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COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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REPORT OF THE EXTERNAL REVIEW OF THE WORLD INFORMATION AND EARLY WARNING SYSTEM ON PLANT GENETIC RESOURCES (WIEWS)

16 – 26 September 1997, Rome, Italy

The Commission, at its Seventh Session, welcomed the arrangements made by the Secretariat for an external review of the WIEWS, to be undertaken in the latter part of 1997. The Commission requested that the review process be reported upon. Document CGRFA-8/99/6 reports on that review, and on the development of the WIEWS since the review. This document provides, for information, the text of the review itself.

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WIEWS Review

The Global Plan of Action called for the review of FAO's World Information and Early Warning System on Plant Genetic Resources (WIEWS). A review panel was convened in Rome on the 16th of September 1997 to evaluate the efficiency, purpose, and value of the WIEWS. This report is the findings and recommendations of the panel.

SUMMARY AND RECOMMENDATIONS

Summary of points addressed in the Terms of Reference

1. Relevance of the programme -- The programme is highly relevant to FAO's mandate, the activities of the CGRFA, and the MOUs with CBD and IPGRI. There are several activities within other departments of FAO that have relevance to WIEWS and PGRFA, AGPS needs to develop more co-operation with other in-house activities related to PGRFA and strengthen their information dissemination.

2. Coherence -- The programme lacks coherence and is not integrated. There is a need to develop a data model that shows how the separate data sets are related to each other and external systems and how FAO should participate in the flow of data through the global community.

3. Efficiency of operation -- The programme is very efficient and has done much with minimal staff and resources.

4. Achievements -- FAO has gathered data from many sources, established a network of people to provide data, analysed the country reports, contributed data to the State of the World report, provided assistance to researchers in many facets of PGRFA activity, and developed software to share information.

5. Factors affecting the programme -- The primary factors impeding the programme are limited resources, lack of input and poor data from member countries, and focus on software that has limited utility. The programme is negatively impacted by missing, incomplete, and out of date data which can only be remedied by greater commitment and participation by the member countries.

6. Recommendations for the future -- FAO needs to collect current data from existing electronic and other sources using WIEWS correspondents. They need to make available the real WIEWS data on the Internet and to build links to other international, regional, and national PGRFA databases. The AGPS must be integrated into the "corporate" information system of FAO (WAICENT), develop better co-ordination and collaboration inside and outside of FAO, and improve the stand-alone WIEWS software.

Assessment of Objectives and Recommendations

Assessment of EWM

The system was meant to provide an Early Warning Mechanism/System (EWM) for possible genetic erosion. The current system provides for some documentation of potential threats by national focal points but there are no threshold levels or procedures in place to monitor and evaluate the threats. The Panel feels that this is not the fault of the program. Instead it is due to a lack of scientific research and policy mechanisms. Also, there is no mechanism for tracking actions that were taken when threats were identified.

Recommendation – Several steps must be taken to have an EWM. First, scientific community needs to do research to identify parameters and thresholds. Second, countries must implement systems to continuously gather data on these parameters. Lastly, the international community must develop policies and procedures to take action. FAO should take leadership in co-ordination according to FAO's mandate. IPGRI and other scientific institutions should engage in more

research related to loss of diversity in PGRFA. For the foreseeable future, human analysis and input is necessary to produce a warning.

Assessment of Data Flow

The system was to be dynamic and current. This cannot be accomplished in its present form as a collection of non-network applications and with the lack of regular updates from countries.

Recommendation - National governments of member countries need to make a strong commitment to provide data on a regular basis to make the system current. Centres having *ex situ* collections under FAO should take leadership and set an example by providing regular summaries of their collections. Regional *ex situ* collections, regional networks of PGRFA, and crop oriented networks need to collaborate and co-ordinate activities to facilitate the flow of data.

Assessment of Design

The system was to be a "database of databases". There is a DBREVIEW system containing information on PGR databases but this is not integrated with WIEWS software. A stand-alone system of WIEWS exists with summary information on *ex situ* collections and organisation of national PGR programmes but does not link to DBREVIEW or through the Internet to other systems.

Recommendation - Proceed quickly to establish a presence on the Internet (WWW) with linkages to national, regional, and international databases (in the next 3 to 6 months). Collect information not only on the web sites but also on how to access relevant information buried in the databases. AGPS must make countries aware that FAO is the focal point for global PGRFA information.

The stand-alone version can be used as it is for non-Internet users. However, improvements to make it more "friendly", correct technical problems, and have greater functionality need to be considered.

Assessment of System Decentralisation

The system was to be decentralised. This is partially accomplished through the exchange of diskettes and exported data. However, the Panel feels that with the technology available for the last several years, including Internet, Web servers, and on-line databases, and the documentation activities in national and international programs, a greater exchange of information is possible.

Recommendation – The issues of decentralisation should be re-examined in light of the recent advances in computer and telecommunication technology. Decentralisation can mean a loose, simple linkage, between databases or a higher integrated, distributed global system demanding more co-operation between countries.

Assessment of SIS

The Varieties List database was to be included in the original World Information System and this has not been accomplished. The existing Variety Lists database at FAO needs to be complete and needs to be addressed by the Commission, since there may be other sources in the world with similar data.

Recommendation - If FAO is to disseminate information on varieties, it needs complete and up to date information from world seed and variety sources. It may be possible to link to OECD, regional, or national lists of cultivated varieties.

BACKGROUND AND CONTEXT

Genetic uniformity and loss of genetic diversity are serious concerns for the future security of the world's food supply. Facilitating the conservation, utilisation, and documentation of the plant genetic resources for food and agriculture (PGRFA) has been part of the FAO mandate since 1947.

PGRFA is an important component of the international movement to insure food security. It must be considered a necessary part of the "Food for all" initiative. Without the genetic diversity found in landraces and wild species, plant breeders and farmers will have increasing difficulty utilising marginal lands, increasing crop yields, and combating novel pests and pathogens. The increasing pressure on agro-ecosystem to produce food for the expanding world population makes the maintenance, documentation, and exchange of PGRFA for an important element in utilising the resources in agro-systems.

During the Fourth International Technical Conference on Plant Genetic Resources (ITCPGR) in 1996, members of the Commission on Genetic Resources for Food and Agriculture (CGRFA, formerly Commission on Plant Genetic Resources for Food and Agriculture, CPGRFA) adopted the Global Plan of Action (GPA). Activity 18, para 286 of the GPA calls for the evaluation of the World Early Information and Warning System (WIEWS). The development of WIEWS has a long history. A global information system was first proposed in the first meeting of the CPGR during 1985. At each successive Commission meeting, the structure and objectives of the "Information System" were revised. Review of the Commission Reports indicates that the main expectations of the commission are that the "Information system" would:
- be a referral mechanism;
- be decentralised and FAO will not house all the data;
- includes wild species related to food and agriculture as well as landraces and commercial varieties;
- be dynamic and constantly updated;
- be able to generate updates to the report on the SW/PGR;
- include an EWM of loss of PGRFA;
- and the EWM should be addressed to policy makers.

During the 1996 ITCPGR meeting the objectives of the EWM were further refined. The EWM should monitor key elements of genetic resources, conservation, and various factors causing genetic erosion. Also, it should establish mechanisms to insure that information on remedial or preventative action is transferred to appropriate points.

This review focuses on the part of the organisation that is responsible for the gathering, organising and dissemination of information on PGRFA, primarily through the WIEWS. In conducting this review, the Panel examined the historical evolution of the information system, the objectives of the system; organisation of the unit managing the programme; the relationship to other programmes in FAO, collaboration with other international organisations; the software and data produced by the programme; and publications produced by the programme or in collaboration with other programmes.

HISTORICAL PERSPECTIVES

In order to promote utilisation of PGRFA, the CGRFA has stressed the need to develop accurate, dynamic, up-to-date information system. The nature and scope of this information system has been monitored, reviewed and defined in subsequent meetings of the CGRFA. The Panel reviewed the reports from the Commission to put the events in perspective.

The need for an international information system on plant genetic resources was raised during the first session of the CGRFA in 1985 and the Commission called for the *establishment of a referral system to source information.* (Report of the First Session of the CPGR 1985 para 75).

The Third meeting of the Commission called for the inclusion of an EWM as part of the Global Information System (GIS). The purpose was to monitor the network of collections maintained by non-governmental international organisations (CPGR/89/5 para 35).

In the Fourth Session of the CPGR, the Commission noted that FAO would not maintain all the databases included in the Global Information System (Report of the PGR Fourth Session 1991, para 67). *...The Commission agreed to the Secretariat's proposal for the expansion of the SIS ... as the basis on which to build the GIS...* (Report of the CPGR Fourth Session 1991, para 65).

Also in 1991, a Memorandum of Understanding (MOU) for program co-operation between FAO and IBPGR was signed. This document explains which areas would be the primary responsibility of FAO and of IBPGR as well as where there is overlap and co-operation.

The Commission noted *that the PGR/WIS should be dynamic, constantly updated database of databases and other important information sources on all potential areas of interest to scientific community* (Report of the CPGR, Fifth Session. 1993 para 19). Also in the Fifth Session, the Commission *confirmed that the Early Warning System should form part of the Information System on PGR,* that an E*arly Warning System has a particular role in assessing the danger of erosion of PGRFA,* and *Warning will be directed at decision making bodies* (CPGR/93/5 para 30, 32).

The proposed warning [warning bell] would be brought to the attention of the international community through *State of the World report, a scientific report to the Commission, a periodic newsletter, or through an appeal by FAO to donors* (CPGR/93/5 para 32).

In the Sixth Session of the CPGR, *the Commission suggested that recent technological advances that could permit the decentralisation of the WIEWS be explored* (CPGR-6/95/REP para 38).

EVOLVING OBJECTIVES

The overall objectives of the PGR/GIS (CPGR/91/7 Rev. Section III para 12) were to:

(i)   *provide current information on PGR with regard to research, training, conservation (including regeneration), assessment of diversity, biotechnology, and its local application, the use of such resources, and health and quarantine factor; and*

(ii)   *provide a practical inventory of PGR (ex situ and in situ) to optimise their utilisation.*

The specific objectives for the PGR/SW (CPGR/91/7 Rev. Section II, para 7) were to describe the PGRFA activities in each country; to identify gaps in the current knowledge and understanding of the extent of diversity, availability, and utilisation of PGR; to identify gaps in the database network; and to propose priorities for actions on a global basis.

The system was to provide facts and figures to member nations describing national programmes on PGR; listing institutions involved in PGR activities, plant breeding and seed production; documenting *ex situ* collection; compiling variety lists; collecting information on *in situ* conservation of plant genetic resources, within and outside protected areas; describing other activities on PGR at the country level (Report of the Fifth Session of the CPGR, 1993 para 25).

The EWM was to alert decision-making bodies of all critical situations, which are likely to occur in gene banks or in the field as a result of natural disaster or human activity. The system should produce a warning so that the problem can be reported to the international community by appropriate means. This may be the State of the World report, a scientific report to the Commission or a periodic newsletter or through an appeal by FAO to donors (CPGR/93/5 para 19, 30 32). The Warning System's main function will be to continuously monitor key elements of genetic resources conservation (*in situ* and *ex situ*), in order to alert of any threats (CPGR/93/5 para 32). Opportunities of detecting changes and identifying the likely results include the country reports, collector's reports and the systematic monitoring of the causal phenomena (CPGR/93/5 para 31).

RELEVANCE

The WIEWS programme is located within the Seed and Plant Genetic Resources Service (AGPS) which is past of the Plant Production and Protection Division (AGP) of the Agriculture Department (AG). Size of staff involved in WIEWS is relatively small and includes the time of the following personnel since 1992, unless noted:

Table 1. Personnel involved with WIEWS.

Position	Time
Service Chief	(10% of time)
Senior Officer	(15%)
Information Officer	(100%)
Data Entry Clerk	(100% since 1995)
Seed Exchange Officer	(15%)
Secretarial support	(43%)

In the sub-programme 2.1.2.1 the work on WIEWS was started in 1992 when the Information Officer joined FAO. The work on developing an information system prior to that is mainly the development of Seed Information System containing list of commercial crop varieties.

The total biennial budget for WIEWS in 1996-97 is $770,000 (Sub-programme 2.1.2.1, Element 03 -- State of the World's PGR). The 1998-99 budget calls for shifting resources, one Information Officer and money, from another project within SP 2.1.2.1 to the WIEWS project. This would increase the budget for WIEWS to $1,089,000

Since 1993, FAO hired nine consultants to compile information, analyse data, provide assistance to a member country, and write software. Over the four years from 1993 to 1996, the total outlay for consultants was $96,903 out of a total of $187,903 for all operational activities (Other Human Resources) The remaining funds were used to support the ITCPGR, PGR newsletter, training and a technical workshop on WIEWS.

With the adoption of the GPA in 1996, governments undertook a legal commitment to build stronger national programmes (Activity 15); promote networks of PGRFA (Activity 16); construct comprehensive information systems. (Activity 17); and develop monitoring and EWM for the potential loss of PGRFA (Activity 18).

International events impacted this program. The ratification of the Convention on Biological Diversity (CBD) and the separation of the International Plant Genetic Resources Institute (IPGRI) from FAO create opportunities for co-operation and potential overlaps in activities with regard to information systems and networks of researchers.

The potential user-base is broad ranging. Breeders and other scientists are interested in locating collections, identifying material in collections, and what areas of collaboration are possible. National programme administrators may look to WIEWS for areas of potential co-operation with other nations or assess the needs for further exploration. Regional or international organisations may use WIEWS to produce statistics, contact relevant institutions, organise discussion groups, and exchange information on regional and global issues.

RELATION WITH CHM

The Convention on Biological Diversity also deals with documenting and exchanging information on genetic resources. Countries are encouraged to survey all of their genetic resources and make the information available to the rest of the world through a Clearing House Mechanism (CHM). Since PGRFA is a subset of the total biological diversity in a country, it was necessary to distinguish the responsibilities of FAO and the efforts of the CHM. This was accomplished through a Memorandum of Understanding with CBD in 1997, in which, ... *FAO shall co-ordinate*

the development and co-ordination of the Clearing house mechanism for the agro-biodiversity sector, in accordance with FAO's mandate, taking into account the complementary between the Clearing House Mechanism, ... (UNEP/CBD/SBSTTA/3/Inf.21 Article 2 (b)). The primary means of information exchange by the CHM is the Internet and WWW technologies. Both the CHM (UNEP/CBD/SBSTTA/3/Inf.12) and GPA (Activity 17 para 266 and 270) propose capacity building in the form of Internet connectivity. National governments are to decide their Internet requirements and should recognise that facilities may be shared between Ministries. International agencies should not be expected to provide redundant services.

RELATION WITH IPGRI (WAS IBPGR)

In its Memorandum of Understanding with IBPGR (now IPGRI), *FAO will establish a global information and early warning system designed to provide and update information for the preparation of the report on the state of the World's PGR.* Article 6 of the MOU referred specifically to databases and stated that *databases and documentation dealing with plant genetic resources will remain with both Organisations.* Also *the parties agree to continue to provide each other free access to their respective databases... on subjects of common interest. FAO will be the focal point for information and technical expertise on in situ conservation of PGR and will provide leadership in assisting countries to determine priorities for in situ conservation.* The databases "country profiles" and institutions are currently being shared between these Organisations with updates being exchanged as significant changes are made.

RELATION TO OTHER INFORMATION SYSTEMS

Information on PGRFA is expanding and being made available through new channels. Member countries have committed more resources to PGRFA. Regional and crop-specific networks have been formed to reach more breeders and researchers while the World Wide Web (WWW), e-mail, and the Internet have facilitated the flow of information.

Information system within AGP

AGPS has several information systems that are not fully integrated. WIEWS Country profile includes information on institutional structure, committees, crop activities, and general activities of the member countries. This information has been compiled from questionnaires, country reports, other databases, and personal communication. WIEWS *ex situ* collections include information on the holdings of gene banks. The database is structured to accommodate the crop (commodity), scientific name, type of material, origin of material, and number of accessions in the collection.

DBREVIEW (Database of Databases) is a directory of existing PGRFA databases and information systems, information on what data are held, and how they are disseminated.

SIS (Seed Information System) maintained by the Seed Exchange Officer, Dr. Sgaravatti, includes both the Crop Variety Database and the World List of Seed Sources. The first database lists the existing crop varieties in production. The second database lists the commercial and non-commercial seed sources. Neither of these two databases should be assumed to provide a definitive list. There is no mechanism in FAO to gather the data in a systematic or comprehensive way. In 1996, the fourth edition of the "World List of Seed Sources" was published. While this is a valuable publication and database, it is also an example of poor co-ordination between databases within the Plant Genetic and Information and Exchange Unit. Institution information is maintained separately and assigned different codes from those used in WIEWS.

The EWM information, assessable from the WIEWS software, contains reports on the possibility of genetic erosion in the natural environment and *ex situ* collections.

Information systems within FAO

Several information systems at other facilities within FAO are relevant to WIEWS and could have important implications. The following technical programmes within the FAO could provide

important sources of information for monitoring genetic erosion of *in situ* conditions and could possibly be involved in corrective measures.

CropInfo contains data on crop utilisation, environmental requirements, and husbandry. It is intended that this system would be able to link and extract relevant information from both WIEWS and SIS. This will require greater co-operation and co-ordination within FAO in areas of database technologies and standardisation. One example is the maintenance of a standard list of plant nomenclature including higher classifications so there is less confusion. The need is apparent when output from the CropInfo database is compared with output from WIEWS. CropInfo uses the family name Leguminosae while WIEWS uses the more widely accepted name Fabaceae.

The Domesticated Animal Database-Information System (DAD-IS) is basically a parallel system to WIEWS for poultry and livestock. The requirements and design of the system are different because the material is much harder to preserve *ex situ* or *in situ*, there are fewer domesticated animal species and breeds than crop species and varieties, and the program is very recent. However, DAD-IS does have some similar themes as WIEWS, in particular, its network of focal points and importance of receiving updates.

REFORGEN - Conservation of forest genetic resources is a subject of major national and international concern. The objective of REFORGEN is to make available reliable and up-to-date information on forest genetic resources for use in planning and decision making at sub-regional, regional and international levels.

FAOSTAT is an on-line and multilingual database currently containing over 1 million time-series records covering international statistics on a wide variety of subjects. Statistics on crop production land use and irrigation may be very valuable in assessing *in situ* genetic erosion and changing patterns in agriculture. This data may also be used in producing country profiles for future reports on the State of the World's PGRFA.

WAICENT is not so much a database as a common interface or vehicle to disseminate data at FAO. WIEWS data could be disseminated by WAICENT through Internet.

Information systems outside of FAO

Many information systems outside of FAO are relevant to WIEWS. There are international, regional, crop-oriented and national information systems on PGRFA.

SINGER is the result of a combined effort by the CGIAR centres and IPGRI. It is available on the WWW and CD-ROM. This is an accession level database on the holdings of the centres. Passport data on more than 500,000 accessions will be available through this system.

Many regional and national gene banks also are making their passport data available on-line and by CD-ROM. Some examples of current WWW sites are the NGB, CGN, ZADI, UKPGRG, CENARGEN and GRIN. Many more gene banks are developing databases, gaining access to the Internet, and installing WWW servers. Usage statistics from the GRIN web server show that it is accessed from more than 80 countries in a month.

DISTRIBUTION SYSTEMS

Currently, the primary means of distribution of data in WIEWS is by shipping diskettes on request. The data is on three diskettes and includes a data entry and retrieval program (wiews.exe). The software runs under DOS and is discussed elsewhere. The Panel believes that the present format is limiting. The Panel recommends that data in WIEWS be incorporated into the central database management system and be made available through WAICENT and Internet as well as a revised, stand-alone system.

The Internet and FAO web servers (WAICENT and ICPPGR) disseminate information relevant to PGRFA. The ICPPGR implemented a web server (URL=www.icppgr.fao.org) for the distribution of information relevant to the ITCPGR and received a snapshot of the WIEWS data. The server

provided a temporary interface to the data for the Leipzig Conference. The data on the server have not been updated and do not include the complete data set. FAO is in the final stages of creating the World Agricultural Information Centre (WAICENT, URL=www.fao.org). The Centre will provide clients - including governments, research institutions, universities and private users - with fast economical access to FAO's vast library of information on agriculture, fisheries, forestry, nutrition and rural development. The Panel views this as the official channel of FAO information dissemination onto the Internet and an umbrella structure for co-ordinating all FAO databases and information. Information on PGRFA needs to be prominently displayed and easily retrieved through this service. The Panel recommends that high priority be given to providing WIEWS data through this channel. The data displayed through WAICENT will be the official, national government provided data maintained by the AGPS. FAO management should monitor WAICENT to insure that there is consistency in presentation but, at the same time, it should not impede the specialised requirements and dynamic nature of the information.

Problems require clarification by the Commission on Genetic Resources

Some objectives of the WIEWS and expectations of the CPGRFA that requires further clarification. For instances, the Commission needs to clarify whether they want WIEWS to develop summary information about all PGRFA in the world, only that material held in national, regional, and international collections or in designated *in situ* locations, or detail information about all accessions. Some of the problems related to the rapid advancements in information technologies particularly the Internet, as a medium for data dissemination requires clarification too. The followings are other issues needing clarification:

1 World Information System portion. This developed out of a desire by the Commission for a database of databases to monitor the activities in documentation and dissemination of information. FAO databases like the Seed Information System, Cultivar database, and the database of database were meant to provide this information. The objectives are to be clear and the requirements must be updated to fit changing technology. There are still issues regarding how much detail FAO should maintain; should the system contain data on all PGRFA collections in the countries or just base collections; and what constitutes the "official" data from a country.

2   The cost and value to FAO and the national governments to maintain duplicate information at FAO about contacts, committees, and organisation. Maintaining a valid list of people active in PGRFA is important and replicated by many information systems. However, tracking changes, detecting duplicates, and maintaining computer programs in two systems is costly and needs to be managed more efficiently.

3 EWM portion. The Commission requested that FAO incorporate a means to record and track threats to PGR so that governing bodies would be notified and actions could be taken to preserve genetic diversity. As currently implemented, the EWM requires considerable data input for each threat, including specific problems with facilities, seed management, personnel for *ex situ* collections and topology and climate of *in situ* locations.

4 Source of information for the PGR/State of the World reports. WIEWS provided information for the first report on the State of the World's PGR. The primary contribution of WIEWS to the State of the World report was   the two tables in the annex documenting the size of the *ex situ* collections by country and crop.

5 The summary information of national programs, *ex situ* conditions, and participation in the data gathering process.

6 The Seed Information System deals with cultivars in production. The current SIS is valuable and contains much useful information. Many of the varieties are commercial and would not be in national collections. How these data fit with summary information about national programmes is not clear. More information is needed on what commercial ventures, countries, and international organisations (i.e. OECD) are planning so there is no duplication of effort.

ACHIEVEMENTS

The Sub-Programme 2.1.2.1, Element 03 has had to work on many activities to develop the WIEWS system. The first was to hire an Information Officer and set up an office. Then assess the needs, analyse data, develop a database structure and software to store the data, create a network of information providers, develop channels for distributing the information, and, in many cases of developing countries, provide training and/or equipment.

To collect data on all PGRFA in all countries and to report regularly this data requires the establishment of contacts in all the countries. There may be some redundancies with other FAO correspondents and IPGRI contacts in many countries. However, in many situations, the WIEWS correspondent would be a PGR information specialist associated with the national programme.

To establish this network, the FAO Information Officer is holding regional meetings to explain the role of this correspondent and provide training. This process should build regional networks. Meetings have been held in West Africa and Asia.

Several computer programs have been developed for this programme. The Seed Information System (SIS) records data on varieties in production and their important characteristics. This subprogram paid for the conversion of this system into a proper database and maintains back-ups of the system.

Another computer program/database maintained by this subprogram is DBREVIEW. This database is an attempt to summarise all the information systems on PGRFA. However, the data are not current. Information gathered from the country reports for the State of the World report can be used to improve the accuracy of this data.

The other major computer application/database developed by this subprogram is WIEWS.

MAIN POINTS OF WIEWS SOFTWARE

Overview

The WIEWS software requires special attention since it is meant to be the primary means of data collection and dissemination. The following is an overview of the WIEWS software and data. A full description and analysis is found in the Annex.

WIEWS provides information on PGR activities in 178 countries. The information has been extracted from country reports provided to FAO. In addition, WIEWS has information on institutional level activities, as general descriptions and as specified type of activity for different crops. WIEWS has provision for coverage of country profiles, committees and members, institute and contact persons, summaries of material stored in *ex situ*, and alerts on genetic erosion on material in *ex situ* storage and natural habitats.

The main functions performed by the software include the ability to view, edit, add and delete records from WIEWS databases. Exports of updated and added records create compressed files that can be sent to FAO for inclusion into new distributions of WIEWS. Search functions are provided to locate specific records according to entered criteria.

The software has the ability to create some reports and display certain statistics. Tabular reports on selected records in the country profile or conservation databases can be generated sent to a printers or files. Statistics on number of accessions and type of material stored *ex situ* can be generated on screen.

WIEWS runs in DOS environment as a menu-based program that supports mouse and keyboard shortcuts. A help function, for example, to show decoded values of coded fields, is provided for most of the fields in the database. Export of new or edited records for updates to be sent to the FAO is supported. Import of data from external databases is not supported, so all additions to the databases have to be made through the keyboard. The application does not provide a browse lists for selected records, only singe-record views.

The WIEWS application interface suffers from being a proprietary application built for the DOS operating system. It lacks many of the features available as standard in most applications designed for graphic environments. Regardless of hardware and operating system most software for graphic environments today provide a standard and consistent menu structure, use of dialogue and alert windows, navigation tools and keyboard shortcuts. WIEWS provides some similar features, but not consistently and not necessarily with the same functionality users have learned to expect from their software. In addition, because of the numerous bugs and missing features (e.g. browse capability), the process of learning and using WIEWS may become a tedious and frustrating experience.

The individual tables that make up the databases in WIEWS (Country Profile & Conservation databases) form run-time relations that are difficult to describe for uninitiated users. The number of tables included in the relations is adequate for the Country Profiles database, but the Conservation database could benefit from inclusion of synonym tables for taxonomic names and commercial varieties and cultivars.

The internal structure of the tables is also highly adapted to the special needs for WIEWS functionality. Direct import of information from users' own data structures with automated conversion scripts is not easy to accomplish. As a result, users are required to type in their data into WIEWS record by record, something that is not likely to happen at institutes with hundreds of records to report.

In the table for early warnings in natural habitats, the number of descriptors for the description of the location seems to be unnecessary high for a summarising approach.

Although the quantity of information available in WIEWS is impressive, the quality of the data is variable. For example, the Contacts table, which contains names of persons at the institutes, is already extensively out of date. If WIEWS remains a stand-alone application, unaware of global networks, updating the data may become more tedious and resource demanding than the initial gathering of information.

As the application does not apply integrity rules on values entered by the user, there also is a risk of further deterioration of data quality due to unintentional manipulation by the users.

The WIEWS software is meant to provide a means to enter and search summary data on conservation, PGRFA activities in countries, and reports of threats to PGR. No other organisation and database is in the position to gather and store this information for the entire world. However, there are problems with the flow of data. Most developed countries and many developing countries have an existing PGRFA information system as documented by DBREVIEW and the country reports. In those cases where the information is stored electronically, there should be no reason to use the WIEWS software for data entry. However, no facility is available nor format specified to receive data from these systems. In those countries without an information system, entering summary data into WIEWS only postpones the development of a complete, accession level, and gene-bank management system.

Database architecture

WIEWS contains three subsystems: contacts, material and warnings. The subsystems are not isolated from each other, i.e. relations are formed between tables belonging to different subsystems.

Application structure

WIEWS implements the database model as a 'one-tier' solution; local machines running WIEWS perform the function of:
- user interface (top tier or front-end)
- business logic (intergrity checking middle tier)
- database access (bottom tier or back-end)

The user interface is described in detail in the Annex. The integrity checking middle-tier functions are missing or poorly implemented in WIEWS. The back-end is represented by a Clipper database engine working on files in DBF-format.

Maintainance and updates

Updates from users are sent to FAO on diskette or as attachments to email. FAO performs integrity checking manually and distributes updated versions of WIEWS on diskette to the users.

Prospects

In a network environment, two- or three-tier models are preferrable to single-tier solutions. Only the user interface is present on the user machine, and can even be represented by a general Internet browser. The other tiers (middle and bottom tiers) can be implemented as server programs running on different machines on the network.

A two- or three-tier network solution substantially shortens the process of maintaining the database system. Users do not need to update their software from diskettes as any changes on the server side are immediately visible to all users on the network, both in respect of data content and in structure and functionality.

On the other hand, users that do not have access to the Internet would still need a one-tier software package of WIEWS. Since the number of users not having Internet access can be relatively large regionally, it would be adviceable that a single-tier version of WIEWS be maintained in parallel with a multi-tier network-aware application, at least for the near future.

The rapid development of information technology on Internet today does not allow very detailed recommendations on how a network application should be accomplished. The designers of the networked system should be left some freedom in design and possibilities to pick up on new innovations that may emerge in the field of information technology on Internet. At the time of writing (October 1997) access to relational database servers through ODBC or JDBC drivers, using either general Internet browsers enhanced with Java scripts or free-standing Java appliations on the client side, seems to be the main trend. Within the FAO, the department responsible for maintaining the WAICENT system already has the capacity to use these tools.

Database design issues

The SIS, DBREVIEW, and WIEWS data structures where designed for each application specifically. Each system has its own data model, data dictionary, coding schemes, and user interface. There is no global data model that encompasses the data activity for all the separate activities. There has been some normalisation of the data. For example, in WIEWS there are separate DBF files for the country profile (CP.BF), committees (COMMITTE.DBF), and members (CMEMBER.DBF). Data structures for the WIEWS files are discussed with IPGRI and FAO does provide copies of the DBF files upon request. The most requested information is from the Institute file (INST.DBF). People within FAO and from member countries request the file since it provides a good base for a mailing or contact list.

Efficiency in its operation and management

Numerous opportunities are available to collaboration within FAO considering the key nature of this programme: the activities of the Forestry Department in forest tree genetic resources and *in situ* conservation; the Agriculture Department in sustainable development; ICPPGR; and the information group in information dissemination (WAICENT).

The primary contact outside of FAO has been with IPGRI on several occasions resulting in joint publications, and shared information in the form of databases. Other collaborations included assistance to the Albania national programme and support of a regional training course in India. Also, in the context of establishing a global network of national correspondents or focal points, every country was requested to appoint a contact and to participate. Less than 30 countries have replied so far.

Coherence and appropriateness of its scope and design

The programme is not very coherent. Each database is a stand-alone product. There is a lack of consistency and integration between the systems. FAO needs to develop a data model that shows how the separate data sets are related to each other and to external sources of information. Then the user can examine the possible linkages to external data sources, particularly those that are available on the Internet. The summary information in WIEWS and country profiles should be linked to international, regional and national systems. The FAO web pages should assist the user in navigating the PGRFA data throughout the global community.

FAO will need to gather data on which systems are available through the Internet and how to query these other systems for basic data. It is envisioned that for a given species, WIEWS would show a summary of the world's holding by country or gene bank with links to the actual passport data if available. More elaborate searches may be performed as more systems come available, search tools become more sophisticated, and standards accepted.

Identification of factors facilitating or impeding effectiveness or efficiency

There is a lack of communication within FAO at a technical level of the development of information systems and databases that could be accessed by other divisions. Each new information system project should build on existing systems. This requires more in-house standards, a global data dictionary, assigning responsibilities for types of data, and mechanisms to resolve conflicts in data or the flow of information.

Changing computer and telecommunication technology has created many opportunities. The choice of software language for the WIEWS computer application (Clipper) has several limitations in its execution and user interface. For example, the requirement to press <Enter> after certain fields to accept the value is inconsistent with most other applications. In addition there are some bugs, many annoyances, and inconsistencies in the current program. These are documented in the Annex.

The panel is not aware of any survey of computer capacity and plans for enhancement by national programmes. FAO needs to monitor the current capabilities of countries and plans to upgrade so FAO can propose a minimum system configuration that is realistic in developing countries. This should be done by a survey of computer facilities in developing countries. A distinction is needed between what is the current computer capacity, what projects are currently being developed to improve the situation by their national government or other source, and if there are other limiting causes such as manpower and training. Equipment purchases might already by planned as a step toward electronic communication and Internet access. A graphical-based application would just add further justification and reduce overall training costs since there is greater uniformity of the user-interface under a graphical operating system.

EARLY WARNING MECHANISM/SYSTEM

An EWM to alert officials of potential threat to PGRFA is to be an important output of the WIEWS. Global environmental changes and human perturbation both affect the composition and genetic make up of our future plant communities. However there might be a long time (50-200 years) before the change and its impact on food production is realised. Policy makers and scientists are concerned about the possible loss of genetic resources because this will have adverse consequences for future agricultural production. Loss of some of the genetic diversity is unavoidable, but if the trend and the part of the diversity under threat are identified, at least complementary actions such as *ex situ* conservation could be put in place. However, there is no agreement on what to measure, how to monitor, nor what are the critical thresholds. It is not known what pests, pathogens, and environmental conditions will be important in the future, how to set priorities when every allele for every loci can not be preserved, and who will take responsibility for remedial actions.

The mechanism can only work if accurate, up to date measurements strongly related to erosion of PGRFA are made available. Genetic erosion can occur in *ex situ* collection as well as *in situ* sites,

while the number of factors affecting the erosion in *ex situ* are limited, those affecting that *in situ* are enormous. Similarly, corrective measures to control erosion at *ex situ* collections are generally more simple to apply than that of *in situ*.

Research is being done to assess genetic diversity in various crops. A current survey of scientific literature having "genetic erosion" as the key word in Plantgene CD 1989-1996 reveal that there are as many as only 322 reports. Many of these reports do not focus on the issue directly. Therefore, in order to have a quantifiable and reliable measure of genetic erosion more scientific research in this area is required. Some indicators having relevance to genetic erosion of PGRFA are listed in Table 2. FAO or national governments, by either the ministries of agriculture or environment, are gathering data on these indicators.

Table 2 Generalised examples of indicators to assess threat to PGRFA.

in situ genetic erosion

Indicator/ Case for concern	Reporting organisation	Type of data
Change in precipitation	FAO	Quantitative
Appearance of exotic species	National Gov. / CHM	Quantitative / Descriptive
Change in ground water level	National Gov.	Quantitative
Change in species composition	National Gov. / CHM	Quantitative / Descriptive
Change in species abundance	National Gov. / CHM	Quantitative / Descriptive
Mechanical disturbance of soil	FAO	Quantitative
Fire	FAO	Quantitative
Socio-economic factors	National Gov. / FAO	Quantitative / Descriptive
Livestock grazing	National Gov. / FAO	Quantitative
Soil erosion	National Gov. / FAO	Quantitative
Salinity	National Gov. / FAO	Quantitative
Land use	National Gov. / FAO	Quantitative / Descriptive
Crop productivity	National Gov. / FAO	Quantitative / Descriptive

ex situ genetic erosion (Loss of viability)

Human factors	International, Regional and national gene banks	Quantitative
Inadequate facilities	International, Regional and national gene banks	Quantitative
Gaps in knowledge	Scientific community	Descriptive

As it appear in Table 2, there are many sources of information which might already be available, various programmes within FAO are already working on topics related to measurement of factors related to *in situ* genetic erosion of PGRFA. Following is the list of such programmes as appeared in the memorandum of understanding between FAO and CBD in 1997.

Agriculture Department
> Conservation and management of plant genetic resources
> Plant protection.
> Agriculture support system
> Land and water development

> Plant nutrition management
> **Department of Sustainable Development**
>> Assessment and monitoring of biological diversity for food and agriculture at the agro-system level.
>> Gender and biological diversity for food and agriculture
> **Economic and Social Department**
>> Economic aspects of the conservation and sustainable utilisation of biological diversity for food and agriculture
>> Nutrition and biological diversity for food and agriculture
> **Forestry Department**
> **Watershed Management and Sustainable Mountain Development Department**

CGIAR centres housing international collections could take a lead in studying the genetic erosion in *ex situ* collections and IPGRI could have a co-ordination role in that. The result of such study could have important implications for national programmes and could help FAO to identify the threshold level for action and threatened *ex situ* collections in countries and priorities it's rescue activities related to the objectives of the EWM.

Information on *in situ* erosion of PGRFA is of much more complex nature compared to *ex situ* collections. The document UNEP/CBD/SBTTA/3/9 provides a comprehensive description of possible indicators to assess genetic diversity. Activity 1 of the Global Plan of Action asks for surveying and inventorying PGRFA. The effect of factors listed in Table 1 (a) on PGRFA can only be realised if they are assessed in the context of PGRFA only. Therefore it is recommended that FAO give a high priority to this part of the Global Plan of Action. FAO needs to draw the attention of the member countries that other activities in the GPA are dependent to the information generated by inventorying PGRFA (e.g. Supporting planned and targeted collecting of PGRFA, Developing monitoring and EWM for loss of PGRFA). Donor countries should also be approached to help this practice.

The panel believes that it would be impossible for an automatic computer based system to produce automatic warning. However FAO could co-ordinate and collect information from various sources and generate warning based on human inference of the accumulated data.

Possible scientific projects to assess genetic erosion

1. To estimate the gaps in diversity of species maintained in *ex situ* at CGIAR centres gene banks. This could help for identifying priority *in situ* sits important for maintaining genetic diversity of major food crops. Consequently the FAO through WIEWS could assess if a warning or any corrective / preventive or a rescue measure is to be taken by the International Community.

2. To assess the evolutionary response of major important food crops and their wild relatives to long term environmental changes. If the pattern of change is known, more attention could be given to those alleles or part of the diversity, which is in danger of loss.

3. To monitor the degree of human perturbation in centres of diversity of important food crops. Considering the slow paste of response to environmental changes by plant communities and the rapid expansion of human disturbance to plant natural habitats, it is important to make sure that plant populations have the chance of survival in their natural habitats and to help them evolve and adapt to the changing environment.

RECOMMENDATIONS FOR FUTURE DEVELOPMENT

The Panel stresses the importance of data flow from countries. None of the databases at FAO can fulfil the objectives without current data from the member countries. While the current software allows country updates to be transmitted by diskette to FAO it has no facility for importation of

data from existing systems. The Panel proposes that a transaction file format/definition be specified by FAO for accepting summary data from *ex situ* collections as given in this review.

Focus on gathering data to summarise and link to regional and national collections. Encourage countries to adopt standards so data can be compared. For example, using the same nomenclature and crop names (commodities). Currently data are provided with common names, genera, and species.

The Panel believes that the accession by accession data should not reside in WIEWS. The WIEWS database should be a summary of the holdings, conditions of *ex situ* collections and *in situ* activities. WIEWS should contain links to other data sources and where appropriate provide Internet links (URLs) to international (e.g. SINGER), regional (e.g. ECP/GR, NGB, SADC), and national databases.

CONCLUSIONS

WIEWS can play an important role in the exchange of information on PGRFA. For this to become a reality, member countries need to provide accurate and timely data. The WIEWS must accept bulk data summarising the content national systems. FAO needs to organise its databases into a coherent system. Finally, the PGRFA community needs to agree on certain standards to facilitate the exchange of data.

An EWM envisioned by the Commission is not technically feasible at this time. More discussion is needed to clarify what is a threat. More research is needed to identify the proper parameters to monitor and thresholds set for triggering alarms. Then monitoring systems can be implemented.

ANNEX

REVIEW OF WIEWS SOFTWARE

General

The notes presented on the performance and achievements of WIEWS are based on the stand-alone version 1.0. The WIEWS interface that was accessible through the Internet 1996-1997 is not covered, because of the temporary nature of that installation and the fact that it was based on a reduced data set.

The stand-alone version of WIEWS is installed on a normal PC running the DOS operating system. It does require Windows, but if Windows is not installed WIEWS still needs a memory manager (e.g. EMM386) to run.

The installation script installs 17 DBF (data) files in two directories, one for the country profiles and institutional data (defaults to \CP, 13 files) and the other for conservation data (defaults to \CONS, 4 files). The program itself, as well as some files for system settings (SYS.DBF), compression of exported records is installed in a third directory (\WIEWS). Five of the DBF files are for temporary data (CPCONTTA, CPCONTTE, CPCROPTA, CPCROPTE, and MATTEMP)

WIEWS is menu-based, and supports mouse and keyboard shortcuts.

PGR activity

WIEWS has information on the National Programs of 247 countries or former countries. The information has been extracted by FAO to database format from descriptive texts in 158 Country Reports and information provided by contacts in the countries. There are more than 8300 institution records in the INST file and they have 6222 contact records (CONTACTS), 111 committees (COMMITTE), and 175 committee members (CMEMBER). The MATERIAL file contains 43,000 records summarising the holdings of 1386 institute collections.

The WIEWS database contains two tables for description of PGR activities: A general table containing a text field describing the activities of institutes and a specific table for different crops of each institute. The crop/institute table contains fields with values representing activity of collection, conservation, characterisation, evaluation, documentation, utilisation, conservation research, diversity research, in vitro research, seed production, seed quality control, and breeding.

The general table contains information on PGR activities of 795 institutes, representing 102 countries. The crop/institute table covers 1543 institutes with PGR activities on at least one crop, representing 146 countries. The total number of crops covered is 3030.

Functions performed

The menu hierarchy of WIEWS is as follows:
> Quit
>> Yes
>> No
>
> Info Databases
>> Country Profiles
>> Conservation (*ex situ*)
>> Quit
>
> Early warnings
>> Genetic erosion in *ex situ* collections
>> Genetic erosion in natural habitats
>> Quit
>
> System Settings

Files
Output
Reindex
Quit

The 'quit' options on the three last menus are redundant, since they will not terminate the program but only close the menu.

Selecting Country Profile or Conservation will provide a pop-up list with following options:

View/Update
Search
Reports
Export Records

Country Profiles/View/Update will open up a dialogue box asking for a country code. Entering a country code will display records for that country, in full screen layout, if data for that country exist. The user will be able to skip forward and backward between the multi-page records in full-screen layout, or select sub-pages displaying data on institutes or national and regional committees. In the case of institutes, a dialogue box will be displayed, providing options for specification of institute code, acronym, location or country profile number. From the committee or institute level the user can go to further sub-pages to see member and staff information.

In all detail views the user can edit, delete or add new records by clicking appropriate buttons or by using keyboard shortcuts. There is no browse view of the records selected.

Conservation/View/Update will provide a field for species name in addition to the field for institute or country code. The 'species name' field is case sensitive, but will find partial strings. Entering a country code or a (partial) species name will display records corresponding to the selection in full screen layout, if data exist. The user will be able to skip forward and backward between the records in full-screen layout. A sub-page showing storage condition can be opened thought a button click or keyboard shortcut.

In all detail pages the user can edit, delete or add new records by clicking appropriate buttons or by using keyboard shortcuts. There is no browse view of the records selected.

Country Profiles/Search will open a dialogue box that asks the user to select between two target tables: 'contacts' or 'crops'. The user should also specify a country code or type 'ALL' in the country code field. The dialogue window also has an option for redirecting the output from the search to a printer/file.

Selecting 'Contacts' will open a dialogue screen for entering search criteria like person name (case sensitive but with partial string match) or logical descriptors in the form of 'Y' or 'N' for 'National PGR co-ordinator', 'Regional PGR co-ordinator' etc. The result page(s) will display information on the person(s) matching the criteria.

The user can skip forward and backward between the result pages, but editing is not possible. There is no browse view of all the matching records.

Selecting 'Crops' will open a dialogue box providing search criteria for crop name and generic crop name (case sensitive, partial string match) and type of PGR activity (Y/N values) that the institute/country is concerned with.

The user can skip forward and backward between the result pages, but editing is not possible. There is no browse view of all the matching records.

Conservation/Search will open a dialogue box that asks the user to provide search criteria for species name (case insensitive, partial string match), county code for country of origin, a code for type of material (AC – advanced cultivar, LR – landrace etc.) and whether (Y/N) the result should be an exact match of the type or include records with other types as well as the specified one.

The result page(s) will display information on the location (holding institute) and the storage terms of the material searched for. Editing is not allowed in the result pages. The user can skip forward, but not backward between the result pages. There is no browse view of all the matching records.

The content of a report is similar to the data that can be view through the View/Update menu option, but the format is tabular.

The report will be sent to a printer or a file depending on the settings in the System Setting/Output. There is no provision to display the report output on the screen.

Country Profiles/Reports will open a dialogue box providing options for following types of reports:
> Country Profile
> Institutions
> Contacts
> Crops
> General Activities
> Country codes

Selecting one of these options will open another dialogue box asking for the country code for the country of interest.

Conservation/Reports will open a dialogue box providing options for following types of reports:
> Germplasm maintained in collection(s)
> Conservation facilities in collection(s)
> Summary on genera (Country, Institution)
> Statistics on origin/type of germplasm

Germplasm maintained in collection(s)

A dialogue box will provide options for entering following criteria: Institute code, species, crop code (code for type of crop like forage plants, cereals, legumes), country of origin, type of sample, exact match.

Conservation facilities in collection(s)

A dialogue box will provide options for entering following criteria: Institute code, type of storage (coded value for short-term, medium-term, long-term, in vitro, field collection, vegetative, cryo-preservation or pollen storage)

Summary on genera (Country, Institution)

A dialogue box will provide options for entering an institute or country code.

Statistics on origin/type of germplasm

A dialogue box will provide options for entering a species name, an institute or country code, and a code for the type of sample (AC – advanced cultivar, LR – landrace etc.)

Export records (Country Profiles & Conservation Import

WIEWS provides functions for export of records that have been added or updated after a set date. The target date can be set separately for the country profile and the conservation databases through the System Settings/Output menu option.

Exports are performed through Country Profile/Export records and Conservation/Export records. As a result, compressed files named EWIEWS1.ZIP and EWIEWS2.ZIP respectively are created in the \WIEWS directory. These files should be sent to FAO to be included in the next update of WIEWS.

Remark: There is no provision to import records into the databases in WIEWS. All editing/adding of records has to be made manually from the keyboard.

Early warnings

The two options in the Early Warning menu are:

Genetic erosion in *ex situ* collections

Genetic erosion in natural habitats

Selection of these menu options will provide a dialogue box where a country code can be entered. If one or more institutes within the selected country have reported instances of genetic erosion, the result pages will display details on the species threatened and the type of threat in a multi-page layout.

The user can skip forward and backward between the result pages, but editing is not possible. There is no browse view of all the matching records.

There is no provision to search for institutes that have reported genetic erosion in *ex situ* collections or genetic erosion in natural habitats.

There is no way to add records for a country if the country does not already have records of threats. The software simple returns a message saying, "Information for this country is not registered". There needs to be a means to indicate that you want to add record not just view existing records.

Survey: 13 institutes representing 13 countries have reported genetic erosion in their *ex situ* collections. Seven institutes representing seven countries have reported genetic erosion in natural habitats.

System settings

Files

This option allows you to change the location of the country profile and conservation data files. If you performed a normal installation this is not necessary. This can be useful if there is not much disk space on the C drive and these files are located elsewhere. However, you must exit and restart the program after modifying the settings for the changes to take effect.

Output

The destination of the reports generated, and the dates for the installation of WIEWS and earliest change date for records to be exported can be defined here.

Reindex

Provides options for reindexing and packing of the tables included in the databases. However, the default is to do nothing and one must manually select which options to perform.

User-friendliness

Help functions and list of values exist in the WIEWS software but need to be expanded to make the system friendlier.

The dialogue boxes and detail pages of WIEWS provide context sensitive help functions that can be activated by pressing the F1 key while the cursor is placed in the field in question. For example, the help function may provide the decoded values of coded fields. In other instances the help text is not very descriptive and sometimes the help function is not available at all.

Elementary provision to decode country codes is provided in some of the dialogue boxes of WIEWS. The codes cannot be picked with the mouse from the list. The user has to memorise the code, close the list, and then enter the code from the keyboard.

For institute codes, no list is available. Since browsing of records is not supported, the user may have to skip through the detail pages of all institutes of a country in order to find a wanted institute and its corresponding code.

The decoding of the species code, which supposedly stands for groups of related crops (vegetables, cereals etc.), is not to be found anywhere in the program.

Inconsistency in search functions

Search functions related to text fields are either case sensitive or insensitive. Testing have revealed inconsistency between the different menu options in the WIEWS programs.

Confusing handling of dialogue boxes

Dialogue boxes remain open even after the user has performed the wanted action, e.g. after performing the generation of a report. In other cases the program asks the user to click on 'cancel' to close a search dialogue after an unsuccessful search. A new search, with new values, will not work unless the user obeys and really closes the box and then reopens it. The dialogue boxes seem to be performing a double function of both dialogue and alert boxes.

Non-standard handling of keys

Special keys that have well known and commonly used functions do not work as such in WIEWS. For example, the page-up and page-down keys have no effect, nor does pressing the escape key close dialogue box (normally equivalent to clicking on 'cancel').

LIST OF DOCUMENTS EXAMINED FOR THIS REVIEW:

1. Terms of Reference of the independent external review commissioned by FAO on the WIEWS on PGR
2. Extracted sections form the 1st to 7th Reports on the Sessions of the CPGR
3. CPGR/85/6 International Information System of PGR. December 1984.
4. AGP/SIDP/84/166 Rev. Seed Information System 4 December 1984.
5. CPGR/87/9 the FAO Information System on PGR. December 1986
6. CPGR/89/5 Overall Review of FAO's Activities in PGR and Progress Report on the Establishment of the International Fund for PGR. February 1989.
7. CPGR/91/7 Rev. The State of the World's PGR and the Global Information and Early Warning System on PGR. March 1991.
8. CPGR/93/5 Progress Report on the Global System for the Conservation and Utilisation of PGR. January 1993
9. Report of the First extraordinary session of the CPGR, para 34-48.
10. CPGR-6/95/8 Annex (CPGR-EX1/94/5 ANNEX*) Survey of existing data on *ex situ* collections of PGRFA. September 1994.
11. CPGR-6/95/13 Progress Report on the WIEWS on PGRFA. April 1995
12. CGRFA-EX2/96/REP Report of the Second extraordinary session of the CPGR, para 1-12.
13. CGRFA-7/97/3 Progress Report on the Global System for the Conversation and sustainable Utilisation of PGRFA. March 1997
14. CPGR/91/Inf.4 Memorandum of Understanding on programme co-operation between FAO and IBPGR. March 1991
15. Report of the Technical Meeting on the Methodology of the WIEWS on PGR
16. Leipzig Conference Follow-up by FAO, A Consultant Report.
17. SDR/TAC: IAR/97/1 Report of the Fourth External Programme and Management Review of the IPGRI. 21 April 1997
18. Project Evaluation Questionnaire for Completion by all Evaluation Missions. Evaluation Service FAO, January 1994
19. Evaluation Mission Brief. Evaluation Service FAO July 1996.
20. UNEP/CDB/SBSTTA/3/Inf. 21 Memorandum of Co-operation between FAO and the Secretariat of CBD. 18 August 1997.
21. UNEP/CDB/SBSTTA/3/1 Convention on Biological Diversity, SBSTTA Third Meeting. Advanced Unedited copy 2 June 1997.
22. UNEP/CDB/SBSTTA/3/Inf.12 Convention on Biological Diversity, SBSTTA Third Meeting. International Expert Meeting on Building the Clearing House. 18 August 1997.
23. UNEP/CDB/SBSTTA/3/Inf.3 Convention on Biological Diversity, SBSTTA Third Meeting. National Focal Points for the CHM under the CBD. 23 July 1997.
24. UNEP/CDB/SBSTTA/3/L.5 Convention on Biological Diversity, SBSTTA Third Meeting. Report on the Implementation of the Pilot Phase of the CHM in facilitating and Promoting Technical and Scientific co-operation. 5 September 1997.
25. UNEP/CDB/SBSTTA/3/Inf.16 Convention on Biological Diversity, SBSTTA Third Meeting. Further Guidelines for the Preparation of National Reports. Advanced copy. 10 August 1997.
26. UNEP/CDB/SBSTTA/3/9 Convention on Biological Diversity, SBSTTA Third Meeting. Recommendations for a core set of indicators of Biological Diversity. 10 July 1997.
27. International Technical Co-operation Network on Cactus Pear (CACTUSNET). Descriptors for Cactus Pear (Opuntia spp.). Draft.
28. Crop Information and management Support System (CropInfo) Presentation and additional printouts from the CropInfo system. 1997
29. FAO provisional list of varieties, Information notes prepared by Dr. Eugenio Sgaravatti. 19 September 1997.

30. The State of the World's PGRFA: Background Documentation prepared for the ITCPGR, Leipzig, Germany. June 1996

31. C 95/4. Programme evaluation Report 1994-95. Twenty-eight session 20 October-2 November 1995.

32. FAO (1996). World list of seed sources. Compiled by: E. Sgaravatti and J. Beaney, FAO 1996

33. FAO (1995). Report on proposed activities and management structure of the FAO network of *ex situ* plant genetic resources collections. A consultancy report prepared by N.L. Innes Feb. 1995.

34. ITCPGR/96/3. Report on the state of the world plant genetic resources. International technical conference on plant genetic resources, Leipzig, Germany 17-23 June 1996.

35. ITCPGR/96/REP. Report of the International Technical Conference on Plant Genetic Resources. Leipzig, Germany 17-23 June 1996.

36. Frison, E. A., Serwinski, J. Ed's. (1995). Directory of European Institutes holding Crop Genetic Resources Collections, Vol. 1, Forth edition. FAO and IPGI joint publication 1995.

37. Freiberg, H., Nauber, J. (1997). CHM Expert Meeting "Building the Clearing-House". Convention on Biological Diversity (CBD) June 25-29, 1997 Bonn, Germany. Federal Agency for Nature Conservation, Germany 1997.

38. FAO (1994). Introductory Guidelines for Country Reports. ICPPGR June 1994.

PEOPLE VISITED

1. Mr. M. Kato, Chief, Evaluation Service, Office of Programme, Budget and Evaluation.

2. Prof. Jose T. Esquinas-Alcazar, Secretary of the CGRFA, Plant Production and Protection Division.

3. Mr. C. Stannard, CGRFA, Plant Production and Protection Division.

4. Mr. Per Diemer, Crop Information Support.

5. Mr. M. S. Zehni, Director, Plant Production and Protection Division.

6. Mr. J. Hielkema, Remote Sensing,

7. Mr. E. Sgaravatti, Agricultural Officer, Seed and Plant Genetic Resources Service, Plant Production and Protection Division.

8. Mr. U. G. Menini, Service Chief, Seed and Plant Genetic Resources Service, Plant Production and Protection Division.

9. Mr. N. M. Anishetty, Senior Officer, Seed and Plant Genetic Resources Service, Plant Production and Protection Division.

10. Mr. F. Perez-Trejo, WAICENT Manager, Library and Documentation System Division, General Affairs and Information Department.

11. Mr. K. Vertucci, Chief, Technical Systems Branch, Computer Services Division.

12. Mr. G. Pace, Director, Computer Services Division.

13. Mr. D. Cooper, Officer in Charge, International Technical Conference on Plant Genetic Resources, Seed and Plant Genetic Resources Service, Plant Production and Protection Division.

ISSUES RAISED BY COUNTRIES WITH RESPECT TO THIS REVIEW.

The additional issues raised by the countries can be separated into three major areas: what should be the scope of the system; what is the mechanics and data flow; and what are the broader implications for PGRFA.

Issues raised by Dr. Ndoye from Senegal

- The need of a continuous improvement of the quality of recordings contained in the preliminary databases...

- The need to complete the present basses of the WIEWS, in connection with efforts of FAO to assist the CBD...

- Wish further development of the WIEWS to include:

    - Enhance the information system on *in situ* collections to include complimentary information on the origin of seeds and studies of the genetic diversity of those seeds in agro-ecosystems and the wild relatives in natural ecosystems.

    - Develop static and dynamic indicators of genetic erosion for the need of assessment and monitoring the state of PGR.

    - Reinforce the role of conservatives and collectors in drawing rapid attention to threats to *ex situ* and *in situ* PGR.

    - Set the highest priority to regions and countries at greatest risk.

Issues raised by Mr. Hildebrand from Germany

- Which data are needed on a national, regional, and international level considering the progress in information technology?

- Which concepts exist for the sharing of responsibility at the international level regarding the CHM of the CBD and the GPA of FAO?

- Who are the main users of the information collected?

- What are the present methods of information dissemination and how to avoid overlap?

- Analyse the media for data exchange and propose changes.

- Analyse the information flow and clarify whom FAO should correspond with.

- Which databases exist at FAO in the framework of WIEWS and recommend which ones should be maintained by FAO. This topic is covered by the review report.

- Analyse FAO achievements with respect to WIEWS and present activities of other international organisations.

Issues raised by T. T. Chang from Taiwan

- Is FAO prepared for the investment in maintaining a global information system?

- How will FAO deal with national agencies that are reluctant to reveal the sad facts about their collections, and in particular, those crops not backed up in international centres?

Issues raised by Eliseu Bettencourt from Portugal

- The Panel should look at the matter of data gathering, quality, timing, and comprehensives of the country reports and other requests for data since WIEWS must rely on the flow of data from countries.

Issues raised by Dr. Castillo from Ecuador

- The status of *ex situ* conversation in developing countries.

- Has to be reported by the country's national program. Information has to actuate and timely and subject to verification by international organisations. Action to insure the developing *ex situ* in the framework of GPA.

- The status of laws and rules at national and regional level to manage and preserve the PGR.

ACRONYMS

AGP	Agriculture Department, Plant Production and Protection Division
AGPS	Agriculture Department, Seed and Genetic Resources Division, Seed and Plant Genetic Resources Service
CBD	Convention of Biodiversity
CGIAR	Consultative Group on International Agricultural Research
CGRFA	Commission on Genetic Resources for Food and Agriculture, formerly CPGRFA
CHM	Clearing House Mechanism of the Convention on Biodiversity
CPGRFA	Commission on Plant Genetic Resources for Food and Agriculture
CropInfo	Crop Information System
DAD-IS	Domesticated Animals Information System
DBF	Database File format
DBREVIEW	Database Review
ECP/GR	European Co-operative Programme for Crop Genetic Resources
EWM	Early Warning Mechanism/System
FAO	Food and Agriculture Organisation
FAOSTAT	FAO Statistics Information System
GIS/EWM	Global Information System/Early Warning Mechanism
GPA	Global Plan of Action
IARC	International Agriculture Research Centre
IBPGR	International Board for Plant Genetic Resources
ICPPGR	International Conference on Plant Genetic Resources
IPGRI	International Plant Genetic Resources Institute
ITCPGR	International Technical Conference on Plant Genetic Resources
JDBC	Java Database Connectivity
MOU	Memorandum of Understanding
NGB	Nordic Gene Bank
ODBC	Open Database Connectivity
PGR	Plant Genetic Resources
PGR/GIS	Plant Genetic Resources/Global Information System
PGR/WIS	Plant Genetic Resources/World Information System
PGRFA	Plant Genetic Resources for Food and Agriculture
REFORGEN	FAO world-wide information system on forest genetic resources
SADC	Southern Africa Development Community
SINGER	System-wide Information Network for Genetic Resources
SIS	Seed Information System
TOR	Terms of Reference
URL	Universal Resource Location (WWW address)
WAICENT	World Agricultural Information Centre
WIEWS	World Information and Early Warning System
WWW	World-wide Web