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THE STATE OF THE WORLD'S PLANT GENETIC RESOURCES AND THE GLOBAL INFORMATION AND EARLY WARNING SYSTEM ON PLANT GENETIC RESOURCES

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I. INTRODUCTION

1. The UN Conference on the Human Environment, held in Stockholm in 1972, adopted a series of recommendations for action with regard to information and documentation on the world's plant genetic resources, and particularly addressed these to FAO. FAO, at first alone, and since 1974 with IBPGR, has worked to realize the recommendations of the Conference. At the same time, many national, regional and international organizations have undertaken substantive work in establishing information systems for plant genetic resources. Much has already been achieved. There have, however, been many gaps, as well as a certain duplication of effort. There is also a particular need for the coordination and harmonization of the available information.

2. In keeping with FAO's major role to compile, analyse, and disseminate information on world agriculture, and considering the reports by governments on the measures taken to implement the International Undertaking, as provided by its Article 11, the Third Session of the Commission on Plant Genetic Resources, in April 1989, requested FAO to prepare a periodic report on the State of the World's Plant Genetic Resources (PGR/SW), as the basis on which it might make reasoned policy decisions. Article 11 is the only provision, at government level, for reports to an international body, on national programmes and plans in the field of plant genetic resources, in relation to the objectives of the International Undertaking.

3. The establishment of a "flexible but comprehensive information system" was also recommended by the same session of the Commission on Plant Genetic Resources. It stated that this Global Information System on Plant Genetic Resources (PGR/GIS) should include an "Early Warning System", to "draw rapid attention to potential hazards threatening the operation of genebanks holding base collections, and to the danger of the extinction of plant species and the loss of genetic diversity throughout the world" (CPGR/89/REP, Para.16). This recommendation followed the mandate set forth in Article 7.1 (e) and (f) of the International Undertaking.

4. Progress in preparing the PGR/SW and the PGR/GIS has been somewhat delayed because of the aggravation of the financial crisis of the Organization in 1989 and 1990, which considerably constrained the commitment of staff and financial resources to this work. However, during this period, FAO benefited from the assistance of IBPGR. The Memorandum of Understanding between FAO and IBPGR specifically provides for cooperation on the preparation of the PGR/SW and PGR/GIS. It is planned that the task of preparing and maintaining the PGR/GIS will ultimately be undertaken by the FAO Seed Laboratory, which would then be expanded to become the Plant Information and Exchange Unit.

II. THE STATE OF THE WORLD'S PLANT GENETIC RESOURCES

5. The PGR/SW would identify constraints and emergency situations in conservation, assess the gaps in knowledge, and describe activities and programmes being carried out by national, regional, international and non-governmental organizations.

6. The PGR/SW will be prepared periodically from country reports provided persuant to Article 11 of the International Undertaking, supplemented by other information. Information emanating from country reports will be clearly identifiable and distinct from data obtained from other sources. The prime purpose of the PGR/SW is to provide the Commission with a regular analysis of the current situation of the world's plant genetic resources, and such information as it will require to enable it to recommend priorities for areas of work, and to update and redirect, as necessary, the Plan of Action on Plant Genetic Resources. In addition to the Commission, other potential users of the PGR/SW include national governments, policy makers, international and national funding and executing agencies, non-governmental organizations, research institutions and individual researchers.

7. The specific objectives of the PGR/SW will be:

(i) to describe, in detail, the current status of significant activities related to plant genetic resources;

(ii) to identify gaps in the current knowledge and understanding of the extent of diversity, availability and utilization of plant genetic resources;

(iii) to identify gaps in the database network; and

(iv) to propose priorities for action on a global basis.

8. The PGR/SW will initially cover the major crops and commodities, including wild and weedy crop relatives of use in breeding, and key forest ecosystems. Priority topics will be adequately covered. FAO will identify gaps in the information, and estimate the extent of resources needed to acquire the missing information. A cost-benefit analysis may be necessary before deciding which type of information to acquire for the PGR/SW or the PGR/GIS. Appendix 1 gives possible elements for the PGR/SW, for the exclusive purpose of facilitating the Commission's discussions, and allowing it to provide its guidance. On the basis of this first report, the Commission may then wish to direct that later reports become progressively more comprehensive, and cover a wider range of economically important plants, and minor or underexploited crops, especially those that have traditional value.

9. The preparation of the first PGR/SW will contribute to the identification of problems and priorities in the context of the preparation of the Plan of Action on Plant Genetic Resources by the Fourth International Technical Conference on Plant Genetic Resources, provided it is recommended by the Commission and approved by the FAO Council and Conference.

10. National reports provided under Article 11 of the International Undertaking will be structured, through the use of a questionnaire, so that all relevant databases that refer to plant genetic resources within a country are described, as such information provides insight into the extent of crop genepools, and of the world's holdings of particular crops.

11. The PGR/SW will be a periodic review and report, and not directly dependent on the PGR/GIS, which is a database. Nonetheless, the PGR/GIS will also be a significant source of information for the PGR/SW. For this reason, the function and contents of the PGR/GIS will be periodically reviewed in the light of the information needed by the PGR/SW. The fast changes and the large number of activities occuring in this field, and the extent of geographic coverage of the PGR/GIS, will mean that frequent reviews will be required.

III. THE GLOBAL INFORMATION SYSTEM ON PLANT GENETIC RESOURCES

12. The objectives of PGR/GIS will be to:

(i) provide current information on plant genetic resources with regard to research, training, conservation, including regeneration, the assessment of diversity, biotechnology and its local applications, the use of such resources, and health and quarantine factors; and

(ii) provide a practical inventory of plant genetic resources (*ex situ* and *in situ*), to the extent that accurate assessments can be made, so as to provide information to optimize their utilization for research and agricultural development.

13. The FAO Seed Laboratory, expanded to become the Plant Information and Exchange Unit, will manage the functions of the PGR/GIS, and the FAO Seed Information System (SIS), which it maintains, will form the basis of information on crops for the PGR/GIS. The Forestry Resources Division of FAO will be responsible for providing information on forest ecosystems and forestry matters. IBPGR also maintains rather complete databases on crop genetic resources, organized on a country and crop basis, and lists of *ex situ* holdings of plant genetic resources, which will also be a major source of information for the PGR/GIS.

14. The PGR/GIS is intended to be a dynamic, constantly updated database of databases, covering economically important plants, including forest trees and shrubs. It will draw extensively upon information in other related databases, and national reports submitted under the provisions of Article 11 of the International Undertaking. A number of specialized databases currently exist, or will soon be established by a variety of organizations including IBPGR, IUCN, WWF, and FAO itself. These will act as sources of information for the PGR/GIS.

15. Because of the number and variety of organizations involved, and the sheer amount of potentially useful data, FAO will not undertake to maintain all data areas included in the PGR/GIS directly. Instead, the Secretariat, with the guidance of the Commission, will ensure that the information needed is compiled and maintained by expert groups, and enter into formal collaborative agreements with them.

16. For the purpose of designing this database of databases, organizations maintaining relevant databases will be contacted, to ascertain if subsets of the information they maintain are suitable inputs to the PGR/GIS, to ensure complementarity with the overall system, to extend the usefulness of the single databases, and to reduce duplication. The extent of, and type and amount of relevant information maintained in such databases is, in many cases, already known to FAO and IBPGR. FAO and IBPGR have also, until recently, developed common databases.

17. FAO maintains a number of information systems from which data on plant genetic resources may be obtained. These include AGRIS, an international agricultural bibliography; the Seed Information System (SIS), with information on plant breeding institutes, and germplasm sources; CARIS, with information on agricultural research projects in developing countries; and the Plant Quarantine Database. There are a considerable number of crop databases held at the International Agricultural Research Centres (IARCs). In addition, a number of central crop databases have been developed, with the support of IBPGR and FAO support.

18. Supplementary information will be solicited from Universities, informal and formal networks (such as biotechnology information networks), and from member countries of the Commission, principally through a plant genetic resources questionnaire and fact sheet that will list the information currently maintained in the PGR/GIS, and request corrections, and modifications. Gaps in the network of databases will be identified, and action proposed to fill the gaps.

19. The PGR/GIS will also include data on socio-economically important woody species, as determined by the FAO Panel of Experts on Forest Gene Resources. Computerized and regularly updated information on the status of the world's forests will be integrated in the PGR/GIS.

20. Useful information for in situ conservation activities, as well as information concerning the geographical distribution of germplasm, can be derived from herbarium data. International standards for taxonomic and related data are currently being examined by the Taxonomic Database Working Group (TDWG): FAO will participate in future activities of this and related groups.

21. The concept of establishing a clearinghouse for plant genetic resources information, that is a database of databases, is also being considered by the Institut de la Vie. This institute has been contacted by FAO, and progress will be followed closely, so that a mutually beneficial division of work and ways of cooperation may be determined.

22. All data must be periodically analysed to provide material for the PGR/SW and the PGR/GIS's early warning system. Parameters for analysis must be determined, so as to prevent subjective or biased analysis from obscuring features of importance. Caution must be exercised in interpreting data maintained by organizations other than FAO or IBPGR, or else parameters must be agreed whereby the organizations maintain the data and analyse it for the PGR/GIS. Procedures must therefore be determined at the time of establishing collaboration with such organizations.

IV. THE EARLY WARNING SYSTEM ON PLANT GENETIC RESOURCES

23. The Third Session of the Commission, in line with Article 7 of the International Undertaking, recommended that an Early Warning System (PGR/EWS) form part of the PGR/GIS. It should be able to draw rapid attention to hazards threatening the operation of genebanks holding base collections, and to the danger of the extinction of plant species, and the loss of plant genetic diversity throughout the world.

24. Various factors, both natural phenomena, and the results of human behaviour, can put plant genetic resources at risk. In the former category are desertification, floods, drought, famines, macro-climatic change, climatic cycles - such as caused the changes in the el Niño current - changes in the spectrum of pests and disease, and plant invasions, all of which can have very rapid consequences. In many such cases, the event can be forecast, and the consequences for the safety of plant genetic resources extrapolated.

25. Among humanly caused phenomena are deforestation, large-scale settlement, wars, dam construction, agricultural development programmes, seed substitution programmes, irrigation projects and large-scale social and economic change, such as is now occuring in Eastern Europe. Although the phenomena may not be reversable, action may be taken to prevent or minimize the plant genetic erosion they cause.

26. Opportunities of detecting changes and identifying the likely results include the national reports under Article 11 of the International Undertaking, collectors' reports (as provided for in the International Code of Conduct for Plant Germplasm Collecting and Transfer (CPGR/91/10) and the systematic monitoring of the causal phenomena, as part of the PGR/GIS. Thus, if any situation is likely to occur in genebanks, or in the field, the equivalent of a warning signal will turn on automatically, so that the problem can be reported to the international community by the appropriate means, which may be the PGR/SW, a specific report to the Commission, periodic newsletter, or an appeal by FAO to donors.

V. FOLLOW-UP ACTION

27. The Commission needs regular detailed and trustworthy information on all aspects of plant genetic resources as a basis on which to establish policy and determine priorities. It has been proposed by the Commission that the PGR/SW and the PGR/GIS should provide the framework in which such information is presented. In order to be able to prepare a regularly updated PGR/SW, and to develop and maintain the PGR/GIS the Commission may wish to consider and endorse the following:

(i) the scope and objectives of the PGR/GIS and PGR/SW, as outlined in this document;

(ii) priorities for subjects to be covered in the first PGR/SW;

(iii) the strategy that has been proposed for acquiring information for the PGR/GIS;

(iv) the proposal that FAO establish cooperative agreements with organizations that maintain information relevant to the PGR/GIS, so as to harmonize their systems of data acquisition, maintenance, and analysis with the requirements of the PGR/GIS and obtain such data; and

(v) the expansion of the seed information system (SIS), maintained by the FAO Seed Laboratory, as the basic mechanism for the development of the PGR/GIS, with the reorganization of this group as the Plant Information and Exchange Unit.

Appendix 1

POSSIBLE ELEMENTS FOR "THE STATE OF THE WORLD'S PLANT GENETIC RESOURCES" FOR DISCUSSION BY THE COMMISSION*

1. Executive Summary: Priorities for Action

2. World plant genetic resource diversity, and genetic erosion

An overall assessment of plant genetic diversity will be attempted. The focus will be crop-oriented, but particular geographic regions of great diversity will be identified. Crops will be considered along with the complete associated range of their wild and weedy relatives. For forest genetic resources, attention will focus on species of socio-economic importance in managed native forest ecosystems, industrial plantations, and agro-forestry. A parallel assessment of the rate and extent of genetic erosion, and ecosystems and crops at risk, will be undertaken.

3. Collection and ex situ conservation

A report will be given of observance of the International Code of Conduct for Plant Germplasm Collecting and Transfer. There will be an overview of recent collecting missions, and of what has been collected and where. In this light, the priorities for further acquisition will be assessed. The contents of collections in genebanks will be reviewed, and questions of whether germplasm is adequately duplicated, safely stored, and easily available will be addressed. The effectiveness of maintenance in genebanks throughout the world will be assessed, and problem situations will be identified. In the light of current holdings, recent acquisitions, and information on the diversity status of various crops, the state of genetic erosion in genebanks will be reviewed, with the aim of allowing the Commission to recommend remedial action and priorities.

4. In situ conservation and management

This section will review the status of in situ management and conservation, with special emphasis on forestry ecosystems, wild and weedy relatives of crops, and semi-domesticated plants. A variety of different management and conservation systems will be

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* These elements are proposed solely in order to allow the Commission to provide guidance on areas to be covered, and priorities for the first PGR/SW. Not all matters covered below need necessarily be considered either in the first, or subsequent issues of the PGR/SW; successive issues will address the priorities established by the Commission with more precision.

covered, including reserve areas, conservation networks, and on-site farmer-managed programmes within the context of indigenous farming systems. The state of current knowledge and practice in these field will be described.

5. Germplasm characterization, evaluation and enhancement

This section will review the status of, and current methodology for the characterization, agronomic evaluation and improvement of various crops. Coverage of existing germplasm holdings of invididual crops will be assessed.

6. Germplasm utilization

The state of knowledge and practice regarding plant germplasm utilization, through breeding and the production of improved seed and planting material, will be reviewed. The capabilities of developing countries to fully utilize plant genetic resources, through such technologies, will be assessed. Promising new techniques and biotechnologies will be reported, with particular emphasis on their application in developing countries. Advances in the development and use of new cultivars, including the results of variety trials, will be reviewed, and promising new cultivars will be identified, particularly those of value in the area from which the germplasm was derived.

7. International, regional, national and local programmes for crop and forestry plant genetic resources

This section will review the adequacy of the resources available to international and national institutions, in the light of current priorities and action programmes. Institutional arrangements for the management of germplasm, and the status of international and national crop committees and networks will also be covered. Particular attention will be paid to questions of manpower, funding and training.

8. International, regional, national and local arrangements, and regulations related to the conservation and utilization of plant genetic resources

This section will include consideration of the safe effectiveness of international arrangements - including codes of conduct - for the collection, transfer and maintenance of germplasm, and will identify any areas of weakness that require attention. Particular emphasis will be put on questions of plant health during transfer, and the adequacy of quarantine measures, and on the development and status of various forms of intellectual property protection over plants, including national legislation and international conventions, as these may affect the exchange and utilization of germplasm.

Information on national laws and regulations, and international conventions governing these matters will be considered.

9. Research

This section will review the status of research in fields related to the conservation and management of plant genetic resources, ex situ and in situ, as well as their utilization. Germplasm health in storage and exchange will be covered. Special emphasis will be put on appropriate technologies under development, and their applicability to the needs of developing countries; the status of the transfer of such technologies will be reviewed. The question of the effectiveness of current biosafety regulations will be assessed.

10. Information and Documentation

Current methodologies for the management of plant genetic resources information will be reviewed. Reviews may also be undertaken of individual systems. Current constraints and problems in the effective exchange and use of information will be considered, with emphasis on standardization of data and methodologies. The needs of the developing countries, particularly for training and technology procurement, will be assessed.