansion of agricultural activities continued thereafter, it was at a slower pace because of various factors, with water availability assuming the prime consideration. FAO started providing technical assistance in land resources inventory to the Kingdom in 1983 through a major national soil survey and land classification project (UTFN/SAU/015/SAU), which was mandated to survey and evaluate soil resources at a high level of reconnaissance intensity for about 0.72M ha, identified and delineated as most promising for agricultural investment in addition to conducting soil surveys in arable areas. The Project scope also included: establishing soil, water and plant nutrition analyses, and assisting the Land Management Department of the Ministry in their land distribution programme. The outputs Project included a land-resource data bank, including a soil atlas of 82 map sheets covering the country at 1:500 000 scale; a land use map of the country; an automated land evaluation system (ALES software adapted to Saudi conditions); a set of AEZ maps; and a detailed soil survey for about 600 000 ha in the central, eastern, and southern regions.

Yemen: The country went through more than 20 soil surveys of various kinds during the past three decades, using different systems, such as USDA, Russian, East European, and FAO/ UNESCO. The recent FAO-executed project GCP/021/YEM/NL initiated a soil map at a scale of 1:500 000, including soil resources, distribution, characterization and classification. A land use map at the same scale is under way through an extended phase of the same project. A soil database incorporating over 500 soil profile descriptions from previous soil surveys, as well as a climatic data base were also established. In addition, a national SOTER unit was set up and a land cover map at 1:500 000 scale is under preparation. The nucleus of a National GIS was established and an Operation Manual was compiled for the use of ArcInfo and ArcView.

Potential benefits of a gateway for land resources information systems (LRIS)

A digital LRIS allows the combination of data layers in developing land use models, as well as in preparing zoning maps and other thematic maps. In this way, numerous applications can be developed using basic data sets and computerized models. These tools can produce various maps and other outputs presenting and facilitating the evaluation of results related to climate, soils, land cover, land use, water resources, land suitability and socio-economic data analysis.

From such outputs products many uses and benefits from establishing an LRIS Gateway for a country can be envisaged, including better land use planning, monitoring of land and water resources, and promoting sustainable land and water use.

Better land use planning: The arable land available per capita in the Near East Region is about 0.22 ha; and16 countries in the Region have renewable water resources below the deficiency level of 500 m^3/caput. This alarming situation in many member states increases the need for a reliable and easily accessible database on the land and water resources in each country. Appropriate plans for land and water resources utilization and allocation should be achieved; particularly with the tough competition that agriculture is facing from other economic sectors such as industry, urban development and tourism.

Monitoring of land and water resources: The intensive farming activities that in several countries have resulted in the deterioration of both soil productivity and water quality. These trends became serious concerns which need to be closely studied, monitored regularly and addressed by effective measures, in order to check their detrimental impacts. Soil salinization and desertification of agricultural lands are serious threats to land development projects and to food security efforts in many countries. In Egypt for example, the extent of prime agricultural lands that have become salt-affected by high watertable, impaired drainage and poor agricultural and irrigation practices has reached about 840 000 ha.

Promoting sustainable land and water use: The sustainability concept is of prime importance since these two natural resources are essential for the livelihood of all communities. To sustain the rational and efficient use of this natural resource base is imperative, not only for the current stake-holders, but also for future generations

The Egyptian experience with LRIS

The FAO project outputs

The Land Resources Information System (LRIS) at EALIP of the Ministry of Agriculture and Land Reclamation has been operational since 1997 through a FAO Project "Strengthening the information capacity of the Executive Authority for Land Improvement Projects". As a part of this system a GIS facility was established to collect, store, retrieve, analyse, and display spatial data in a timely manner and at low cost. The soil database provided the necessary soil data to the GIS unit for the production of maps and other outputs related to several activities:

- monitoring of soil degradation situation (salt-affected soils, drainage problems, depth to water table, etc.);
- determination of gypsum and subsoiling requirements;
- preparing base maps relying on data from soil and plant tissue analysis, which were added to the database, for spotting occurrence of any particular macro- or micronutrient deficiency;

- acquiring skills for operating and updating automated data collection and the soil data base applications.
- producing data and maps for subsoiling needs, gypsum requirements, depth to water table, and salinity level for the whole country. Such studies were possible at district-level (1:100 000), village-level (1:25 000) and basin-level (1:2 500) scales.

Further benefits from the above Project were strengthening national capacity, through equipment upgrade and staff training, of the central and provincial soil laboratories to provide reliable data for identifying soil productivity constraints, as well as for monitoring and evaluation of soil improvement activities.

Monitoring and evaluation activities

The monitoring and evaluation process is presently operated by the EALIP, to serve as a tool for reporting on resources utilization and the progress of field operations. This undertaking became possible due to the linkage that was made between monitoring information and the GIS unit. EALIP was able, therefore, to track and monitor the progress reports on most of its soil improvement operations; evaluate these activities; and to introduce any corrective measures that might be needed for land improvement.

Economic evaluation based on benefit/cost ratios was becoming a standard practice for continuous assessment of the Authority activities. However, the economic evaluation was conducted only in cases where yield data showed statistically significant increases in the particular amelioration treatment. When an economic evaluation was carried out within an "integrated soil and water improvement programme" at the Authority, some varying results in crop yield were observed. These differences were thought to be related to problems in the field monitoring programme, perhaps some inadequate data sets. The evaluation showed a positive impact of soil improvement processes on cotton, wheat and rice. For maize and berseem the impact was greatest in the first and second year but ceased by the fifth year.

Technical evaluation of the land improvement processes showed a significant response to deep ploughing and to the addition of gypsum in field plots located in Kafr- El- Sheikh, Fayyum and Beni-Suef Governorates. Changes in soil salinity (EC) and sodicity (ESP) of the 0-30 and 30 – 60 cm layers were most pronounced in the second year of the amelioration treatment. From then and until year 4, the values were similar to those preceding the amelioration. Yield increases of the main crops (wheat, maize, cotton, rice and faba beans), were observed and B/C ratios ranging from 4.3 for wheat to 8.8 for rice were reported.

It should be emphasized here that a successful land improvement programme would require farmers to integrate these land improvement activities with their on-farm soil and water management practices.

Promoting the gateway for land and water information systems

The FAO Land and Water Development Division (AGL) initiated an Internet Gateway for land and water information to serve as a global facility for these resources. Similar national similar databases can be connected to this Gateway and benefit from the exchange of information and experience of other countries. FAO convened a number of workshops and meetings for promoting this methodology in West Africa, Latin America, Southeast Asia, and the current Regional

Workshop for the Near East. As a result of these efforts, the Gateway now is operational in several countries, including Bangladesh, China, Malaysia, Ghana, Nigeria, Egypt, Iran, Botswana and South Africa.

A standardized methodology to serve as a general framework for reporting on the state of land and water resources was prepared in the form of Guidelines. This is to ensure that reports will be comparable along the lines of common themes, such as land use and degradation, state of water resources, hot spots and bright spots. These guidelines will be updated, as more experience is gained through their actual implementation in different countries

Updated Land and Water reports with major topics, discussion items, constraints and possible solutions, as well as relevant links could prove to be valuable for decision-makers and planners. Desk-top information should be preferably presented to land use planners, officials and politicians in the form of trends depicted in a visual format (maps, tables, charts, and images). Comparisons and time series trends showing major concerns to communities such as desert encroachment, salinization of water resources, and urbanization consuming agricultural lands are good eye-catching examples.

Follow-up action

Upon the recognition and acceptance by country representatives of the feasibility and usefulness of this facility, action and follow-up is needed from both FAO and the countries. FAO should continue to fulfil its leading role and in the development and maintenance of the LRIS information system to function as a clearing house for exchange of knowledge and technology transfer.

FAO, with full co-operation of countries, is expected to assist in realizing these tasks:

- Facilitate identification of key opportunities to use information technology;
- Foster data communication, co-ordination and networking, as well as the development of standard and meta databases;
- Play a key role in the design of standards, formats and indicators for promoting data exchange and harmonization;
- Assist member countries to set up their national LRIS and help in identifying any data gaps;
- Provide technical assistance for institutional and human capacity building to support the sustainability of national LRIS units;
- Advise on dissemination systems and mechanisms for achieving appropriate targeting;
- Develop a pilot project on land and water resources information systems to demonstrate their applications.

Member Countries are expected to work closely with FAO through:

- Presenting their country reports, making and maintaining them as credible, accessible and up to date, as possible;
- Specifying the soil classification system/s used in the country, and the type of survey system, soil legend, scale, etc;
- Identifying an official department or institution responsible for updating the information to ensure sustainability of the LRIS;

- Communicating any specific recommendations or comments to enrich and improve the Guidelines;
- Correlation and co-ordination among different institutions having GIS, remote sensing, or other relevant databases in order to facilitate establishing linkages and avoid duplication;
- Reporting on national institutions and potential users of the LRIS, in order to broaden the range of users and thus give it more credibility.

The use of geoinformation technology for agriculture application in Egypt

Abstract

Remote sensing (RS) can provide valuable and timely information about natural resources and environment as an important basis for sustainable development. Geographic Information systems (GIS) can provide effective tools for decision makers. Both RS and GIS techniques are important geometric tools which are extensively utilized in developed countries. However, in developing countries, the utilization of such advanced technologies differs from one country to another because of one or more of the following reasons: lack of tools and infrastructure; inadequate training; lack of coordination between aid agencies; too much emphasis on technology push rather than demand-led application; restrictions and regulations; and lack of basic information and maps.

The experience of Egypt in the utilization of earth observation satellites and aircraft remote sensing data in soil mapping can be represented in its Remote Sensing Center, the National Authority for Remote Sensing and Space Sciences (NARSS). Advanced geometric tools (Landsat and SPOT imagery, GPS, GIS) have been used at NARSS for different applications. In addition to NARSS, there are many Remote Sensing and GIS units in other public institutions.

In this paper two major activities for RS and GIS applications at NARSS are presented. These activities include the production of digital soil and terrain data of Egypt in cooperation with the FAO and the European Soil Bureau (ESB); and the estimation of water use efficiency for natural vegetation and agriculture in the Mediterranean Project sponsored by the European Commission.

Introduction

The United Nation Conference on Environment and Development (UNCED), Rio de Janeiro 1992, has focused the world's attention on the alarming state of environmental degradation caused by growing population pressures and short-sighted development strategies that have not taken into account protection of the natural environment. One of the main UNCED documents, Agenda 21, identifies the main causes of environmental degradation and recommends a set of specific activities essential for the sustainable development and management of natural resources.

High on the priority list of Agenda 21 is the availability of reliable, geographically specific information on natural resources and the environment. Such information is required by decision-

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makers for national planning and implementation of development strategies. Spatial information, while readily available in industrialized countries, is often incomplete or outdated and thus not compatible with modern management requirements in developing countries.

Consequently the decision-makers in developing countries in critical environmental zones, who need such information most, have the least chance of obtaining it. Also, most developing countries have neither the capabilities nor the resources to undertake the extensive mapping and monitoring programs required to fill the spatial information gaps.

Such countries are in great need of using advanced remote sensing techniques for the assessment and management of their resources and for social and economic development projects. Remote sensing can also be used to help adjust such resources management and development schemes to fit within the controlling environmental factors. However, it should be recognized that the establishment of sophisticated remote sensing centers, with advanced hardware and software packages, and highly equipped remote sensing aircraft, requires considerable investment and O+M expenditure, a high level of training, and several years of dedicated effort to achieve most effective means of operation and use of such sophisticated equipment. Without such effective operation and utilization of these centers, the benefit of this great investment becomes doubtful.

This discussion paper presents the status of geo-information technology application in soil mapping in Egypt, through the presentation of the activities of the main public institutions. Recommendations and suggestions are given for internal cooperation between public and private sectors in Egypt. Recommendations and needs for regional cooperation are also highlighted.

Remote sensing application in land resources monitoring and management

In the last fifty years, the rapid population growth in Egypt has caused a great demand for food and other agricultural products. Only half of the food needed is produced locally. Therefore, much attention had been paid to increase agricultural production in Egypt. This could be realized by two main strategies: desert areas must be brought into cultivation, and the existing cultivated land should be intensively used by applying proper management. In both cases it is important to have good knowledge of the characteristics and distribution of the soils in these areas. Therefore, there is a pressing need for a system that can deliver accurate, useful and timely information on soil and water resources to decision makers and policy planners. Such a system is a prerequisite for development planning at all levels, efficient use of both internal and external resources, and for implementation of development programmes.

The soil information system supports the national efforts of the Arab Republic of Egypt to promote sustainable agricultural development and enhance food security. Realizing the importance of accurate and readily available information, the Information and Decision Support Centre (IDSC) of the Egyptian Cabinet of Ministers started setting up national natural resources databases as part of the Natural Resources Programme. In 1992, The National Authority for Remote Sensing and Space Sciences (NARSS), was commissioned by IDSC to establish a database on Soil and Terrain resources of the Sinai Peninsula. Besides its main objective to supply information, the land database will be the first georeferenced database in the natural resources program. The soil database will have a leading role in the natural resources project. The soil and terrain database (SOTER) and a digital soil map (1:100 000) of Sinai have been completed in 1995.

As a follow-up to these activities, NARSS has completed a SOTER database for many regions in the Egyptian desert: Tushke (1:25 000), Darb Al Arbien (1:25 000), Siwa (1:25 000) in the western desert, and Halaib- Shalatien (1:100 000) in the eastern desert. In 1999, NARSS

started a FAO-sponsored project to produce a digital soil and terrain database (SOTER) at a scale of (1:1 000 000).

Equipment and facilities available at the National Authority for Remote Sensing and Space Sciences (NARSS) in Egypt

The NARSS has accumulated a large inventory of Computer Compatible tapes (CCTs) from Landsat 1, 2, 3, 4 and 5, as well as Multispectral Scanner and Thematic Mapper images covering all of Egypt and some surrounding countries in the Near East and North Africa. SPOT data of some regions of Egypt are also available.

Technical and Administrative Personnel comprises about 128 staff members and technicians distributed as follows: Agriculture (3); Soils (5); Water resources (1); Geology (4); Mineral resources (2); Computer specialists (4); Photo lab. operators (5); Drawing (4); Documentation (1); Architecture (1); Air craft crew (12); and Administration (80) most of whom are supporting and auxiliary staff.

The major facilities and equipment available in NARSS include:

- Aircraft data acquisition equipment: Beechcraft (Super King Air 200) twin engine pressurized and specially modified aircraft; two RC-8 (wild) aerial camera; one four-lens multispectral aerial camera; thermal IR scanner with interchangeable scanner with HDDT output.
- Digital data processing laboratory for processing Landsat and aircraft digital data and GIS applications. The computer laboratory contains a network of different Systems, VAX 8350, Micro VAXII. PDP 11/44, PC's and Alpha workstation.
- A photographic development and production laboratory, well equipped with automatic processors, developers, enlargers and various photographic quality control and measurement equipment.
- A photogrammetric laboratory for producing topographic and planimetric maps from aerial, terrestrial and space photographs, with the Wild Avidity BC2 Analytical Plotter, Avoitab TA2 Digital plotting table, DG130 Computer, and Tektronix 4109 graphic Unit.
- Some other laboratory and field equipment, including: Portable IR Thermo vision Cameras (AGA) with both black and white and color monitors; additive color viewers; automatic reflectance spectrophotometers; field radiometer; GPSs.

Other governmental institutions using remote sensing data and GIS for assessment and management of land resources

The following public institutions have remote sensing or geographic information system facilities. Each of these units uses the geo-information technology in specific applications.

- Remote Sensing Unit, Soils and Water Institute, Agriculture Research Center. Soils and agricultural applications are the main tasks of this unit.
- Desert Research Center, Ministry of Agriculture and Land Reclamation. It has a NOAA receiving station, Remote Sensing and GIS unit. The main concerns are the establishment of environmental databases of the desert areas in Egypt.

- Ministry of Public Works and Water Resources and its affiliated institutes. It uses geo-information technology for water resources assessment and development, irrigation and drainage planning.
- Information and Decision Support Center (IDSC). It applies GIS technology for natural resources management and development as well as land use planning.
- Egyptian Survey Authority. It applies GIS and photogrammetric techniques for producing topographic maps at Egypt of different scales (1:2 500-1:250 000).
- Egyptian Geological Survey and Mining Authority. It works mainly in mineral exploration and geologic mapping.
- Universities: Aerial photo interpretation and GIS application.
- Egyptian Meteorological Authority.

Land resources assessment and evaluation in Egypt

The Egyptian Authority for Remote Sensing and space sciences (NARSS) has been one of the few centers in the world that applied both visual and digital Landsat image interpretation as early as 1971, after the launching of the first U.S. Landsat. This unique experience of NARSS may well be of use to other developing countries, and for countries in arid and semi-arid regions in particular.

It is not possible in this paper to examine all of the applications and projects implemented in Egypt using satellite and aircraft remote sensing data, combined with other ground truth and field observations and Geographic Information System. Many of these projects will fall under one or more of the following categories: land use mapping; water resources investigation; land use planning; and soil mapping.

Land use mapping

The land surface of Egypt (1 million square km.) is almost all deserts, and only 4 percent of its total area comprises the agricultural land of the Nile Valley and Delta. Therefore, there is severe pressure by the growing population on this limited area of valuable agricultural land. The demand of this growing population for housing, utilities, services and infrastructure has been steadily reducing this limited agricultural area at an estimated rate of about 13 000ha per year. Therefore, land use patterns are constantly changing, with agricultural land being converted to urban use.

If land in Egypt, both in this traditional agricultural area and in desert areas, is to be allocated to its most appropriate use, planners must have two types of information: information on current land use patterns; and information on land potential and feasible uses.

Satellite data, with the aid of computer categorization and classification and supplemented by ground truth data, proved to be valuable in providing up-to-date information on regional land use patterns in the traditional agricultural area. Also, repetitive satellite coverage proved to be very helpful in monitoring changes. For the desert area, satellite data with aircraft and field observations provided valuable information on soil types, potential groundwater resources mineral resources, and other parameters which can be used in conjunction with information from other sources through GIS application. The main objective is to determine suitability of non-agricultural areas

and establishing new communities outside the limited valuable agricultural area. Landsat images in various forms of digital processing at scales of 1:100 000 and 1:25 000 were successfully used at NARSS for such studies and for producing a land use map for most of Egypt.

Another important project of NARSS is the Landsat map atlas of Egypt at a scale of 1:250 000. This atlas includes more than 70 sheets compiled on the UTM grid used for the cartographic maps of Egypt, and each is assembled from several Landsat scenes. A mosaic of these scenes is prepared on computer discs in the Remote Sensing Digital Processing Laboratory, with radiometric and geometric corrections, as well as enhancement by special software. This atlas is serving as a valuable basis for updating and completing the 1:250 000 cartographic and Land use maps of Egypt. In addition, there are two other Landsat map atlases of Sinai Peninsula (61 000 square km) at a scale of 1:100 000 and 1:50 000 assembled from MSS and TM data, respectively.

The Remote Sensing Unit of the Agriculture Research Center (ARC) has used SPOT data to produce SPOT-based land use- land cover maps of the cultivated land of the Nile valley and delta, about 35 000 km², at a scale of 1:100 000.

Different remote sensing and land information as well as geographic information systems were used for land resources assessment and evaluation. Landsat-based soil maps of most Egypt were produced of scale (1:100 000). Land capability maps of the Sinai Peninsula and other desert areas were also produced by NARSS staff.

Water Resources investigation

About 96 percent of Egypt is covered by deserts. These include the western desert, the eastern desert, and the Sinai Peninsula. Groundwater is an important factor to be considered for their development and utilization.

The interpretation of Landsat images for large areas in the Egyptian desert has been going on for more than fifteen years, and comparison of the results with the information on groundwater aquifers in these areas has yielded much information on the conditions, sources and potentials of groundwater.

Various interpreted features have a strong bearing on groundwater in the arid environment. These include the nature of geological and lithologic units, structural lineament, present and old drainage systems, distribution and form of water pools, geomorphic units, weathering surfaces and other weathering phenomena, desert soils, sand dunes and dune accumulations, natural vegetation, agriculture, and salt crusts and other expressions of salinization. These features can also be utilized in the regional exploration and management of groundwater aquifers in the arid zones.

Many examples illustrate the significance of satellite image interpretation on the regional groundwater conditions which could be traced and interconnected over several tens or even hundreds of kilometers.

One example is the occurrence of fresh to brackish groundwater lenses floating on the saline seawater in the Mediterranean coastal zone of the Western Desert. This phenomenon is caused by the presence of the highly porous and permeable detrital limestone which belong to a geologic unit, extending along the coast, called Alexandria Formation. This latter unit has been delineated, accurately and rapidly by Landsat interpretation, along a distance on the coast of some five hundred kilometers,

The investigation of Shuttle Imaging Radar (SIR-A) combined with Landsat Multispectral Scanner (MSS) data of the southwestern desert of Egypt revealed buried drainage patterns and valleys covered with sand; some of these valleys were measured as wide as the Nile Valley. It is expected that there is significant groundwater from the past geologic period, which may be used to irrigate large areas in this region. The results can also be used to estimate the water storage capacity of the area. Additional hydrologic investigations can now be localized in areas with the greatest potential for water yield.

Land use planning

National experts at the Information and Decision Support Center (IDSC) created an Integrated Natural Resources Information System (INRIS) for the assessment and management of natural resources of the northern Sinai Peninsula. Landsat TM data and GIS techniques were successfully applied to this system. The main natural resources considered in INRIS were land, water, mineral, energy and human resources. The system is also used for land use planning in the southern Sinai Peninsula.

A major project was recently completed at NARSS (1996–2000). The project was aiming to producing a land use Map of the Halaib- Shalatien region in the southeastern part of Egypt. The area covers about 20 000 km². Landsat satellite data and GIS technology have been used to produce thematic maps of the area, which include soils, geology, hydrogeology, erosion hazard and water resources. The land resources have been evaluated to determine the potential for agriculture.

Soil mapping

Hanna (2000) reported seven stages in the production of soil maps of Egypt between 1964 and 1986. The first was published in 1964 by d'Hoore and Lagos as a part of the soil map of Africa. The second was also published in 1964, as part of a soil map of Africa at a scale of 1:25 000 000 in a geographical atlas of the world produced in Moscow. The third soil map of Egypt was compiled by Veenenbos *et al*. (1964) at a scale of 1:2000 000. The soil map, published by the FAO High Dam Soil Survey, is considered a good base for subsequent detailed studies. The fourth soil map of Egypt was compiled from existing materials of some parts of Egypt by El Gabaly *et al.* (1981), at a scale of (1:4 000 000). The fifth is the pedological map of Egypt compiled from existing studies by ASRT, Hamdi *et al.* (1982), scale (1:100 000). It is not built on mapping units, but on taxonomic units. The sixth is published through the project of Land Master Plan (1986). It covers the desert fringes and some parts of the coastal region. These maps were drafted using the maps of the High Dam Soil Survey and satellite data, and produced at scales between 1:250 000 and 1:50 000.

The land resources of Darb Al Arbien region in the western desert of Egypt have been mapped using SPOT panchromatic and Landsat TM data. In this project the impact of wind erosion on agriculture extension projects was investigated. Wind erosion hazard maps at scale of (1:25 000) were produced.

The same techniques were used to map land resources in Tushke area (Branch 3 and 4). Remote sensing, GIS, LIS and data bases were used to determine land potential for agricultural use. This project was conducted in cooperation with the Ministries of Agriculture and Water resources.

Recently, the soil team of NARSS has produced the first digital soil map of Egypt at a scale of (1:1 000 000), based on the SOTER methodology. This project was carried out in cooperation with FAO-RNE .

Demonstration of the Gateway to Land and Water Information on the Internet

The demonstration is based on the Gateway Internet site:
http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/swlwpnr/swlwpnr.htm

The purpose of the Gateway

The overall purpose of the Gateway is to help the world community to know the state and trends of land, water and plant nutrition management at national, regional and global scales, with a view to promoting sustainable land management and agricultural practices.

Gateway is a dynamic Internet-based network. It relies on the active participation of professionals and institutions from all over the world concerned with collecting reliable information on land, water and plant nutrition for improved natural resources management and prepared to share it with the global community.

This network essentially consists of land and water "reports". The reports are compiled at different levels of detail (see below) and are linked together as part of a global system of information on the Internet. The Gateway acts as a clearinghouse and facilitator, providing a convenient entry point for land and water information.

- Global report (Global prospect) ← FAO
- Regional Report ← FAO / Regional Institution
- National Report ← National Institution
- Sub-national Report ← Subnational or national Institution

The Global prospect summarizes the state of land and water resources and agricultural land use trends and challenges in a global perspective. The structure consists of a well-ordered collection of worldwide Internet links.

Twelve Regional reports are envisaged, of which the Near East and North Africa regional report is one. Each regional report discusses regionally relevant land and water issues, and in particular hot spots, bright spots and challenges identifiable in that region. A regional report also serves as an entry point for the Country Reports, reports prepared by the countries within that region.

The National Reports are the principal part of the Gateway. They are prepared by respective country representatives and their collaborators.

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Land and Water Development Division, FAO, Rome

Subnational Reports are of district-level land and water resources. They are generally prepared by district-level bodies in close collaboration with the national institution.

The Gateway has two functions:

1

An access point to global, regional and national reports compiled by FAO and participating institutions worldwide.

This applies to the sections:
- reports
- what's new
- feedback
- contact worldwide

Common process:

1: National or regional institution is identified.

2: The institution starts compiling a national or regional report using Guidelines, a Checklist and an Internet Template provided by FAO.

3: Draft is sent to FAO for preliminary review.

4: The institution posts the final report on its local website and establishes a hyperlink to the Gateway and vice versa. FAO assists institutions without access to local websites in hosting their reports on the FAO website. The final reports are also disseminated on CD-ROMs.

5: The institution regularly updates the report.

6: FAO regularly updates of the information on Gateway site.

2

An entry point to the worldwide web of information on land, water and plant nutrition and related subjects.

This applies to the sections:

- FAO internal links
- global links by sectors
- database
- feedback

Common process:

1: FAO organizes and maintains FAO internal links, the global links by sector and the database links.

2: Participating institutions and the users of the network contribute to the enrichment of the new Internet links by means of the feedback function of the Gateway.

THE NEAR EAST REGION IN RESPECT TO THE WORLD NETWORK

The Near East and North Africa Region is one of the twelve regions identified according to FAO's regional representation.

Ten countries in the Region were represented at the Workshop; Egypt, Iran, Jordan, Lebanon, Libya, Morocco, Oman, Syria, Tunisia and Turkey.

It is expected that the information gathered to compile country reports would directly contribute to the content of the Regional report. In the reports, hot spots that are characteristic to the region, such as land degradation due to salinization and urbanization and water scarcity, should be emphasized as well as examples of effective responses to manage such problems (bright spots).

GUIDELINES

The following are extracts from the Gateway guideline.

Principles for reporting

The report needs to be concise and to the point

Provide synthetic information in the form of short text, maps, tables, charts and photographic images and reliable meta-data (title, year, data provider, data origin, etc.), references as complete as possible and well-sorted related Internet links. Clarify technical terms with definitions. Also, provide notes on methodology of information gathering. When the FAO approach cannot be used, provide information gathered by other methodologies with an indication of that methodology.

The report needs to be easily understandable, reliable and accurate

Pay attention that the information is comprehensible, colours easily distinguished and legends legible. The information has to be reasonably up-to-date. This requires both constant updating in content and an indication of "when last updated".

The report has to be attractive

The report should encourage visitors to surf through with ease and should stimulate their curiosity. Try making it look interesting!

Content of the report

The content of the report is manifested in the form of a checklist of items. It is arranged according to the following eight categories or sections.

1. Country overview
2. Land resources
3. Water resources
4. Plant nutrient resources
5. Hot spots
6. Bright spots
7. Challenges and viewpoints
8. References and internet links.

Each section comprises several subsections. The Checklist can be partially modified to suit specific needs and relevance of each country or region.

This document was prepared for the participants of the Near East and North Africa regional workshop to facilitate the compilation of the Gateway Country Report.

More specific information on how to compile the report is provided in the **Guidelines**: Gateway Home page > Report > Guidelines.

Country reports

Land and water resources information system in Egypt

Summary

Egypt covers an area of slightly over one million square km. Ninety-nine percent of the population (65 million) lives in a small band alongside the Nile river in the Nile valley, in the Nile delta and in coastal areas on about 4 percent of the land.

Agriculture is a key sector in the Egyptian economy. It contributes about 40 percent to the Gross Domestic Product (GDP), 22 percent to commodity exports, and 50 percent of overall employment. Thirty-four million people, about 54 percent of Egypt's population, lives in rural areas.

The arid climate of Egypt characterized by high evaporation rates (1500-2400 mm/year), and very low rainfall (5-200 mm/year) leaves the River Nile as the main freshwater supply. However, the favorable climate of Egypt around the year is ideal for a wide variety of crops. This made it possible to adopt an intensive cropping system and thus permitted the production of more than one crop per year in most of the cultivated area. The crop acreage is much greater than the actual cultivated area, making a total of about 6.5 million ha. Soils in the Nile valley and the Delta are Vertisols, characterized by strong expansion by wetting and shrinking by drying.

At present only 5.4 percent of the land resources in Egypt is of excellent quality, while about 42 percent is of poor quality mainly due to development of salinity and sodicity problems, which hinder realization of the beneficial effects of any agricultural inputs.

Irrigation has been practised throughout the Nile valley since the earliest times. After the construction of the Aswan High Dam, this land was converted to perennial irrigation. Before completion of the dam, the cultivated area was about 2.8 million ha. After completion, including the horizontal expansion, the total irrigated area has risen to about 4.1 million ha.

All irrigation water comes from the Nile. More than 80 percent of the Nile water is used in agriculture. Using this resource more economically will reduce the overuse of Egypt's share of the Nile water (quota 55.5 billion cubic meters) and allow better relations with neighboring countries that are depending on the water of the Nile as well.

Saving water is a major concern for Egypt. Per capita water resources are approximately 950 m^3/year, which will decrease to 560 m^3/year by 2025. New resources must be developed and irrigation development must continue.

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Executive Authority for Land Improvement Projects (EALIP),
Egypt

In Egypt, productive lands are finite and irreplaceable and thus should be carefully managed and protected against all forms of degradation. These include physical, chemical and biological degradation processes such as soil crusting, compaction, soil fertility depletion due to nutrient mining, decrease in soil organic matter, pollution of soils by toxic wastes including heavy metals, salinization and sodication. Salinity problems are widespread. Almost one million hectares of the irrigated area are salt-affected.

In 1971, the Ministry of Agriculture and Land Reclamation established the Executive Authority for Land Improvement Projects (EALIP), which has the overall responsibility for all types of land improvement in Egypt. EALIP has been implementing a land improvement programme covering the entire irrigated lands of Egypt. The programme includes gypsum application for improving the productivity of sodic soils; subsoiling to improve soil physical properties, break up hard pans, soil compaction and all indurated layers within the root zone; land levelling and reshaping for better water management; and improvement of the drainage and canal system for salinity and waterlogging control.

A Geographic Information System (GIS) has been in use at EALIP since 1997, and a GIS-based soil database was used for production of maps and other related materials on soil salinity, sodicity and water table level, and on gypsum and subsoiling requirements. Information from soil and plant tissue analysis was added to the database, and GIS was used to prepare the base map. The presence and location of particular macro- or micronutrient deficiencies were determined from the maps. EALIP produced information maps for subsoiling, gypsum requirement, watertable depth and salinity for the whole country at the district level (1:100 000), for one governorate at the village level (1:25 000) and for three governorates at the basin level (scale 1:2 500). Work is now ongoing to produce these maps at a scale of 1:2 500 for the all relevant areas in the country. The information is being used for the planning of gypsum application and subsoiling.

The full Egypt country report is available at the Gateway Web site:

http//www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/sw1wpnr/sw1wpnr.htm

Land resources information system in Jordan

Summary

Jordan, a semi-arid country, 8.9 million ha in extent, has an average rainfall ranging from 500 mm/year in the highlands to less than 50mm/year in the eastern parts of the desert. Mean temperatures are 8-16 C in winter and 22-26 C in summer. There are 18 physiographic regions, including the Jordan valley, escarpments and highlands, sandstone, basement, basalt and limestone plateaus, partly dissected, and closed depression.

Besides the capital Amman there are six major cities. Of the total population (an estimated 4.7 million in 1998), 79 percent live in the major cities and 21 percent in the rural areas. Agriculture accounts for 20 percent of the labour force and 15 percent of GDP.

Three main agricultural zones are distinguished in the country, for rainfed agriculture, irrigated agriculture and mixed land use. The major cropping pattern is wheat or barley followed by fallow or summer crops. A land cover map of ten percent of the country was prepared in 1994 based on the FAO legend, using satellite imagery at a scale of 1:50 000. Urban areas tend to encroach on agricultural land and fruit trees are gradually replacing annual crops.

Land suitability maps were prepared for almost 10 percent of the country according to the Framework for Land Evaluation, on the basis of the soil map of the potentially arable lands. Ratings were made for five major land uses: rainfed cereals, rainfed perennial crops, drip irrigation, forestry and rangeland use.

JOSCIS, the Jordan Soil and Climate Information System, started in the early nineties, consists of a database management system (DBMS) and a geographic information system (GIS). It covers some 44 000 soil descriptions of which about on tenth are fully described and analyzed soil pits. Soils and geological maps are included, as well as other GIS layers such as hydrology, temperature and precipitation form other department.

Hot spots

Problems include scarcity of water resources and low rainfall; unbalanced land use and limited land resources; erosion; drought; forest fires and degradation of vegetation cover.

Bright spots

Assets include a stable and secure country with a good climate and high potential for tourism, and well-educated, hardworking population.

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Jordan

State of land and water resources in Lebanon

Summary

Country overview

Lebanon, about 1 million ha in extent, borders on the Mediterranean sea in the west; on Syria in the north end east; and on Israel in the south. The country is divided administratively into six governorates: Beirut, North, South, Bekaa, Mount Lebanon and Nabatieh.

The country has a Mediterranean climate with dry, mild summers and wet winters. Average annual precipitation ranges from 200mm to more than 1 500mm locally in the mountains. The average yearly temperature is 18ºC.

The population in 1998 is estimated at 4.2 million (within Lebanon; plus around 6 million abroad. Population density is about 400/km². The civil war between 1975 and 1991 seriously damaged the economic infrastructure, but peace since then has enabled the central government to restore control in Beirut, and collect taxes and regain access to key port and government facilities.

The gross domestic product at purchasing power parity is 16.2 billion US dollars, GDP at 4 500 US dollars per capita and the real GDP growth rate one percent.

The agriculture sector has played a diminishing role in the Lebanese economy since 1960, but unfortunately its share for the GDP has declined from 12 percent to 8 percent at present time with a corresponding decline in agricultural labor 38.3 percent to 7 percent. At present Lebanon is an exporter of fruits and vegetables and self-sufficient in poultry. It produces 15, 45 and 10 percent of its wheat, legumes and sugar needs respectively, and 22 percent of its consumption of dairy and meat products.

Land resources

Lebanon is made up of four physiographic units: the coastal plain, a narrow fertile plain less than 5 km wide; Mount Lebanon, east of the coastal plain; the Bekaa valley, 8–10 km wide; and the Anti Lebanon ranges along the border with Syria.

About half of the total area is suitable for cropping. A green project was established by the government for rehabilitating the agricultural lands. There are ancient terraces used for fruit

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trees and other crops adapted to high elevation. But there is a tendency to extend agriculture into areas of very low suitability.

Water resources

In Lebanon there are 15 major rivers, with a total discharge of about 4 billion m^3/year. The twelve coastal rivers are characterized by small catchment areas of about 200km^2, small length < 50km and a general direction EW. The three inner rivers are shared rivers with neighboring countries, but all are discharging from the Lebanese territory. The Litani river is the biggest river in Lebanon, with a catchment area about 2 500km^2 and average discharge 630 million m^3/year.

Springs are widely distributed in Lebanon: there are about 2000 major springs. A realistic estimation of water volume from these springs is 1 150 million m^3/year. They are the major source of rivers waters and play an important role in the agricultural sector.

Ground water is abstracted by about 2 500 wells tapping the major regional aquifers. The depth of these wells varies between 50 to 300 m, the average discharge is 35/sec/well. Total ground water abstraction is estimated at 1 360 million m^3/year. Overpumping from these wells is considered as the major reason for saltwater intrusion.

Along the coastal stretch, there are around 60 submarine springs. Fifteen are offshore springs, the rest are littoral ones. These submarine springs play an important role in the Lebanese water budget and are considered to be a non-conventional water source. A general estimation of water volume averages about 600 million m^3/year. Different reports estimate that only 67 000 ha of the cultivated 240 000 ha are under perennial irrigation, 42 000 ha of which are irrigated by surface water and 25 000ha by groundwater and 20000 ha are seasonally irrigated. Irrigation is usually done by furrow, but in private farms where groundwater is available new pressurized techniques in irrigation have been adopted.

Hot spots

Hot spots in Lebanon are mainly natural and to a certain extent man-made. Large areas are subject to various hazards, some sudden, others gradual, for example land degradation or groundwater depletion.

Bright spots

Bright spots are uncommon in Lebanon. They are principally human-made, while natural spots are rare. Examples of these bright spots are land-related (terraced lands, rehabilitated rock lands, natural protected sites, etc) and water-related (such as inaccessible springs, streams and lakes in the remote mountainous region, man-made ponds).

The full Lebanon country report is available at the Gateway Web site:

http//www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/sw1wpnr/sw1wpnr.htm

Land Resources Information in the Libyan Arab Jamahiriya

Summary

Overview

The Libyan Arab Jamahiriya is situated in North Africa between 20 and 37º north and between 10 and 25º east. It is about 1.75 million square kilometers in extent. More than 95 percent of the country is desert. Cultivable areas cover an estimated 3.8 million hectares, slightly over two percent of the total area. The majority of the cultivated land and rangelands is located in the northern zone. At present, the areas which are under irrigation are estimated at 400 thousand hectares. These areas include large projects, settlements and smallholder farms. The total population is about 4.8 million (1995) of which 14 percent is rural. Agriculture contributes less than five percent to GDP, although it provides employment for approximately 13 percent of the active population.

Climate and water resources

The climatic conditions are influenced by the Mediterranean sea to the North and the Sahara desert to the South, resulting in an abrupt transition from one kind of weather to another. In The Libyan Arab Jamahiriya, the volume of water potentially available for use is estimated at 3820 million m³ of which 170 million m³ is surface water, 650 million m³ is annual recharge to groundwater aquifers and 3 000 million m³ is an acceptable depletion rate of the nonrenewable aquifer.

Soil resources

Extensive soil studies (about 250) have been carried out in The Libyan Arab Jamahiriya over the last four decades. Emphasis was given mainly on the northern part of The Libyan Arab Jamahiriya and to small scattered areas in the southern desert. The present soil survey reports and maps differ in their contents, types of maps, scale of mapping, classification systems used, methods of soil analysis, and the criteria on which the interpretation of data is based. The major soil classification systems used in these reports are USA Soil Taxonomy, modern soil classification of Russia, French soil classification, and FAO/UNESCO system. The major available interpretive soil and land maps are land capability, soil salinity, soil erosion, soil depth, and soil and land suitability.

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The Libyan Arab Jamahiriya

Information systems

None of these maps are in digital format yet. Despite pressing needs for natural resources management in The Libyan Arab Jamahiriya, the necessary LRIMS is still lacking. This has recently (September 2000) promoted urgent calls for establishment of a Libyan land resources database and Information Management System through project LIB/00/004, implemented by FAO. This project will insert all natural resources data in a geographically referenced computerized data base.

A national regional Soils and Terrain Digital Database (SOTER) has not yet been established in The Libyan Arab Jamahiriya, it will be one of the outputs of the project. However, in 1999 a pilot project established a SOTER map for an area of 433 000 ha extending from Tripoli to Garian. A scale of 1:250 000 was tried and resulted in identifying 21 SOTER units. Maps of types and degrees of erosion on the same area were also produced by using SWEAP software.

Land degradation

The major soil problems of Libyan agriculture are erosion and salinity. New tasks that have become priorities in the last few years are counter-acting land resources degradation and improving poor land management practices. Therefore, plans must call for LRIMS to be used in guiding and supporting wise land use, soil and water conservation and revising productivity.

The full Libyan Arab Jamahiriya country report is available at the Gateway Web site:

http//www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/sw1wpnr/sw1wpnr.htm

The state of land, water and plant nutrition resources in Morocco

Summary

Overview

Morocco covers a land area of 71 million ha and has an estimated population of 28 million in 1998. The country is divided into four main landscapes: the mountain areas of Rif and Atlas, the central plateau, the plains of the Atlantic and Mediterranean coast, the Saharan areas.

Economic and social development in Morocco is mostly based in agricultural activity. This sector is the source of income for about half of the population and provides jobs to more than half the working population. It contributes one-third to domestic exports and accounts for more than 20 percent of GDP.

Land resources

Of the total area of 71 million hectares, Morocco has 20 million hectares of sloping areas and 8.5 million hectares suitable for cultivation, of which 1.35 million hectares are potentially irrigable. In Morocco the problems of salinity are widespread, particularly in the irrigated areas (intensive agriculture).

In 1986, the Ministry of Agriculture surveyed the extent of stony lands which could be reclaimed and used for intensive agriculture. Two million ha are stony, constraining or inhibiting machinery use and reducing yields.

A survey in all agricultural areas of Morocco by the Ministry of Agriculture in1995 showed that 0.74 million ha, more than 8 percent of the land suitable of agriculture, are infested by weeds, principally by jujube.

Water resources

The average annual rainfall amounts to about 150 billion m³ per year, but may fluctuate between 50 and 400 billion m³. Potentially usable water was 830 m³ per inhabitant and per year in 1996 and will be 411 m³ per inhabitant and per year in 2020.

L. Lahen,
Ministry of Agriculture, Rural Development, Water and Forests,
Rabat, Morocco

Plant nutrition: supply and consumption

The average consumption of fertilizers in the last 5 years was about 720 000 tonnes/year, while the requirement would be 2,5 million tonnes/year.

The main current problems are:

- Generally low application rates.
- Big disparity between zones and crop systems.
- The potential and needs of crops not taken into account.
- The excess use of fertilizers in irrigated areas is causing accumulation of nitrate in soil and groundwater.

Land degradation

In Morocco, there is limited information about water and wind erosion and other problems such as stoniness, desertification, salinity, waterlogging, soil compaction.

According to a Ministry of Agriculture report (1995), 5.5 million hectares of sloping area are subject to water erosion.

Wind erosion is affecting soils and vegetation. To reduce this problem, farmers are planting trees as barriers to reduce the erosive velocity of wind. These conditions are met in arid and Saharan areas of southern Morocco, which are characterized by low and variable precipitation and frequent droughts, and high winds and high temperatures wind erosion also cause damage to infrastructure in irrigated areas such as Agadir.

The urban population in Morocco is about 54 percent in 2000. The urban population has been increasing rapidly, from 3.4 million inhabitants in 1960 to 8.7 in 1982 and 15.6 million in 1999. It is estimated that the urban population will be 18.7 million in 2007. Uncontrolled urbanization has led to shanty towns, which are constructed on fertile land near the big towns. Even urban planning trends to focus on productive agricultural land in level areas.

An inventory of soil studies by the cadastral administration in 1993 has listed information about the kind, date of realization of the soil study, the location and extent. The studies cover about 10 millions hectares at 1/50 000 and 1/100 000 scales, and about two million hectares at 1/20 000 scale.

Results of previous programmes

Several plans and strategies give priority to land and water resources:

- National irrigation programme.
- National watershed planning.
- National plan of reforestation and reforestation framework plan.
- Strategy of pasture land development.
- National programme to combat desertification, which is in preparation in accordance with the international convention to combat desertification.
- Land management and conservation framework plan “ISCRAL”.

In cooperation between MADREF and the FAO's Regional office, a Soils and Terrain database was produced at a scale of 1:5 million, on the basis of the manual by ISRIC (1995).

Several priority actions have been recommended:

- Partial completion of the soil map of Morocco.
- Establishment of land vocation map.
- Preparation of soil degradation map.
- Preparation of a practical guide for land management and conservation.
- Promotion of dryland cropping technology.
- Study and establishment of funds for reparation of damage caused by flooding on cultivated land.
- Institution of an interministerial committee responsible of management of land use.
- Establishment of a network to collect information on land resources.

The full Morocco country report is available at the Gateway Web site:

http//www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/sw1wpnr/sw1wpnr.htm

The state of land and water resources in Syria

Summary

Country overview

The total extent of the Syrian Arab Republic is 18.5 million ha, one-third of which is arable land or forests and two-thirds, desert and rocky land. Syria is divided into four main geographic regions:

- the narrow coastal region along the Mediterranean, between the mountains and the sea;
- the mountains and hills, including the coastal range;
- the interior region, east of the coastal range, including the plains of Damascus, Homs, Aleppo, Al Hassakeh and Daraa;
- the Badia, the desert plains in the southeastern part of the country.

The population is about 16 million (1999), half of which is rural.

The climate is Mediterranean, with rainy winters and hot dry summers and two short transitional seasons. Annual rainfall ranges from more than 600 mm in the west to less than 200mm in the arid central and southeastern half of the country. Natural vegetation ranges from forests in the west through shrub pseudosteppe to pseudosteppe and sub-desert.

Water resources

The Euphates river and groundwater are the main sources of irrigation water in Syria. There are about 1.2 million ha of irrigated land (1997), six percent of the total land area and 21 percent of total cultivable land. Sixty percent of the irrigated land is served by groundwater, although total renewable groundwater resources represent less than seven percent of the total available water resources.

Land degradation

Major land degradation processes in Syria are salinization in irrigated areas, water erosion in mountain regions and wind erosion in the steppe area.

Waad Youssef Ibrahim,
Ministry of Agriculture and Agrarian Reform (MAAR),
Soil Research Directorate-GIS Department,
Syria

While irrigation became extensive in the area as early as 4 000 – 3 000 B.C., salinization of irrigated land only started in the nineteen-forties, when large-scale irrigation became possible by using diesel pumps. It became serious from the nineteen-fifties, when cotton was introduced as a summer cash crop, with the rise in groundwater level because of the absence of any drainage system and misuse of irrigation water.

Water erosion mainly occurs in the mountains in the western, subhumid part of the country. Wind erosion is affecting about a quarter of the steppe area, and has become significantly more prevalent in recent decades with the large increase in rainfed agriculture in the steppe, from some 36 000 ha in 1982 to more than 550 000 ha in 1990.

The full Syria country report is available at the Gateway Web site:

http//www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/sw1wpnr/sw1wpnr.htm

Land resources information in Tunisia

Summary

Agricultural development in Tunisia is related to the economic growth and better use of natural resources in the North-African and Mediterranean environment. Programmes and strategies for 10 years were elaborated on:

- mobilization and national use of hydraulic resources;
- conservation and protection of the rural environment (soil and water conservation, reafforestation, pastures);
- improvement of the productivity of the agricultural sector (large-scale crops, arboriculture, olive growing, animal health, etc.);
- implementation of plans relative to the intensification of sectors of agricultural production

Numerous pedological studies based upon prospecting, photo interpretation, laboratory analyses, remote sensing and the results of monitoring stations, have been realized in Tunisia over more than half a century and cover almost all the territory. 10.4 million ha, 65 percent of the country is covered by maps. These studies aim to better knowledge of the country's soil resources in order to use them rationally for agricultural purposes. Thus, at the African level, Tunisia is among the best studied countries in Africa, with 636 pedological studies; 317 special pedological studies; 2086 preliminary prospecting studies; and 18 issues of *Sols de Tunisie*, the bulletin of the Direction of Soils. All these documents are classified and available in the library of the Direction of Soils.

Tunisia, with a total area of 16.4 million ha, 9 000 km long and 542 km wide, presents, from north to south, a strong bioclimatic gradient. Among the 16.4 million ha of its total surface, Tunisia has at present about:

- 3.5 million ha of agricultural lands (21 percent of the total area), which are divided up as follows:
  - 1.3 million ha for annual crops on the average, which may reach 1.7 million ha in rainy years;
- 2.0 million ha for arboriculture;
- 1.0 million ha of scrub and forest rangelands, of which 0.7 million ha of forests;
- 6.0 million ha of rangelands (decreasing resources);
- 0.4 million ha of steppe (decreasing resources);

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Director, Soils Department, Ministry of Agriculture,
Tunisia

- 5.0 million ha (30 percent of the total area) of soils not suitable for cultivation, composed of raw mineral soils and saline soils (salt lakes, saline depressions, etc.).

In Tunisia land degradation is due to water erosion (37 percent) and wind erosion; the two forms of erosion are often associated.

The medium- and long-term objectives concern first, the diagnosis of the state of soil resources in Tunisia, and a better use and the durable management of soil resources in the environment of Mediterranean and desert regions. In the second place, study of the following subjects:

- Soils and systems of soils in the different agro-ecological environments;
- Original organization of soils in the landscapes;
- Problems of the use of soils by man (irrigated and dry farming)

The country has a diversity of landscapes:

- forests and steppes;
- lakes and saline depressions;
- the desert;
- the littoral plains

In the future, soil information systems based on well structured data bases and geographic information systems (GIS) will provide easier access to the available information and enable technicians and researchers to understand the functioning and evolution of the different soils. At present, the computer science unit is able to realize the following studies:

- pedologic cartography for dry and irrigated farming systems (mapping of soil types and soil use, determination of geo-referenced coordinates by GPS, digital elevation models, etc.);
- mapping of water erosion risk by use of Arc Info and Arc View. Because of insufficient human resources, the areas studied remain limited to a few landscape units in the North.

The programme "Spatially referenced information system for irrigated systems in Tunisia" realized by the Direction of Soils with the collaboration of the Research Institute for Development (IRD, France) and applied to the low valley of Medjerda in north-eastern Tunisia presents results concerning hydro-agricultural development. It enables the integration of georeferenced pedologic, hydraulic and agronomic data aiming at establishing a model for the functioning of the developed irrigated system: The GIS contributes largely to the modelization of the data. The goal of the project is improvement of water use at the parcel level with respect to climate, soil type and agricultural practices, in order to find the necessary solutions and choose the actions to be undertaken.

The full Tunisia country report is available at the Gateway Web site:

http//www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/sw1wpnr/sw1wpnr.htm

State of land, water and plant nutrition resources in Turkey

Summary

Country overview

Turkey has influential geo-political status because its location serves as a natural bridge between Europe and Asia. Turkey has a total area of 779 452 square kilometers, of which 14 300 square kilometers is water surfaces. It is surrounded by the Black sea in the north, the Mediterranean Sea in the south and the Aegean sea in the west. It shares land boundaries with Greece and Bulgaria in the northwest, Georgia, Armenia and Azerbaijan in he northeast, Iran in the east and Iraq and Syria in the southeast. Turkey is generally divided into the Aegean, the Mediterranean, Central Anatolia, the East and Southeast Anatolia regions. Turkey has 81 provinces and 76 457 villages. Capital of Turkey is Ankara city.

The average rainfall is about 650 mm, which varies considerably from region to region, from about 250mm in the central and southeastern plateaus, to 2 500 mm in the northeastern coastal plains and mountain regions. Turkey, situated in the temperate zone, has various climatic types in different parts of the country. The average annual temperature ranges from 4 to 20ºC. Because of the highly variable terrain and exposure to hot and cold winds, local microclimates can vary widely from the regional averages.

Turkey is a predominantly mountainous country, and true lowland is confined to the coastal fringes. Four main regions can be identified; the northern folded zone, the southern folded zone, the central massif, and the Arabian platform.

Agriculture production is of special importance to Turkey due to its increasing population and the great contribution agriculture makes to the national economy (Table 1). At present, 46 percent of the population depend on the agriculture for their livelihood. The share of the urban population in the total is rising by around 4.5 percent every year. In 1999, agriculture accounted for 14 percent of GDP and 13.8 percent of exports. Agricultural output increased by an annual average of 1.1 percent between 1990 and 1998. The country produces virtually all the commonly needed food crops, with some surpluses for export. Agricultural output in

Table 1
Main economic indicators and population

Real GDP growth (percent)	7.0
Consumer price inflation (percent)	92.0
Current-account balance ($bn)	0.6
Trade balance ($bn)	-13
Foreign reserves ($bn)	22.0
Foreign debt ($bn; estimate)	75.2
Average exchange rate (TL: $)	123 000
Interest rate (percent)	79.2
Population (million)	64.3

Source: SPO and SIS, 1998

Sebahattin Keskin
Soil and Water National Information Center of GDRS
Turkey

Turkey consists predominantly of crop production which in 1999 accounted for 72.4 percent of total agricultural output, as against 21.6 percent for livestock products. Fisheries and forestry account for 3.9 percent and 2.46 percent respectively. A major portion of the economically active population is employed in the agricultural sector. Cereals, especially wheat and barley, are Turkey's most important crop. Turkey's most important agricultural exports are tobacco, cotton, dried fruit (hazelnuts, seedless raisins, figs, apricots), pulses (chickpeas and lentils), live sheep, goats, fresh fruits (apples and citrus fruits) and fresh tomatoes. Exports of processed agricultural products include tomato puree, some mutton and sugar, processed nuts and canned fruit. Agriculture also plays a key role in supplying raw materials to industry, especially sugar, tobacco, tea and cotton. Although Turkey remains a net exporter of food products, imports, particularly of dairy products and beef, are tending to grow faster than exports.

Land resources

In Turkey the real understanding of soil survey and mapping began in 1952 with the help of FAO. A Turkish team, led by the American soil consultant Harvey Oakes, produced the first general soil map of Turkey at a scale of 1:800 000 by 1954, on the basis of reconnaissance survey and geological and topographic maps. The General Directorate of Soil and Water prepared the Turkey Development Soil Map (TDSM), based on a 1:25 000 topographic map at the reconnaissance level. In this study, map units were recorded relating to the 1938 American Soil Classification System including depth, slope, stoniness, and erosion phases. After evaluating the data, two maps were produced: a Soil Resource Inventory Map for every province at a scale of 1:100 000; and a Watershed Soil Map and Report showing 17 of Turkey's 26 major catchments at a scale of 1:200 000. Today this study is the main resource base for addressing the problems and uses of Turkey's soils (Table2).

The Turkey Soils Potential Survey and Non Agriculture Aims Land Usage Planning Project was replaced with the Turkey Development Soil Map Surveys by the General Directorate of Soil and Water between 1982–1984. From 1987 onwards, maps were prepared from the results of the Turkey Development Soil Maps Surveys at a scale of 1:100 000. With the consultation of the GDRS and the surveys, a map called the Turkey Soil Zones Map was also prepared at the scale of 1:2 000 000. This was published as the Turkey General Soil Management Plan.

Water resources

Rainfall accounts for an average of 501 billion m³ of water annually. It is estimated that 274 billion m³ of this returns to the atmosphere through evaporation and transpiration from soil and water surfaces and plants; 41 billion m³ feeds underground reservoirs through leakage and deep percolation; and 186 billion m³ runs off into seas or lakes. Around 6.9 billion m³ of water is added to the country's water potential through rivers of neighboring countries. Thus the renewable fresh (surface) water potential of Turkey is about 234 billion m³, depending on climatic fluctuations. The total safe yield of groundwater resources is estimated at 12 billion m³. Finally, it is estimated that the total (technically and economically) usable surface and ground water potential of Turkey is 110 billion m³, with 95 billion m³ of this coming from internal rivers, 3 billion m³ from external rivers and 12 billion m³ from ground water resources. Turkey possesses 177 714 km of river, 203 599 hectares of lakes natural of lakes and 179 920 hectares of lakes created by dams and artificial lakes, an area which is increasing all the time. The total annual water withdrawal is 42.0 billion m³ for whole country by 2000. The total development of water resources by public

TABLE 2
Land cover and land use by land capability class

Land Use	LCC Class								Total	Percent Cover
	I	II	III	IV	V	VI	VII	VIII		
Cultivated lands	**4.82**	**6.04**	**6.03**	**4.87**	**0.01**	**3.96**	**2.30**	**-**	**28.05**	**36**
Rainfed-fallow agriculture	1.58	2.80	3.77	3.50	0.01	2.47	0.75	-	15.02	
Rainfed agriculture	0.94	1.69	1.20	0.76	0.01	0.86	0.75	-	6.23	
Irrigated agriculture	2.01	1.21	0.72	0.25	0.01	0.11	0.02	-	4.35	
Vineyards	0.05	0.72	0.11	0.10	0.01	0.13	0.09	-	0.56	
Orchards	0.17	0.13	0.08	0.07	-	0.05	0.03	-	0.56	
Special crops	0.05	0.12	0.12	0.16	0.05	0.32	0.52	-	1.31	
Pasture/meadowland	**0.14**	**0.44**	**0.73**	**1.64**	**0.09**	**4.16**	**14.28**	**-**	**21.51**	**27.6**
Pasture	0.01	0.15	0.09	0.07	0.07	0.04	0.14	-	0.64	
Meadow	0.09	0.28	0.63	1.56	0.01	4.11	14.14	-	20.86	
Forest/shrubs	**0.01**	**0.17**	**0.42**	**0.84**	**0.02**	**2.62**	**19.11**	**-**	**23.22**	**29.8**
Forest	0.01	0.11	0.29	0.59	0.01	1.63	12.53	-	15.19	
Shrubs	0.01	0.06	0.12	0.25	0.01	0.98	6.58	-	8.04	
Waste or abandoned lands	**0.09**	**0.10**	**0.08**	**0.06**	**0.01**	**0.07**	**0.13**	**0.32**	**0.89**	**1.1**
Other	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3.06**	**3.06**	**3.9**
Water bodies	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.15**	**1.15**	**1.5**
Total	**5.08**	**6.77**	**7.28**	**7.42**	**0.12**	**10.82**	**35.83**	**4.54**	**77.90**	
Percent of total land area	**6.5**	**8.7**	**9.3**	**9.5**	**0.2**	**13.9**	**46.0**	**5.8**	**99.9**	
I + II = 15.2 percent, I + II + III = 24.5 percent, I + II + III + IV = 34 percent, VI + VII = 59.9 percent, VI + VII + VIII = 65.7 percent										

Source: (GDRS), 1997

institutions in several sectors reached 32 billion m³ in 1994. This is 14 percent of the gross water potential, or 29 percent of the technically and economically usable potential. Agriculture consumes almost 75 percent of the developed water resources.

In Turkey, 25.85 million ha of the 28.15 million ha of cultivated can be irrigated. Since the land that can be irrigated and the water resources are in different locations, under considerations of project economy the area of land that can be irrigated is accepted as 8.5 million ha. By the end of 1995, 4.5 million ha of land were connected to the irrigation network, meaning that 47.8 percent of the 8.5 million ha of land that can be irrigated was being irrigated. To organize the water regime in Turkey, the building of 473 dams of various sizes is under consideration and the most important investment in this respect is the Atatürk High Dam within the Southern Anatolia Project (GAP) now under construction. When this project, along with all the dams within it, is completed, 1.8 million ha of land will be opened up to irrigated farming and agricultural production will rise substantially. Generally, countries with Per capita annual water availability between 1 000 and 3 000 m³ per cap have major problems during drought years. Conflicts in sectoral allocation of water are likely to arise. The burden of adjustment will ultimately fall on the agricultural sector as the major consumptive user. Increase in water use efficiency of already existing irrigation systems will not only save water, but also improve yields. The environmental problems related to water resources have reached quite dangerous levels in Turkey.

Soil and plant nutrient resources

According to the soil survey and research trials, zinc and iron deficiency seem to be a major problems in Turkish soils. Many factors restrict the use of new agricultural techniques related to soil management: extensive sloping areas and cultivation on steep slopes, shallow soils, low biologic activity, high sensitivity to erosion, stoniness, salinity and drought risks. Soil erosion is a crucial problem affecting soil fertility and sustainability. 68 percent of the arable land is seriously eroded. Only 14 percent of the total land area has a soil depth of 90 cm or more. As for land slope, only 38 percent of total land area is ideally suitable for farming. Eleven percent of the arable land is covered by stones, which seriously restrict soil productivity. Improper agricultural practices lead to salinity in some areas. An estimated 1.5 million ha of arable land suffers from yield limitations because of salt and boron problems and a further 2.8 million hectare from waterlogging. The main land management problem faced in Turkey is that land is not used in accordance with its capabilities.

Most soils have high potassium content, but more than half are low in phosphorus. Balanced and sufficient fertilizer applications are very important for the stability of productivity and it is improvement. While total fertilizer production was 3.3 million tonnes, fertilizer consumption was about 5.5 million tonnes in 1999.

Hot spots

Agriculture and rural development are integral parts of overall national resources management covering all related sectors. A draft Law concerning the use of water resources and justification was prepared in 1968 but not enacted yet. Drafting a Law concerning the usage of land resources has not been prepared yet. During the last decades, as in many other countries, Turkey has been involved deeply in realizing many civil works but less so in the human and social components of development, which are of great importance for rapid improvement. This approach, which is changing only slowly, has become a real constraint against rapid development in every sector, including agricultural and rural development.

There is considerable overlap of duties in the same area by several organizations causing many problems of coordination and wasting time and money. Although DSI constructs major irrigation infrastructure and GDRS small-scale irrigation schemes and on-farm development works, DSI is legally in charge of the nation's groundwater development. For small-scale groundwater irrigation projects, DSI sinks the wells, installs the pumps and connects the electricity and GDRS completes the canal infrastructure. Both agencies report the same groundwater schemes as their achievements.

Extension on irrigated agriculture is not effective. The information from GDRS on irrigation and other relevant research findings are not effectively transferred to the extension service under the ministry of agriculture and the farmers. There is no relation with farmers training and finance issues. Land and water management advice is not clearly included in the extension programmes for better land and water management and group formation. Piped and pressurized irrigation systems (more sophisticated and water-saving) account for less than 5 percent of the overall irrigated area. The prevailing irrigation methods in Turkey are conventional. In Turkey, 90 percent of irrigation canals are concrete lined, increasing the conveyance efficiency in the system. But overall water use efficiency is about 40 percent, ranging from 10 to 70 percent. Irrigation water management is deficient in both main and on-farm systems. Training is one of the major problems. Neither staff nor farmers are involved in sound training programmes.

Bright spots

A draft Law concerning the use of water resources has been updated and will be enacted in the near future. Preparation of a draft Law concerning the use of land resources has already been started. The involvement of beneficiaries in agricultural and rural development has been encouraged by government. This is a phenomenal development in privatization efforts, the pace of which has surpassed all expectations. Small-scale irrigation projects can only be carried out after setting up users' cooperatives (generally village people). After constructing the irrigation systems, GDRS hands over the main O&M responsibility to the users.

To solve the problems related to environmental conservation, Parliament approved a new law in 1993, according to this law every activity which may be environment related must be accepted by the Environment Commission under the Ministry of Environment. The Commission is responsible to investigate all agricultural and rural development projects of public of private organizations and has the authority to reject projects that may harm the environment. Facilities defined in the regulation that are subject to the special permission include energy plants, non-metal production and processing facilities, metals production and processing, chemical plants, organic matter and plastics production and processing facilities, timber and paper production, beverage, food and agricultural product facilities, waste disposal plants and storage, packing and dumping facilities for dusty material. A National Environmental Action Plan was prepared and opened for discussion. All services in terms of rural infrastructures are planned to be transferred to local authorities. Thus, it is expected that financial, human and other resources will be efficiently managed. And especially the beneficiaries will be involved in all stages of the system. Some governmental organizations involved in agricultural and rural development have run pilot training programmes for farmers. In these programmes, the beneficiaries have been informed about the importance of environmental conservation and agricultural methods respecting the environment. Some civic organizations and NGOs also have held campaigns to inform the public about environmental issues and sustainable development. In order to increase public support for maintaining the environment, communication tools including, TV, radio, extension services, training and study tours have been used successfully.

Challenges and viewpoints

On the basis of statements in development plans and programmes, the main objectives of Turkish agricultural policy are:

- Ensuring an adequate growth rate in agriculture.
- Increasing productivity and diversifying agricultural production by improving production techniques. Improving the level of nutrition of the Turkish population.
- Raising the standard of living of those employed in the agricultural sector.
- Decreasing unemployment.
- Controlling the influx of labour from rural to urban areas and reducing intrasectoral income disequilibria; and
- Improving agricultural infra structure and ensuring better utilization of production factors.

The full Turkey country report is available at the Gateway Web site:

http//www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/sw1wpnr/sw1wpnr.htm

The state of land and water resources in Yemen

Summary

Yemen contains by far the most fertile land in the Arabian Peninsula. Agriculture has always been extensively practised in the coastal plains, in the wadis, in the highlands, and on the eastern plateau.

The first Yemeni settled in fertile mountain terrain and near wadis. By 2000 BC, they were a prosperous nation. The rainfall in Yemen is irregular. To solve this problem, the Yemenis used stone breakwaters and weirs. They constructed weirs in every wadi, which achieved two objectives: first, preventing frequent damage to villages and farms that had previously been caused by violent torrents after heavy rainfall; secondly, maximizing the amount of the water available for irrigation during periods of drought.

On the high lands, terraces were built to retain water and keep the land fertile. In dry inland areas, wells were dug, sometimes to great depths, and the water used for irrigation. Tanks and reservoirs were built near springs and wadis to conserve the water.

These works helped in achieving significant agricultural development, transformed Yemen into a green land with rich orchards; at this time it became known to those who lived there as "Happy Yemen".

Agriculture is an important sector in the economy. It contributes 18 to 27 percent to the Gross Domestic Product (GDP) and employs 60 percent of the labour force. The main commodity groups produced are cereals, industrial crops, vegetables, fruit and livestock. However, the role of agriculture is changing due to dynamism of these sectors, emigration of rural labor, and structural changes within agriculture.

Increase in population and economic activities have lead to increased pressure on resources use. The natural resources that support agriculture are greatly threatened; the old terraces have degenerated, lands are degraded and soil fertility has deteriorated. Desertification and dune encroachment on agricultural land are severe, particularly along the coastal areas, resulting in an annual loss of about 5 percent in agricultural land. These problems came about as a result of many factors, including land tenure system and insufficient enforcement of formal property rights.

Groundwater is over-exploited, and the tendency to neglect the traditional systems is increasingly causing depletion of groundwater, deterioration of quality of water for irrigation and

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salinization of soils. About 70 percent of the total cultivated area in Yemen is rainfed, where 80 percent of the cereal crops are produced.

The full Yemen country report is available at the Gateway Web site:

http//www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/sw1wpnr/sw1wpnr.htm

Annexes

Annex 1
Welcome addresses

Prof. Dr Ala'a Bunduq, First Undersecretary of Ministry of Agriculture and Land Reclamation and Representative of Deputy Prim Minister and Minister of Agriculture and Land Reclamation
Prof. Dr Yousif Walley;
Dr Ghassan Hamdalla Representative of FAO Regional Office in Egypt;
Dear Guests;
Ladies and Gentlemen,

It is my pleasure to welcome you at the Executive Authority for Land Improvement Projects, which has the honour to host the regional workshop on land resources information systems in the Near East, 3-6 September 2001, under auspices of the Ministry of Agriculture and Land Reclamation.

In Egypt, agriculture is shaped by two goals - the first goal is maximum national production per unit area, the second goal is maximum production per cubic meter of water. Therefore, this strategy relates the utilization of national resources, soil and water, and to do this in a proper way we need tools and technologies which will allow to develop these resources in a sustainable manner without encroachment or putting pressure on the environment or affecting these fragile resources.

The total Egyptian agricultural land is about 8 million ha (3.36 million ha) which is almost entirely dependent on irrigation. With a population of about 66 million people, there is tremendous and constant pressure to produce more on a very limited resource base. At present 50 percent of the land resources in Egypt is either of poor or of low quality mainly because of development of salinity and sodicity problems, which hinder realization of the beneficial effects of any agricultural inputs.

Therefore, increased attention has been given to increase the productivity of such deteriorated soils. Since its establishment in 1971 by the Ministry of Agriculture and Land Reclamation, the Executive Authority for Land Improvement Projects (EALIP) has had the overall responsibility for all types of land improvement in Egypt, with the main function to promote activities and actions which lead to increased yield and productivity of old land and to check the deterioration of soil capabilities. It plays a central role in implementing the strategy of the government for better utilization, conservation and restoration of land productivity. It has a yearly plan to improve one million ha, through 22 regional offices and 37 subregional offices in the different Governorates of Egypt. It undertakes a soil improvement programme including gypsum application for improving

Eng. Ahmed Dawoud
Chairman of Executive Authority for Land ImprovementProjects – EALIP,
Cairo, Egypt

productivity of sodic soil; subsoiling to improve soil physical properties, break up hard pans, soil compactions and all indurated layers within the roat zone; and land levelling, reshaping of field drains, and canals for better water management. Since the establishment of EALIP and till now a total area of 12 million feddans were studied and 11 million feddans were improved, with a reported increase in the agricultural production exceeding 30 percent.

GIS-based soil degradation data have been available at EALIP since 1996. EALIP has produced information maps on salinity, gypsum requirements, subsoiling and water table depth for the whole country on the district level (1: 100 000), for one governorate on the village level (1:25 000) and for three governorates on the basin level (1:2 500). Work is going on to produce these maps at a basin level for the whole country.

I want to express my deep appreciation to The Food and Agriculture Organization of the United Nations for their constant support to strengthen the information capacity of our authority and I look forward to continuing this cooperation in the future.

Before ending, I would like to welcome you to Egypt, and I am confident that the exchange of experiences and know-how that will take place in this workshop will prove profitable and enriching to all.

Thank you.

Mr Ala'a Bunduq, 1st Deputy Minister for Agriculture & Land Reclamation;
Engineer Ahmad Dawoud, Chairman of the Executive Authority for Land Improvement Projects;
Colleagues and Friends,

It gives me great pleasure to welcome you all to this Workshop on behalf of Dr. Atif Bukhari, the FAO Regional Representative for the Near East.

Friends, this current Workshop on Land Resources Information Systems comes at the right time for the Near East.

The 29 Member Countries of the Region extend over a wide geographic span from West Asia to the Atlantic Ocean. The Region covers about 10 percent of the world's land area and had a population of about 600 million, but receives about 2 percent of the global renewable fresh water resources.

In addition, the arable lands in the majority of the Region's countries are limited. An overall average of the arable land available is about 0.20 ha/capita; and in some countries it is less than 0.01 ha. The severe limitations of both land and fresh water resources, coupled with escalating demand for food to feed the ever-increasing population, all tend to aggravate the pressure on the natural resource base and seriously threaten its sustainability. Here the sound management of land and water resources becomes a necessity and not just an option.

One other factor that adds to the complexity of the resource situation relates to the great disparity in the geographic distribution. To explain this contrast in the Near East, we observe that about 60 percent of the good arable lands lie in only four countries of the Region: Iran, Pakistan, Sudan and Turkey. On the other hand, the high-income countries of the GCC council are very poor in terms of both fresh water and good agricultural lands. While the Sudan, for example, has 220 million acres of arable lands, it is often living with food gaps in many parts of the country because of the inadequate infrastructure and capital investment allocations for agricultural development.

We are living in the Information Technology Era, which is manifested in all aspects of our life. Sound planning and sustainable utilization of resources requires reliable information, and updated figures. Access to information has become easy and affordable by almost all nations. They need to deal with their national databases seriously, update the data regularly and establish linkages with other relevant regional and global networks.

The Egyptian experience in establishing the Gateway for Land, Water, and Fertilizers is a good example and we are all pleased to cite it as a success story. In addition to the trained cadre that the country has acquired, this Information System can provide valuable tools for monitoring and evaluation for the soil conditions and could spot any potential hazard such as: salinity level, depth to water table, or any nutrients degradation that requires intervention. Being part of the FAO global Gateway, it gives the national information system an international dimension and broadens its use and circulation

Dr. Atif Y. Bukhari
ADG/Regional Representative, RNE,
Cairo, Egypt

As you are aware, land and water utilization for agricultural production in our Region is facing tough competition from other economic sectors, such as industry, urban, and tourism development. The rate of return per ha or per cubic meter of fresh water is been reckoned for all these sectors, including agriculture. It is a known fact that the share of agricultural consumption of water claims over 90 percent of the total sum in our Region. Assuming this lion share from a dear and vital source of life "Water", one cannot afford to be wasteful or random in its use. Precise planning and utilization of these limited water resources and the good productive soil resources surely need correct and updated data.

Our Workshop today falls within the efforts of FAO, in cooperation with our colleagues from the other Regional and International Organizations, in providing technical assistance to our Member countries in their endeavours to strengthen their national capacity to inventory and conserve their national resource base.

I would like here to recognize and welcome the presence of our colleagues, representatives from AOAD, ESCWA, Arab League, and the UNEP Regional Office in Bahrain.

Dear Participants, we are looking forward to your Country Reports that you have compiled. You will have the opportunity to discuss the format, data collection and reporting, updating and networking with others. This will help in harmonizing the terminology, framework and data reporting of the national Gateway, as part of the Global FAO one.

You have a busy programme and a field trip, and I am sure that you will benefit a great deal from the exchange of national experiences that became possible through the joint efforts of FAO and the Executive Authority for Land Improvement Projects of the Ministry.

Before closing, I would like to express my sincere thanks and appreciation to the Executive Authority and particularly the Chairman, Engineer Ahmed Dawoud and the Soils Department Director, Dr. Mohammad Goma'a and his associates, for the excellent set-up, facilities and logistic support they provided to the organization of the Workshop.

Allow me also to welcome the presence of our participants from Egypt, Iran, Jordan, Lebanon, Libya, Morocco, Oman, Syria, Tunisia, Turkey and Yemen; as well as the presence of all other organizations.

I wish you a successful workshop.

Thank you all.

Annex 2
Workshop programme

REGIONAL WORKSHOP ON LAND RESOURCES INFORMATION SYSTEMS

IN THE NEAR EAST

(3 - 6 September 2001)

MONDAY, 3 SEPTEMBER 2001

Opening Session

08:30 – 09:00	- Registration
09:00 – 09:15	- Welcome remarks and introduction of participants
09:15 – 09:30	- FAO Welcoming remarks (ADG RNE)
09:30 – 09:45	- Inauguration of the Workshop (Host Government)
09:45 – 10:15	- Coffee break

Session I **Land Resources Information Systems (LRIS)**

10:15 – 10:35	- Overview of Land Resources Information Systems in FAO *(Jack Antoine, FAO Senior Technical Officer/AGL)*
10:35 – 10:50	- Land Resources Information Systems in the Region *(Ghassan Hamdallah, FAO Regional Soils Officer/RNE)*
10:50 – 11:20	- Land Information Systems at the National Authority for Remote Sensing and Space Science *(Sami Abdel-Rahman)*
11:20 – 11:50	- Introduction to the AGL Internet Gateway to Land and Water Information *(Sachimine Masui, APO Land Resources Information, FAO)*
12:00 – 13:30	- Lunch break

Session II **Land Resources Information Systems (Continued)**

13:30 – 14:00	- Country report 1- Egypt "Land and Water Resources Information System (LWRIS) in Egypt". *(Mohamed Gomaa)*
14:00 – 14:15	- Country report 2- Iran
14:15 – 14:30	- Country report 3- Jordan
14:30 – 14.45	- Country report 4- Lebnan
14:45 – 15.00	- Coffee Break

15:00 – 15.15	- Country report 5- Libya
15.15 – 15.30	- Country report 6- Moroco
15.30 – 15.45	- Country report 7- Oman
15.45 – 16.00	- Group Discussion for Sessions I and II.

TUESDAY, 4 SEPTEMBER 2001

Session III	**LRIS Appliacations at EALIP**
09:00 – 10:30	- Visit to EALIP Office for Demonstration of the Gateway to Land and Water Resources in Egypt (EALIP Staff)
10:30 – 11:00	- Coffee Break

Session IV	**Country Reports (continued)**
11:00 – 11:15	- Country report 8 - Syria
11:15 – 11:30	- Country report 9 - Tunisia
11:30 – 11:45	- Country report 10 - Turkey
11:45 – 12:00	- Country report 11- Yemen
12:00 – 13:30	- Lunch Break

Session V	**Wrap up of Country Reports**
13:30 – 14:30	- Summary of Country Reports
14:30 – 15:00	- Coffee Break
15:00 – 15:30	- Group Discussion on Session IV and V

WEDNESDAY, 5 SEPTEMBER 2001

Field Trip

08:00 – 18:00 Field trip to Kafr El-Sheikh Governorate to see and discuss the EALIP Authority implementation programmes to reclaim and manage salt-affected soils in Egypt, including land levelling, sub-soiling, gypsum application, clearing of irrigation canals. In addition, the construction of drainage system will be reviewed with special attention to the monitoring system for evaluating and improving of the salt-affected soils after reclamation, including the use of GIS facility in the Authority.

THURSDAY, 6 SEPTEMBER 2001

Session VI **LWRIS Review in the Near East Region – the way forward**

09:00 – 09:15	- Introduction to Review of AGL Gateway Guidelines and the Internet Template (Jacques Antoine, FAO)
09:15 – 10:15	- Review of Guidelines and Template in Working Groups (all participants)
10:15 – 10:30	- Presentation of Review Results (all participants)
10:30 – 10:45	- Coffee Break
10:45 – 12:00	- Discussion on National and Regional Follow-up Action
12:00 – 12:15	- Presentation of Plan of Action (Gateway Reports and Networking)
12:15 – 13:30	- Lunch Break

Session VII **Concluding Session**

13:30 – 16:00	- Workshop Conclusions and Recommendations (all participants) - Report on Workshop Achievements (Antoine/Hamdallah and country representatives) - Concluding Remarks (AGLL/RNE/EALIP)

Annex 3
List of participants

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Annex 4

Status of preparation of country reports

The status and a tentative timeframe for completion of the reports are summarized in Table 1 below.

TABLE 1
Status of preparation of country reports

Country	Status completion of full report for Gateway (percent)	Constraints	Planned date of completion
Egypt	100	Access to information in other Institutions	Summary report to be completed by end September
Iran	0	Late selection of participant, late reception of guidelines and template and time	No date given
Jordan	0	Guidelines not received on time due to deficient line of communication in Jordan	Summary report to be completed by end September Full report: No date given (possibly financial and technical assistance required)
Lebanon	85	Manpower, Time	December 2001
Libya	0	Late reception of guidelines and template and time	December 2001
Morocco	70	Time to reorganize report according to template and to add other information (i.e. SOTER maps)	December 2001
Oman	0	Lack of Institutional capacity and manpower	No date given
Sudan	0	Lack of institutional capacity and manpower	No date given
Syria	50	lack of information	October 2001
Tunisia	50	Time	November 2001
Turkey	90	Time for collecting data	October 2001
Yemen	90	lack of information	October 2001

Annex 5

Guidelines for preparation of a Country report: State of land, water and plant nutrition resources

These guidelines constitute a general framework to assist a systematic compilation of information for the reports. The guidelines should ensure that country reports will be comparable along the lines of common themes, such as land use and land degradation, state of water resources, hot spots and bright spots. The guidelines are exhaustive: they are presented in the form of a checklist of items from which a selection can made depending on relevance and availability of information in specific situations. If the information is not available or is not relevant to the country or the part of the country considered it should not be included in the report or may be added at a later date. In certain cases the FAO approach (e.g. agro-ecological zoning) has been suggested. Where this information is not available, data gathered using other kinds of methodologies should be presented. The guideline will be updated from time to time as more experience is gained.

The report is a 'live' document. The aim of the report is to bring together the most up-to-date information on land water and plant nutrient resources. Where possible, information should not be presented as static data but in the form of trends, preferably in a visual format (maps, tables, charts, images). The motto is to have short but suggestive text and a lot of simple but "attention catching" visual objects. Internet lends itself perfectly for this kind of presentation. Hypertext enables the information to be easily modified: items can be added or deleted at any time and with much ease. As new information becomes available and topical issues change (discussed in the challenges/viewpoint section), the report can be updated, new sections inserted and new links made. Combining information and presenting it in this format will make it more useful and also easier to comprehend by decision makers and other users.

The report is designed for a wide range of users: policy makers; national agencies; international agencies and donors; educational and research institutions; NGOs and other interested groups; private investors.

In the hydrography, irrigation/drainage section, FAO (Aquastat) information may be provided for the country. A country may then choose to add to or replace this information with that from other sources.

General

In the first instance, the report can be prepared as a word document. This can then be stored and converted to html format for dissemination via Internet or CD-ROMs. Using the hyperlink function it is possible to link up the various sections of the report that have common issues as might be the case for example between 'Natural hazards' and 'Hot spots'. It is possible to do this even under 'word 95' by selecting 'cross reference' from the 'insert' box. Links should be

made to other web sites where appropriate. As general rule the most recent available data must be used. The main sources of information should be listed at the end of the document.

Where possible, data should be presented in the form of trends, preferably in a visual format (maps, tables, charts, pictures) that supports or replaces text. The data must be checked for coherence (e.g. percentage values should total 100). Text should be short and factual except in the more discursive 'challenges/viewpoint' section which focuses on important topical issues. Here different opinions could be voiced and links made to relevant articles. At the end of the document there should be a list of contact addresses (e-mail/web sites) of relevant institutions and people. The length of the report should be no more than 20 pages including text, graphics and pictures.

A. Country overview

Geographic location (description, localization map)

Geomorphology

Administrative units (Capital city, regions, provinces, other administrative units)

B. Socio-economic features

Population (population statistics: size, density, percentrural/urban population, percent population growth, major employment sectors, per capita income and per capita arable land).

Economy (brief description of the main economic sectors of the country)

The role of agriculture in the country's economy (trends in agriculture's role in the economy, contribution to GDP and employment)

Major food crops and cash crops and trend in production

Food security (major food source, present and future food demand, methods to achieve this – cropping intensity, crop diversification)

Cropping intensity (country's cropping intensity, trends in the use of single, double and triple cropping)

Crop diversification (crop diversification programmes, results)

C. Climate

Climate description (general climate type)

Table of climatic data (humidity range, temperature data, mean annual rainfall, monsoons and average seasonal rainfall)

D. Physiography

Physiographic units (definition of physiographic units; map and area covered by physiographic units)

E. Soils

Soil types and distribution (soil map; area and proportions occupied by general soil types)

F. Inundation Land Types

Inundation land types (definition of inundation land types; inundation map, area and percentage cover of inundation land types)
Inundation land types and cropping patterns

G. Land cover

Land cover (definition of land cover, land cover map and area occupied by different land cover types); trends in land cover

H. Land Use

Land use (definition of land use)

Land use types. The following major land use types, (and subtypes) are recognized:

Cropland: land used for cultivation of crops, including fallow (field crops, orchards)

- Annual field cropping: land under temporary/annual crops harvested within one year (e.g. maize, rice, wheat and vegetables).
- Perennial field: cropping land under perennial crops. Crops harvested more than one year after planting (e.g. sugar cane, banana, sisal, and pineapple).
- Tree and shrub cropping: producing several crops (e.g. coffee, tea, grapevines, oil palm, cacao, coconut, apple, and pear).

Grazing land: land used for animal production

- *Extensive grazing land:* grazing on natural or semi-natural grasslands, grasslands with trees/shrubs (savannah vegetation) or open woodlands (for livestock and wildlife).
- *Intensive grazing land:* grass production on improved or planted pastures, including cutting for fodder (for livestock production).

Forest land: land used mainly for wood production and other forest products, protection.

Mixed land: mixture of land use types within the same land unit: agroforestry (trees and crops), agro-pastoralism (crops and livestock), agro-silvo-pastoralism (crops, trees and livestock).

Other land: recreation, road sites, construction sites, etc.

Area percentage of the land use type (For each land use type, the relative area should be assessed as a percentage of the total land use area and displayed in a pie chart).

Land use areal trend. The changes in areal extent of the Land Use Type (LUT) can be represented by one of the following five classes:

-2: area coverage is rapidly decreasing in size, i.e. >2 percent per year of that specific LUT area.

-1: area coverage is decreasing in size, i.e. 0-2 percent per year of the LUT area

0: area coverage remains ± stable as a percentage of the LUT area

1: area coverage is increasing in size, i.e. 0-2 percent per year of the LUT area

2: area coverage is rapidly increasing in size, i.e. > 2 percent per year of the LUT area

Land use intensity trends. A change in the intensity of land use is expressed through changes in inputs, management, or number of harvests, etc., over approximately the last 10 years. Only changes within the same LUT and on the same area (change of intensity) are to be considered here - not changes from one LUT to another.

-1: A moderate decrease in land use intensity

-2: A major decrease in land use intensity

0: No major changes in inputs, management level, etc

1: Moderate increase, e.g. switch from no or low external input to some fertilizers/ pesticides; switch from manual labour to animal traction

2: Major increase, e.g. from manual labour to mechanization, from low external inputs to high external inputs, etc.

Example:

LAND USE			
Land use type	*Area percent*	*Areal Trend*	*Intensity Trend*
Cropland	*40*	*2*	*2*
Grazing land	*25*	*1*	*1*
Forest land	*15*	*-2*	*2*
Mixed land	*20*	*0*	*0*
Other land	*0*		

Land Productivity

US dollar equivalents for the average production value of outputs per hectare for each land use type will be used as a relative indicator for productivity, and for estimating trends and regional differences. Figures for cropland will generally be easier to give than for other land uses, but if figures were known for grazing land or forest land, they would be welcome.

Average input. The production value for each LUT is related to inputs of materials, equipment and labour per hectare per year. Hence all inputs, including hidden costs such as the farmer's own labour, should be estimated. Any establishment costs should be averaged over the period since implementation and added to the annual costs. The total value of the inputs may be higher than the total production value. Some quite productive areas may actually appear not to be all that profitable in proportion to the amount of inputs, e.g. from analysis of farm budgets. Inputs include labour – own and hired, seeds, fertilizers, pesticides, mechanization/ hire of ox, cost of irrigation, income from outside farm, income from livestock.

Productivity trend. Although changes in productivity can be attributed to a wide variety of causes, they may also be an indication of soil degradation or, if positive, of effective soil conservation and appropriate land management. Only a rough indication of trends in productivity is required here:

1: increasing outputs

0: no change in outputs

-1: decreasing outputs

Example:

LUT		Productivity	Av. prod. value (US$/ha/yr)	Av.inputs (US$/ha/yr)	Production Trend
Cropland	1	Contour tillage	125	100	1
	2	Grass strips	145	160	1
	3	Association (1/2)			
Grazing land	1	Controlled grazing	?	?	?
	2				
	3				
Forest land	1	Reforestation	200	250	1
	2	Area closure	180	150	1
	3				
Mixed Land	1				
	2				
	3				
Other land	1				
	2				
	3				

I. Agro-ecological systems

Agro-ecological zones *(definition of AEZ, AEZ map)*

Land capability classes *(definition of LCC, percent cover)*

J. Hydrography

Water resources:

Surface water, groundwater, nonconventional water resources, fossil resources. Major basins (surface and groundwater); dams, flood control, mobilization of water resources; international rivers, agreements...

Water withdrawal

Water use by sector and trends: trends in agricultural water withdrawal - irrigation and livestock watering - domestic water withdrawal and industrial water withdrawal, other uses; future: competition between sectors

Wastewater: treatment, reuse (agriculture)

K. Irrigation and drainage

Irrigation potential (method of calculation)

Place of irrigation/drainage in agriculture, percentage of cropland irrigated

History of irrigation in the country, trends

Description of the different irrigation systems

Irrigation methods (spate, flood recession, full control...)

Irrigation techniques: breakdown by technique (sprinkler, surface..); trends in development of drip and sprinkler irrigation; breakdown by source of water (river, groundwater..); wastewater reuse in irrigation

Irrigated schemes: typology by size and by operating modes; scheme size; number of beneficiaries, management, performances, cropping intensity, fees

Cost of irrigation development, cost of O&M, return form irrigation

Irrigated crops: major crops, areas and production, comparison rainfed/irrigated yields for major crops

Institutional environment

Institutions in charge of water resources assessment, development of irrigation; mandates of the main institutions.

Water and land legislation (status, implementation).

Trends in water resources and irrigation development, constraints to development, institutional changes, perspectives.

L. Plant nutrient resources

Use of plant nutrient resources *(types of plant nutrients used, trends in plant nutrient use, projections in plant nutrient consumption).*

Trends in mineral fertilizer consumption per hectare (Kg/ha) and yields, per main food crop (also rice types) and cash crops

Types of fertilizer produced locally/imported

Cost of different fertilizer products *(port handling, transport price, storage price)*

Fertilizer subsidies

Farm budgets in different cropping systems

Farmer cash flow

Impact of fertilizer use on the environment. Nutrient imbalance *(effects of nutrient imbalance on soil fertility; the application of mixed fertilizer programmes and results)*

Water pollution

M. Natural hazards

Natural Hazards *(type, location, frequency, damage to food crops, control methods adopted and their effectiveness)*

N. Hot spots: land and water constraints to sustainable agriculture

The detail of items will depend upon particular country circumstances

Hot Spots *(definition)*

Problem soils (*definition of problem soils, localization map and area of problem soils)*

Human-induced soil degradation *(types, extent, localization and effect on crop yield)*

- ***Water erosion (on-site effects*)**: loss of topsoil by sheet erosion/surface wash and terrain deformation by gully or rill erosion or mass movement.
- ***Water erosion (off-site effects):*** sedimentation of reservoirs/waterways, flooding and pollution of water bodies with eroded sediments.
- ***Wind erosion (on-site effects):*** loss of topsoil by wind action and terrain deformation, deflation hollows, hummocks and dunes.
- ***Wind erosion (off-site effects):*** overblowing of terrain with wind-borne soil particles from distant sources.
- ***Fertility decline*:** net decrease of available nutrients and organic matter in soil.
- ***Salinization:*** net increase of salt content in the topsoil leading to productivity decline
- ***Dystrification:*** lowering of oil pH through the process of mobilizing or increasing acidic compounds in the soil.
- ***Compaction and crusting*:** deterioration of the soil structure due to trampling by cattle or weight or frequent use of machinery; and clogging of soil pores causing development of a thin impervious layer.
- ***Waterlogging:*** effects of human-induced hydromorphism (rising watertables and flooding).

Map of areas affected by different types of soil degradation

Land use issues

Encroachment on prime agricultural land conversion

Land tenure and land policy

Conflicts in land use

Water use issues

Conflicts related to use of water resources

Inadequate use of water resources

Other hot spot issues

Concentration of agrochemicals and pollutants

Genetic erosion and biodiversity depletion *(risk areas)*

O. Bright spots: Examples and perspectives of sustainability of production systems

The detail of items will depend upon particular country circumstances

Bright spots ***(success stories for hotspot items)***

Available lands for sustainable agricultural development

Sound land use and allocation policies

Sustainable land use systems

Landcare programmes

Success stories in land use

Biodiversity/genetic resources conservation and use ***(e.g. crop diversification)***

New technologies (biotechnology etc.)
Infrastructures and mechanization/automation *(e.g. precision farming)*
Sound use of water resources

P. Challenges, viewpoints

The challenges are country specific. They have to be clearly identified especially in land, water and plant nutrition resources management, and strategies developed to meet the challenges.

Q. References

R. Contact addresses

WORLD SOIL RESOURCES REPORTS

1. Report of the First Meeting of the Advisory Panel on the Soil Map of the World, Rome, 19-23 June 1961 (E)**
2. Report of the First Meeting on Soil Survey, Correlation and Interpretation for Latin America, Rio de Janeiro, Brazil, 28-31 May 1962 (E)**
3. Report of the First Soil Correlation Seminar for Europe, Moscow, USSR, 16-28 July 1962 (E)**
4. Report of the First Soil Correlation Seminar for South and Central Asia, Tashkent, Uzbekistan, USSR, 14 September-2 October 1962 (E)**
5. Report of the Fourth Session of the Working Party on Soil Classification and Survey (Subcommission on Land and Water Use of the European Commission on Agriculture), Lisbon, Portugal, 6-10 March 1963 (E)**
6. Report of the Second Meeting of the Advisory Panel on the Soil Map of the World, Rome, 9-11 July 1963 (E)**
7. Report of the Second Soil Correlation Seminar for Europe, Bucharest, Romania, 29 July-6 August 1963 (E)**
8. Report of the Third Meeting of the Advisory Panel on the Soil Map of the World, Paris, 3 January 1964 (E)**
9. Adequacy of Soil Studies in Paraguay, Bolivia and Peru, November-December 1963 (E)**
10. Report on the Soils of Bolivia, January 1964 (E)**
11. Report on the Soils of Paraguay, January 1964 (E)**
12. Preliminary Definition, Legend and Correlation Table for the Soil Map of the World, Rome, August 1964 (E)**
13. Report of the Fourth Meeting of the Advisory Panel on the Soil Map of the World, Rome, 16-21 May 1964 (E)**
14. Report of the Meeting on the Classification and Correlation of Soils from Volcanic Ash, Tokyo, Japan, 11-27 June 1964 (E)**
15. Report of the First Session of the Working Party on Soil Classification, Survey and Soil Resources of the European Commission on Agriculture, Florence, Italy, 1-3 October 1964 (E)**
16. Detailed Legend for the Third Draft on the Soil Map of South America, June 1965 (E)**
17. Report of the First Meeting on Soil Correlation for North America, Mexico, 1-8 February 1965 (E)**
18. The Soil Resources of Latin America, October 1965 (E)**
19. Report of the Third Correlation Seminar for Europe: Bulgaria, Greece, Romania, Turkey, Yugoslavia, 29 August-22 September 1965 (E)**
20. Report of the Meeting of Rapporteurs, Soil Map of Europe (Scale 1:1 000 000) (Working Party on Soil Classification and Survey of the European Commission on Agriculture), Bonn, Federal Republic of Germany, 29 November-3 December 1965 (E)**
21. Report of the Second Meeting on Soil Survey, Correlation and Interpretation for Latin America, Rio de Janeiro, Brazil, 13-16 July 1965 (E)**
22. Report of the Soil Resources Expedition in Western and Central Brazil, 24 June-9 July 1965 (E)**
23. Bibliography on Soils and Related Sciences for Latin America (1st edition), December 1965 (E)**
24. Report on the Soils of Paraguay (2nd edition), August 1964 (E)**
25. Report of the Soil Correlation Study Tour in Uruguay, Brazil and Argentina, June-August 1964 (E)**
26. Report of the Meeting on Soil Correlation and Soil Resources Appraisal in India, New Delhi, India, 5-15 April 1965 (E)**
27. Report of the Sixth Session of the Working Party on Soil Classification and Survey of the European Commission on Agriculture, Montpellier, France, 7-11 March 1967 (E)**
28. Report of the Second Meeting on Soil Correlation for North America, Winnipeg-Vancouver, Canada, 25 July-5 August 1966 (E)**
29. Report of the Fifth Meeting of the Advisory Panel on the Soil Map of the World, Moscow, USSR, 20-28 August 1966 (E)**
30. Report of the Meeting of the Soil Correlation Committee for South America, Buenos Aires, Argentina, 12-19 December 1966 (E)**
31. Trace Element Problems in Relation to Soil Units in Europe (Working Party on Soil Classification and Survey of the European Commission on Agriculture), Rome, 1967 (E)**
32. Approaches to Soil Classification, 1968 (E)**
33. Definitions of Soil Units for the Soil Map of the World, April 1968 (E)**
34. Soil Map of South America 1:5 000 000, Draft Explanatory Text, November 1968 (E)**
35. Report of a Soil Correlation Study Tour in Sweden and Poland, 27 September-14 October 1968 (E)**

36. Meeting of Rapporteurs, Soil Map of Europe (Scale 1:1 000 000) (Working Party on Soil Classification and Survey of the European Commission on Agriculture), Poitiers, France 21-23 June 1967 (E)**
37. Supplement to Definition of Soil Units for the Soil Map of the World, July 1969 (E)**
38. Seventh Session of the Working Party on Soil Classification and Survey of the European Commission on Agriculture, Varna, Bulgaria, 11-13 September 1969 (E)**
39. A Correlation Study of Red and Yellow Soils in Areas with a Mediterranean Climate (E)**
40. Report of the Regional Seminar of the Evaluation of Soil Resources in West Africa, Kumasi, Ghana, 14-19 December 1970 (E)**
41. Soil Survey and Soil Fertility Research in Asia and the Far East, New Delhi, 15-20 February 1971 (E)**
42. Report of the Eighth Session of the Working Party on Soil Classification and Survey of the European Commission on Agriculture, Helsinki, Finland, 5-7 July 1971 (E)**
43. Report of the Ninth Session of the Working Party on Soil Classification and Survey of the European Commission on Agriculture, Ghent, Belgium 28-31 August 1973 (E)**
44. First Meeting of the West African Sub-Committee on Soil Correlation for Soil Evaluation and Management, Accra, Ghana, 12-19 June 1972 (E)**
45. Report of the Ad Hoc Expert Consultation on Land Evaluation, Rome, Italy, 6-8 January 1975 (E)**
46. First Meeting of the Eastern African Sub-Committee for Soil Correlation and Land Evaluation, Nairobi, Kenya, 11-16 March 1974 (E)**
47. Second Meeting of the Eastern African Sub-Committee for Soil Correlation and Land Evaluation, Addis Ababa, Ethiopia, 25-30 October 1976 (E)
48. Report on the Agro-Ecological Zones Project, Vol. 1 - Methodology and Results for Africa, 1978. Vol. 2 - Results for Southwest Asia, 1978 (E)
49. Report of an Expert Consultation on Land Evaluation Standards for Rainfed Agriculture, Rome, Italy, 25-28 October 1977 (E)
50. Report of an Expert Consultation on Land Evaluation Criteria for Irrigation, Rome, Italy, 27 February-2 March 1979 (E)
51. Third Meeting of the Eastern African Sub-Committee for Soil Correlation and Land Evaluation, Lusaka, Zambia, 18-30 April 1978 (E)
52. Land Evaluation Guidelines for Rainfed Agriculture, Report of an Expert Consultation, 12-14 December 1979 (E)
53. Fourth Meeting of the West African Sub-Committee for Soil Correlation and Land Evaluation, Banjul, The Gambia, 20-27 October 1979 (E)
54. Fourth Meeting of the Eastern African Sub-Committee for Soil Correlation and Land Evaluation, Arusha, Tanzania, 27 October-4 November 1980 (E)
55. Cinquième réunion du Sous-Comité Ouest et Centre africain de corrélation des sols pour la mise en valeur des terres, Lomé, Togo, 7-12 décembre 1981 (F)
56. Fifth Meeting of the Eastern African Sub-Committee for Soil Correlation and Land Evaluation, Wad Medani, Sudan, 5-10 December 1983 (E)
57. Sixième réunion du Sous-Comité Ouest et Centre Africain de corrélation des sols pour la mise en valeur des terres, Niamey, Niger, 6-12 février 1984 (F)
58. Sixth Meeting of the Eastern African Sub-Committee for Soil Correlation and Land Evaluation, Maseru, Lesotho, 9-18 October 1985 (E)
59. Septième réunion du Sous-Comité Ouest et Centre africain de corrélation des sols pour la mise en valeur des terres, Ouagadougou, Burkina Faso, 10-17 novembre 1985 (F)
60. Revised Legend, Soil Map of the World, FAO-Unesco-ISRIC, 1988. Reprinted 1990 (E)
61. Huitième réunion du Sous-Comité Ouest et Centre africain de corrélation des sols pour la mise en valeur des terres, Yaoundé, Cameroun, 19-28 janvier 1987 (F)
62. Seventh Meeting of the East and Southern African Sub-Committee for Soil Correlation and Evaluation, Gaborone, Botswana, 30 March-8 April 1987 (E)
63. Neuvième réunion du Sous-Comité Ouest et Centre africain de corrélation des sols pour la mise en valeur des terres, Cotonou, Bénin, 14-23 novembre 1988 (F)
64. FAO-ISRIC Soil Database (SDB), 1989 (E)
65. Eighth Meeting of the East and Southern African Sub-Committee for Soil Correlation and Land Evaluation, Harare, Zimbabwe, 9-13 October 1989 (E)
66. World soil resources. An explanatory note on the FAO World Soil Resources Map at 1:25 000 000 scale, 1991. Rev. 1, 1993 (E)
67. Digitized Soil Map of the World, Volume 1: Africa. Volume 2: North and Central America. Volume 3: Central and South America. Volume 4: Europe and West of the Urals. Volume 5: North East Asia. Volume 6: Near East and Far East. Volume 7: South East Asia and Oceania. Release 1.0, November 1991 (E)

68. Land Use Planning Applications. Proceedings of the FAO Expert Consultation 1990, Rome, 10-14 December 1990 (E)
69. Dixième réunion du Sous-Comité Ouest et Centre africain de corrélation des sols pour la mise en valeur des terres, Bouaké, Odienné, Côte d'Ivoire, 5-12 novembre 1990 (F)
70. Ninth Meeting of the East and Southern African Sub-Committee for Soil Correlation and Land Evaluation, Lilongwe, Malawi, 25 November - 2 December 1991 (E)
71. Agro-ecological land resources assessment for agricultural development planning. A case study of Kenya. Resources data base and land productivity. Main Report. Technical Annex 1: Land resources. Technical Annex 2: Soil erosion and productivity. Technical Annex 3: Agro-climatic and agro-edaphic suitabilities for barley, oat, cowpea, green gram and pigeonpea. Technical Annex 4: Crop productivity. Technical Annex 5: Livestock productivity. Technical Annex 6: Fuelwood productivity. Technical Annex 7: Systems documentation guide to computer programs for land productivity assessments. Technical Annex 8: Crop productivity assessment: results at district level. 1991. Main Report 71/9: Making land use choices for district planning, 1994 (E)
72. Computerized systems of land resources appraisal for agricultural development, 1993 (E)
73. FESLM: an international framework for evaluating sustainable land management, 1993 (E)
74. Global and national soils and terrain digital databases (SOTER), 1993. Rev. 1, 1995 (E)
75. AEZ in Asia. Proceedings of the Regional Workshop on Agro-ecological Zones Methodology and Applications, Bangkok, Thailand, 17-23 November 1991 (E)
76. Green manuring for soil productivity improvement, 1994 (E)
77. Onzième réunion du Sous-Comité Ouest et Centre africain de corrélation des sols pour la mise en valeur des terres, Ségou, Mali, 18-26 janvier 1993 (F)
78. Land degradation in South Asia: its severity, causes and effects upon the people, 1994 (E)
79. Status of sulphur in soils and plants of thirty countries, 1995 (E)
80. Soil survey: perspectives and strategies for the 21st century, 1995 (E)
81. Multilingual soil database, 1995 (Multil)
82. Potential for forage legumes of land in West Africa, 1995 (E)
83. Douzième réunion du Sous-Comité Ouest et Centre africain de corrélation des sols pour la mise en valeur des terres, Bangui, République Centrafricain, 5-10 décembre 1994 (F)
84. World reference base for soil resources, 1998 (E)
85. Soil Fertility Initiative for sub-Saharan Africa, 1999 (E)
86. Prevention of land degradation, enhancement of carbon sequestration and conservation of biodiversity through land use change and sustainable land management with a focus on Latin America and the Caribbean, 1999 (E)
87. AEZWIN: An interactive multiple-criteria analysis tool for land resources appraisal, 1999 (E)
88. Sistemas de uso de la tierra en los trópicos húmedios y la emisión y secuestro de CO_2, 2000 (S)
89. Land resources information systems for food security in SADC countries, 2000 (E)
90. Land resource potential and constraints at regional and country levels, 2000 (E)
91. The European soil information system, 2000 (E)
92. Carbon sequestration projects under the clean development mechanism to address land degradation, 2000 (E)
93. Land resources information systems in Asia, 2000 (E)
94. Lecture notes on the major soils of the world, 2001 (E)
95. Land resources information systems in the Caribbean, 2001 (E)
96. Soil carbon sequestration for improved land management, 2001 (E F S)
97. Land degradation assessment in drylands – LADA project, 2002 (E)
98. Quatorzième réunion du Sous-Comité Ouest et Centre africain de corrélation des sols pour la mise en valeur des terres, Abomey, Bénin, 9–13 octobre 2000, 2002 (F)
99. Land resources information systems in the Near East, 2002 (E)

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