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About the Institute
The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

GENETIC RESOURCES COMMUNICATION INFORMATION DOCUMENTATION SYSTEMS PROJECT

FOR THE

INTERNATIONAL BOARD
FOR PLANT GENETIC RESOURCES

IN CONJUNCTION WITH THE
FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

AT THE Taxonomic Lab
UNIVERSITY OF COLORADO
BOULDER, COLORADO

Preliminary Working Papers for first CIDS Contract

Requirements for development of
General Documentation Functions
for any GRC

A. Data management functions

1. Determine objectives for data.
2. Prepare (define) minimum standards.
3. Define all data banks necessary for GRC work.
4. Devise classification scheme for types of data.
5. Define/decide on appropriate data.
6. Structure/determine basis for description. (What is the item?).
7. Structure data (types of descriptors).
8. Select appropriate devices for data capture (keypunch, mark-sensing, key-tape, or other).
9. Select (appoint) and train documentation officer(s).
10. Prepare training manuals and other training aids for data management.
11. Teach proper techniques for interfacing with computer facility.
12. Teach proper application of information retrieval systems.
13. Define data to be sent to FAO for global needs.
14. Determine means (methods) to provide information to users of genetic resources.

B. Computing functions

1. Select proper IR system
   -costs
   -availability (source or binary)
   -language used
   -is system documented?
   -characteristics (capability)
   -what machines is system mounted on (IBM, CDC, UNIVAC, Siemens?)
   -are competent systems advisors available?
2. Select proper computing equipment
   -memory size
   -tape drives
   -running costs
   -availability (open or closed shop?)
   -what language compilers available
   -time sharing or batch mode only?
   -remote terminals (type and capabilities)
   -peripherals availabe (Calcomp plotters? (microfilm output?)
   -network potentials
3. Develop training manuals and aids.
4. Continuing program (software) development
5. Develop network for communications between GRCS.

DRAFT DR/ss

30.4.74.

PRELIMINARY WORK PLANS. DEVELOPMENT OF COORDINATION AND DOCUMENTATION FUNCTIONS FOR GENETIC RESOURCES

1. Objectives

Please refer to accompanying documents for further discussions and definitions.

A. Provide a complete system for coordination, training, data management, and information storage and retrieval systems in genetic resources.

B. Provide training and operations manuals, and computer software manuals.

2. Statement of work

Following is a list of activities to be completed if the job of coordination and documentation of genetic resources is to be competently accomplished. Each listed activity is described below, and following that is a chart of time requirements.

(i) Development of the documentation system for genetic resources at several levels-national, regional and international.

(ii) Preparation of the computer programmes and computing facilities for information storage and retrieval.

(iii) Preparation of manuals of documentation

(iv) Develop training programmes for data management, keypunch operators and orientation for all personnel in GRC's.

(v) Design techniques for continuing evaluation of documentation system.

(vi) Development of the actual steps of coordination for FAO and the IBPGR

(vii) Design of financing arrangements reflecting shared responsibility.

(i) Development of the documentation system for genetic resources at several levels-national, regional and international.

Please refer to the attached flow chart of activities and documentation in a GRC.

For any single GRC there are common documentation needs:

(a) Standardised formats for data collection;

(b) Standardised formats for data banks (the logical sets of items to be incorporated in each data bank).

(c) Standardised procedures for interchange of information and accessions.

(a) Standardised formats for data collecting

There are varying requirements for formats of different crops, but there are some standard types of data which should be associated with any collection, regardless of the crop. Some centres have already established their own formats, as is the case at the Aegean Genetic Resources Centre, Izmir, Turkey, and at the IRRI, Manila, the Philippines. These represent two different types of GRC - one a general GRC, for all crops of the region and the other, clearly restricted to a single crop. Their requirements, therefore, differ with respect to the format for data accumulation, and therefore the design of the data formats will be slightly different. But one may use these two as a model for design of data accumulation formats at other centres. The standardisation of formats in different ways will not hinder the exchange of information, provided the proper computing system is employed. (see discussion under ii below.). Standardisation will guarantee at least that "finding information" for each collection will be incorporated in the collection record, but probably also some ecological information, as well as appropriate organismic information. Each standardisation of

format, for further stages in GRC functions will likewise guarantee that a minimal necessary set of data are accumulated in a manner most efficient for the work of the centre.

(b) Standardised formats for data banks

As in the case of (a) above, certain minimal requirements must be established to guarantee that the objectives of the GRC are met. Data banks contain logically related sets of information: collection information; storage information; evaluation information, etc. The items and descriptors included in each bank must insure that the accessions are given maximal care, are appropriately described for that function, and provide the necessary information to answer questions. Data-bank design requires the best efforts of systems analysis. Because the eventual accumulation of data necessary for all genetic resources around the world is a staggering quantity very precise systems analysis on data bank design is an absolute requirement. No manner of computing machine can be expected to store all data in one bank at one time, and still run at costs in the realm of the budgetary reality for genetic resources. Close cooperation is required between the "data manager" of a GRC and the computing centre to keep abreast of the size of any one data bank under his control, and when the bank becomes too large to query efficiently, the data bank must be divided into subsets of logically-related items. The efficiency of the software system used for information storage and retrieval is a critical matter; the more efficient the system, the larger any data bank may be before subdivision; the more efficient the system, the better its capability to subdivide the larger data bank into smaller, logically related data banks.

Different data banks are required for the coordinating role of FAO. Clearly, the data at any one GRC should be managed by the centre, or as near to the centre as possible. (There should, of course, be a second center for data storage as a matter of safety.) But the data that the individual GRC shares with the central coordinating unit of FAO must be a digested summary of pertinent information. The content of this information to be shared with FAO from each GRC must be carefully selected to meet objectives of coordination.

Data banks for the coordinating role of FAO and IBPGR must be carefully considered and designed. What types of data are necessary for coordination? Some general statements made in the accompanying document by Sykes and Rogers indicate the broad areas of interest and necessity, but in terms of the actual work to be done, much effort must be expended by the decision-maker as to which actual data banks are possible within his budgetary limitations. Please refer to the discussion under work plan item (2) above for a list of some of the important types of data banks necessary for coordination.

(c) Standardised procedures for interchange of information and accessions

Since it is an important concept inherent in the work of the GRCs that they should be active supporters of the improvement of food production, rather than a passive storage function only, it is necessary that whatever is brought into any GRC be available for the work of crop improvement. The means by which this is to be accomplished are poorly defined. Unless there be some means to notify plant breeders and others of the kinds and qualities of the accessions, the plant breeders cannot take advantage of what might be a very rich store of genetic materials. By what techniques can the information and the accessions be disseminated? Publications of seed indexes are used in some institutions, but these are costly, and frequently of such an incomplete nature that users disregard them. If one awaits a question to the GRC from an unknown public,

it is further likely that no-one will ever make use of the information of the accessions. If one advertised their accessions in some publication, that publication would be very costly, because it must be published in several languages, and sent to many different subscribers around the world at a subsidised cost. Thus, some standardisation for this function must be accomplished. At the moment, no one method appears as the most efficient and least costly, but this is of such critical importance that it must be dealt with.

However, several modern techniques of information dissemination might serve. These are:

1. Employment of a "current awareness" technique, where summaries of inventories in GRCs could be disseminated on the average of twice a year.
2. Microfilm copies of computer printout, where individual crops are listed separately with some of their major qualities given, from each GRC to a selected audience, and further listings of those accessions which had been tested for disease resistance, etc.
3. Abstracts of reports on various collection activities, evaluation and utilisation activities, derived from such related activities as AGRIS and CARIS.

(ii) Preparation of the computer programme and computing facilities for information storage and retrieval

The success of the whole documentation endeavour basically rests on a powerful, computer-aided information storage and retrieval system. Not only must the system be sufficiently powerful to meet all the demands of the GR community, but it must be available at costs within the realm of reason with respect to budgetary restrictions of GR work. There are relatively few systems which are available at no cost. Most systems charge rental fees, depending

upon the organisation which supports (or developed) the system, TAXIR, developed with funds from the National Science Foundation, is in the public domain, and therefore is available to the user. This does not mean, however, that there are no costs attached, or that the system can be automatically put into service on any computing machine anywhere.

All IR systems are very machine-dependent, and when moved from one computing machine to another, require considerable re-programming to make the same system work on another machine. Even though TAXIR is written in FORTRAN IV, the most universal of all scientific computer languages, the FORTRAN IV for a Control Data Corporation (CDC) machine is slightly different from the FORTRAN IV of an IBM system. Further complications exist in the internal design of the different machines, and these require that when conversion is required, there will be additional costs.

Because of these basic facts, we must work very carefully with the various computing machine manufacturers to assist us in making the conversions required. Usually, the machine manufacturers are very cooperative in making these transfers, offering expert programmers and machine time to test the conversion. (For example, see attached letter from Dr. Marler, Technical Adviser to the VP of IBM). However, the programmers do not know the details of the TAXIR system, and must be guided in making the conversions by someone who is knowledgeable in the TAXIR system.

The basic tasks required in this section are as follows:

1. Prepare documentation (detailed description) of the TAXIR system. This has been done already, but needs to be printed and placed in a manual.
2. Transfer TAXIR system to IBM 370/135 at FAO.
3. Continue development of additional programmes required in GR documentation, as follows:

(a) Report generator

(b) Plotting and mapping routine

(c) Statistical analyses package - already written, but needs conversion

(d) Clustering programme - already written, but needs conversion

4. Prepare programmes to run on various types of computers at individual GRCs. This includes:

(a) Discovery types of hardware available and the capacities of each

(b) Request assistance from IBM and other computer manufacturers to convert TAXIR programmes to the various appropriate machines

5. Prepare plans for network of communication systems:

(a) telephone

(b) postal services (diplomatic pouch?)

6. Develop monitoring system for cost effectiveness of the whole system.

(iii) Preparation of manuals of documentation

This task consists of three manuals:

(a) A general manual for all workers in GRCs

(b) A manual for the "data manager" (documentation officer) in each GRC, including a User's manual of the TAXIR system.

(c) A specialist's manual of the computer programmes of TAXIR. Exchxsfxthxxx

Each of these will include the text and appropriate illustrations. At first we will prepare the manuals as loose-leaf, unbound, mimeographed, (or other low cost) printing, with opportunity to substitute up-dated versions as necessary. Each manual will contain stepped flow-charts as well as textual description. Each manual will explain the terminology employed, and the responsibilities of various individuals.

(a) The general manual for all GRC workers will contain only enough detail to acquant the worker with the documentation importance and his part in it.

(b) The data manager's manual will be a detailed explanation of all steps in the work of a GRC, with considerable description of the functions and powers of the TAXIR system, and the connection between each GRC and the central coordination function of FAO and IBPGR.

(c) The specialist's manual of TAXIR deals with the complexities of the information retrieval system, giving flow charts of, and explanations of, each important line of FORTRAN IV instructions. This type of publication is necessary so that operators (programmers) in each computing centre where documentation computing will be done for each GRC can keep the computer system operational. Software packages are continuously being up-dated, and when this happens, the technical programmer must know how to insert the up-dated version into the extant package. This special manual is referred to in the computing milieu as "documentation" but it is documentation of a different meaning from that normally used in the GRC milieu.

(iii) Develop training programmes for data management, key punch operators, GRC staff, and computer centre personnel

Various levels of intense training are needed, in order to accomplish the objectives of the GRCs and the global network. Key personnel are: (a) the documentation specialist (or data manager) in each GRC; (b) ~~data capturing~~ personnel (key punch operators); (c) computer systems programmer and (d) GRC staff-orientation.

Training for (a) should be done on a regional basis, where several documentation specialists (with appropriate basic education) from the GRCs with a common language can be taught together. We envisage about a 3 month intensive training programme, where all aspects of the work of the GRC are analysed, and practice given xix in each function (see insert below). Basic systems approaches will underlie all the activities, to give the documentation specialists a knowledge of how to keep all activities and personnel in harmony.

Training for (b) - data capturing personnel - should be done by the documentation specialist at his own GRC. The basic key-punch training can be done at IBM service centres in almost all countries. Beyond the basic key-punch training, the documentation specialist can develop a programme to educate the key-punch operator in the best systems for actually converting GRC raw data to machine-readable format.

Training for (c) will be about a 3 months operation, to (1) give the basic computer concepts for information storage and retrieval programmes and (2) intensive training on the intricacies of the software package for TAXIR (insert for above) The various functions and power of the TAXIR system will be taught and the powers of the querying system to accomplish the tasks required for the documentation function will be practised. end of insert will be emphasised, so that when "bugs" appear in the system, the individual at the centre can correct it immediately, or will know how to communicate with the appropriate systems [analyst in FAO] to correct or modify the system. One individual from each computing centre should receive this training.

(iv) (d) GRC staff orientation in documentation

Each GRC should have a short, intensive education to indicate the values of accurate documentation, and enough training in the information storage and retrieval system to be able to take advantage of the powers of the system for his

own work. This training can be done by the documentation specialist, and need not involve any travel for the staff.

The training will include: the necessity for accuracy in any data accumulated, means to correct inaccuracies, the organisation of GRC work, with the associated data in each step, the organisation of data banks, and the means to use the information storage and retrieval system. A basic systems pattern will be employed, to guarantee that the individual workers and the data manager work together continuously. This last step requires that a monitoring system be established, whereby the individual GRC is kept in touch with the coordination unit of FAO and IBPGR, so that any misconceptions, inaccuracies, or omissions can be corrected or added as necessary.

(v) Design techniques for continuing evaluation of coordination and documentation function

Since no system is perfect from the start, there must be a systematic procedure whereby changes may be made. Also, since the global aspect requires much monitoring to be certain that the objectives are being met, some regularised means of checking progress, and encouragement of areas that are lagging behind, must be put into action.

In the former aspect, all parts of documentation will probably be modified as experience teaches that this or that aspect can be improved, modified, or deleted. Clearly, the formats for data accumulation will be under constant revision, as individuals and centres become more familiar with modern data processing techniques. It is likely that some form of mark-sensing cards will eventually replace the hand-written data recording procedures. With this will be associated machine reading programmes to convert the mark sensing cards to input for TAXIR processing. Other changes of this nature must be constantly

surveyed, with the idea of increased cost-effectiveness. The evaluation of such changes requires a consistent programme of surveillance, with guidance from an individual trained in both data management and application of computer systems.

With respect to the second aspect of evaluation, for the coordination function, there must be formal procedures where all GRC functions can be kept up to some base level of output. Otherwise , the major objective of all genetic resources collection, preservation and utilisation will not be realised. Clearly, the documentation role plays a fundamental role, since all the coordinator has available to him is the reports of progress of each and all GRCs.

(vi) Development of the coordination function for FAO and the IBPGR

To be certain that coordination is a smooth-flowing operation, there must be a continuing dialogue between the working GRCs and those responsible for the world-wide network. We must identify all the coordinating functions, place these in relation to all the others, and design the means of communication to insure that no part of the operation is forgotten, or de-emphasised.

Coordination at the top level, FAO and IBPGR requires (or includes):

1. Information from each GRC as to personnel, equipment, facilities and budget.
2. The development of the communication network.
3. The development and continued up-dating of data banks of experts, their areas of disciplines, availability as consultants or explorers (collectors)
4. Data bank of funcing resources (all types).
5. Data banks of extant accessions (an inventory) by crops.

6. Determination of regions and localities still needing collection.
7. Provide expert advice and training on all steps of documentation.
8. Coordination of training for collection, storage and utilisation in Universities and Institutes.
9. Others yet to be recognised.

The functions must be not only recognised as important, but placed in an operational framework by the personnel of the Genetic Resources Unit of FAO, and by personnel recommended by the IBPGR.

Since the top-level activities will be constantly under review and modification, a set of guidelines is necessary to give direction to the work. Development of the guidelines must be done with all appropriate participants (i.e. the Panel of Experts) and will require considerable numbers of conferences, exchange of notes and the communication with all concerned.

The Coordinating Officers of each of the GRCs must be involved, to ascertain special conditions for each centre. If there are national, regional and international centres, clearly the actual jobs of coordination will vary because of the different terms of references of each different centre.

(vii) Design of financing arrangements reflecting shared responsibility

Reference: The Documentation of Plant Genetic Resources - A Background Paper, pp. 12-13. FAO, April 1974.

In the above reference, an attempt at estimating the overall costs of documentation of all genetic resources is given. The sum, if examined alone, is staggering. However, one must realise that the costs involved will not all occur at one time, through one fund to a central agency, but rather, will be stepped over a number of years (no estimate is given of actual time), and the costs shared by a number of national, regional and international agencies.

Initial costs of establishing the system for a global network are, of a necessity, large, but these costs are also shared costs and it is with this realisation that we base the discussion below.

FAO has increased its budget for the functions of genetic resources conservation, and part of the increased budget may be available for documentation purposes. The amount budgeted for the biennium 74-75 was, unfortunately, done without the benefit of a cost analysis of the functions and, thus, inadequate for overall costs. However, at least for the purposes of genetic resources documentation, funds are allocated at a number of cantres, and by careful coordination from the IBPGR, some of these budgeted amounts can be shared with the central unit to provide expertise and systems on a global basis. Of course, each centre must, from this shared cost, receive production from t he central unit. This is anticipated, and made a part of the agreement or contract. Additional funds may be contracted from National centres, if they desire to participate in the activities. Careful analysis by the central unit for documentation can keep the overall costs to a minimum, and indicate how the shared costs will reduce costs for all concerned.

We may achieve some benefit (cost reduction) by cooperation with large-scale computing machine manufacturers, by asking for assistance in software development and design, for computers of different sizes and make. This type of assistance is very valuable, but needs careful coordination to insure that the work done will fit into the overall strategy of GR documentation.

Memo to: R. Pichel, Chief AGPE

From: D.J. Rogers

Subject: Program plan for next biennium

1. For CIDS
   A. Personnel (this following does not include the post already established P-5).

      1 Computer systems programmer
      1 Data manager (with experience in TAXIR)
      1 Keypunch operator
      1 Illustrator
      1 Secretary

   B. Equipment needs.
      1 Teletype remote terminal, with appropriate phone coupling and telephone line to computer center.
      1 Keypunch (IBM 029)
      1 storage unit for magnetic tape (small room, secure, with air conditioning).
      5 2-tiered IBM card storage cabinets
      1 electronic calculators (small, table-size unit)

   C. Housing needs
      appropriate office space, and furniture for the above named personnel.

2. Training program for CIDS.
   A. There should be three levels of training programs, as follows:
      a) General introductory program for all workers connected with GR work.
      b) Training program for "data manager" (documentation officer) for each GRC.
      c) Training program for systems programmers---(one from each center where TAXIR is installed).

   B. Means of training.
      For a) above, this should be one week intensive programs given at regional (or appropriate national) centers. The CIDS data manager listed under 1.A. above should give these courses
      For b) above, this training will require about 3 months time, and should be given at some one center (University of Colorado) for at least part of the 3 months, and part of it should be in the centers where the data manager will work. Part of the on-going activity should be a continuing "dialogue" with the CIDS data manager in Headquarters.
      For c) above, the training is intensive, and must be done at the computer center where TAXIR is maintained, and under the direction of the computer systems director mentioned in 1. A. above.

   C. Training will take advantage of the latest educational procedures, including inter-active self-teaching systems carried on by computer-aided procedures. These are essentially designed, and are now running at the University of Colorado, in association with the TAXIR system.

   D. Training manuals will be developed to give to the appropriate data managers as a means to keep themselves aware of the details of their documentation work.

Budgets—
See personnel, Equipment, and housing needs. These must be assigned appropriate costing for FAO professional and staff levels, and I cannot predict these.

Cost of computer time and allied activities are included already in our work plan for the next six months, and these figures can be used on an interim basis. However, these costs will be much more definitive by Jan., 1975.

Travel costs depend upon the Board's decisions as to which centers will be incorporated into the GR global system.

(also routed to Peterson + Freeman

OFFICE MEMORANDUM

TO: M.r. Pichel DATE: 13.3.74

FROM: D.J. Rogers

SUBJECT: Requirements for Documentation Function in this Unit

Below I have prepared a preliminary list of requirements for the Documentation function, so that you can see and begin to plan for these needs. I do not intend that this list be final, because there has not been time to prepare all of the requirements for equipment and supplies.

1. Personnel needs (some may be hired on consultation funds)

1 Management scientist, systems developer
1 Computer systems programmer*
1 Assistant programmer*
1 Data manager
1 Keypunch operator
1 Illustrator
1 Secretary.

2. Housing needs. (office space and storage space)

1 large office for Documentation Director
1 office for management specialist
1 office for systems programmer (and assistant programmer)
1 office for data manager
1 office for secretary and illustrator
1 keypunch room (must be separate because of noise)
1 storage room for mag tapes and computer cards--must be air-conditioned.

3. Equipment needs.

1 IBM elctric typewrite with paper tape unit.
2 regular IBM Selectric typewriters (or equivalent other machines).
1. key punch (on a rental basis)
1 air conditioner
1 storage unit for magnetic tapes
5 2-tiered IBM card storage cabinets
1 light table (for illustrator/artist
1 draftsman table and allied equipment.
2 electronic table calculators (Texas instruments)
1 full set of tape-recording equipment (for secretarial use).
1 Xerox machine for multi-copying

4. Furniture needs
appropriate furniture for each office listed above.

Justification. Please see the paper I prepared for Documentation of Genetic Resources. Each of the above requirements will be described in further detail later.

Functions of organizations with respect to global network of

Genetic Resource Centres.

FAO
(coordination of GRC work on global basis)
Panel of Experts

IBPGR
(overseeing and funding work of all genetic resources functions)

1. Determins priorities of crops and areas
2. Determines effectiveness of GRC work
3. Receives appropriate documentation from GRCs for coordination
4. Aids in finding experts for GR work: ~~collection~~

5.

Genetic Resource Centers

Collection

Storage

utilization

Preliminary list of needs written March13, 1974 4.a

Outline of needs for Documentation function.

1. Housing needs
   Office space--1 large office for Doc. Dir.
   1 office for management specialist
   1 office for systems programmer
   1 office for data manager
   1 office for secretary and key-punch operator.
   1 storage room for mag tapes and computer cards (this must be air-conditioned.)
   5 offices and one storage room.

   Note: If we have one large room, it would be possible to subdivide it into space for two or more of the above functions.

   Further note: please compare this request with that for offices for documentation already in the house. You will see that our requirements are very small in comparison.

2. Equipment needs

   1. Since we have many documents to prepare (including manuals, lists of specialists, lists of crops, lists of many publications, etc.) we will need very good reproduction facilities, such as our own Xerox machine, IBM electric typewriters with paper tape units attached, and our own illustrator for preparation of descriptive graphs, tables, maps charts, etc. This will requir a full line of drawing equipment, such as drafting table, light table, storage drawers for large illustrations, maps, etc.
   2. We will need, very soon, our own remote terminal to the computing machine, as well as our own key-punch machine.

   Note: these equipment needs are in addition to our needs for computing facilities, which will either have to be in-house, or contracted from the outside.

   3. We, of course, need a full set of office furniture for each of the offices listed, plus bookshelves, special file cabinets and storage racks for the proper care of magnetic tapes, and strong card-file cabinets.

3. Personnel needs.
   (See above office requirements)
   1. Management scientist--systems developer.
   1. Computer systems programmer*
   1. Assistant programmer.*
   1. Data manager.
   1. Keypunch operator
   1. secretary.

* I have found that the computing center charges $3,00.00 per month for programmer time. We obviously cannot afford to pay their rates, and can get both of the programmers requested above for 1,000 a month cheaper than the computer center rate.

OFFICE MEMORANDUM

TO: Division Directors,
Divisional Document Control Officers and
Divisional Certifying Officers

DATE: 28 January 1974

CC: ODG, ADG's, AUD, DPB, AFFA, AFFB, AFMO, GIDA, GIPP, GIPT, GIPE, PPCS

FROM: H.W. Mandefield
Director, Publications Division, GIP

SUBJECT: Key Unit Costs for work reported by GIP on Monthly Allocation Utilization Reports, 1974-75

Key Unit Costs for Publications Division facilities in 1974-75 have been recalculated to reflect mandatory increases in salaries, contractual services and supplies. The recalculation has been made in accordance with the formula approved for 1972-73 by the Publications Committee, but is based on projected workload and financial resources under all programmes (Regular Programme, Extra-Budgetary Programmes, Trust Funds, etc.). The following scale will apply as from 1 January 1974:

1.	Translation (Staff and/or Contract):	$98.00 per 1 000 words
2.	(a) Composition Unit	$ 1.20 per 100 words
	(b) Director-General's Circular State Letters	$240.00 per C.S.L
3.	Internal Printing:	
	(a) Plate-making, make-ready, start-up	$ 2.00 per page
	(b) Paper, other supplies, running, gathering, finishing, storage, dispatch including management and supervision	$ 9.00 per 1 000 page-impressions
4.	External Printing:	
	(a) Printer's invoice plus cost of paper	-
	(b) Calculation, placing of contracts, management charges, etc.	$48.00 per $100 of (a)
5.	Editorial and Graphics work:	Reported on the basis of time consumed.

$14 per hour

Although the costs for individual jobs processed in January 1974 have been calculated on the basis of the 1972-73 scale on the worksheets (GIP 48-1) attached to the Allocation Utilization Reports, the totals shown for each operation, under each sub-programme in the January 1974 Reports will show the 1974-75 unit costs as indicated above.

In all cases, the full costs of divisional direction, management at service, branch and section levels, storage dispatching etc. have been included and distributed on a percentage basis among the five basic operations listed above.

Mrs. Guarini-Zeni, Coordination and Operations Officer, GIDA, ext. 3326, will be available to answer queries on the calculation of these key unit costs.

BUDGET REQUIREMENTS FOR FAO - Documentation, Year One

A.	Computer-related	
1.	Personnel	
a.	Full-time systems programmer (~~$ 18,000/yr~~)	$ 18,000
b.	Ass't. part-time programmer	7,500
c.	Key punch (machine operator), full-time	7,500
d.	Secretary	33,000
2.		
B.	Data gathering and maintenance	
1.	Personnel	
a.	Data manager (systems analyst)	18,000
b.	Instructor (information specialist)	16,000
2.	Networking	
a.	Cost of organizing and establishing system 1st year - includes network competitive trials	20,000
b.	Establishing means and routes of international communication	5,000
		59,000
C.	Travel	
1.	Staff -- 6 annual trips at $1,500 each (ave.) including ave. of $25.00 per diem per day, 6 persons	54,000
2.	~~Consultant travel - 10/year~~ ~~trips per~~	~~15,000~~
		69,000
D.	Computer rental costs	
	(Excluding network costs of B.2 above) at $400/hr (ave.) 40 hours	16,000

E. Equipment

Desk calculators (2) (pocket size).	700	
Projection equipment	1,000	
Report preparation equipment	1,000	
Electric typewriters (2)	1,000	
Minor equipment	1,000	4700

Air conditioner for storage

Xerox rental

F. Supplies

Including computer tapes, IBM cards, paper, ~~pencils~~, and all other expendable equipment,	3,000	3.000

G. ~~Publication costs - manuals, reports~~ ~~30,000~~

Editorial expert + translation 12,000 32.000

H. Consultant costs

10 consultants, $150/day, 10 days each	15,000	
Per diem for each consultant (ave. $25.00/day)	2,500	17500

I. Communication costs

Telephone, telegraph (cable)	2,000
Total	$ 236,200

J. ~~Salary - DJR~~ ~~30,000~~ —

~~$ 266,200~~

K. Not included in this budget:

Training programs for computer programmers and documentation specialists.

JUSTIFICATION

A. The Computer Aspects

1. The network

We are entering upon a very new technology when we talk about computerized networks for information retrieval. Only in certain commercial organizations, such as airlines, banks, and stock companies are networks presently established and these mostly operate on a national basis, practically none on an international level. These extant systems are used largely on very restricted, well-organized sets of data, far more simple than the types of data for GRC's. We must proceed in this networking with essentially an untried technology. It can be done, but at a cost. A recent survey by the Office of Scientific Information Services, NSF, indicates that in the most sophisticated centers (i.e. MIT, U. Ill., and several commercial organizations, i.e., G.E. and TRW), the problems of networking are only now being addressed. The problems are very much less in the U.S., where communication systems (microwave and satellite transmissions) are best developed in the world.

This is not to say that we cannot proceed. We can, and with efficiency, if we proceed with the types of personnel listed.

2. The IR system on various machines, mostly small

Most of the localities where GRC's are to be established (or are operating now) will not have very large computing facilities. But all the computerized information retrieval systems of sufficient flexibility to handle the multitude of tasks required in GRC have been built for large, sophisticated computing machines. TAXIR can be segmented (overlays) to run on small-sized machines, but at a cost. This cost is reflected in the budget.

3. The demand

The number of requests already received for TAXIR indicate that many centers are desperately in need of information retrieval systems. Their data are already being generated in such quantities that they can no longer function in an efficient manner. I have had impressive demands on my time already even before I get to FAO. There is no region that does not want my assistance, on all continents. I know that we will have an impressive demand on my time (and my assistants) during the first year at FAO. This also explains the budget requests. Hopefully, after the first year, the various demands and problems will be reduced, requiring smaller expenditures.

B. Data Use

In spite of the fact that many considerations (meetings, resolutions) on data collection have been made over the last few years, almost no consideration has been made on what the data are to be used for. Nor have considerations been made on either the benefits or costs. In our laboratory, we have learned what can be done, for what benefits. There is a great blank on the map of knowledge on this problem amongst the greatest number of workers who will staff the GRC's.

We must spend time on the education of all involved, including the following:

1. How to construct data for best application;
2. Different ways to construct efficient data banks;
3. How to ask different types of questions which will supply answers to complex questions;
4. How to employ all the facilities provided by the TAXIR system, some of which are quite sophisticated.

Education in this type of activity is a continuing function, both for those who educate and those who learn. If we do not simultaneously carry out this function with the installation of the computing system, I can guarantee that there will be a failure in the use of any information retrieval system.

One more point is highly significant in the present setting (data uses). This is the fact that we are providing for functions of a large number of independent specialists who have almost always operated in a manner of individual endeavors, now turning to sharing information at the data level, not at the publication level. Upon a moment's consideration it can be seen that this requires an entirely new type of data application. Again, this helps to account for the budget. The education can be accomplished quickly, using specialists who know how to do it, thus producing benefits now unrealized.

C. Continued Development of Systems

No one knows better than the developers of a system how much more still needs to be done. But clearly, the technology (which is only about five years old) needs many additional developments. If we are to keep abreat of the multitudinal aspects of information retrieval, we must continue to spend some of our time in this area. The budget partially reflects this function.

D. Other Uses of TAXIR in FAO

I have already been contacted by individuals and groups who learned about TAXIR from some source in FAO other than for GRC work. These include soil and animal scientists. I am sure that these contacts are but the "tip of the iceberg". We have a good system and it is very certain that there will be many additional demands for the system, including all the

considerations given above. These demands, while not necessarily a primary responsibility of the documentation group, for GRC, cannot be ignored. If they are not to be ignored, then time and money are involved.

In conclusion, It must be said that TAXIR is not the only computing system of value to GRC work. Two other major computer programs which have been developed in the Taximetrics Laboratory which are powerful allies to correlative work in systematic, ecologic, genetic and agronomic work. These two programs -CHARANAL and GRAPH- will no doubt play a powerful role, in conjunction with TAXIR. In addition to our own systems there are many other programs of great power and significance.

Work plan - TASKS —

A. Computer-related:

1. Establish working relations with a computer center, either FAO or other in Rome, Milan, Geneva.
2. Put up TAXIR - convert to IBM 370
   Estimate of time for this -
   " needs for programmer at Comp Center, if we want to train one of their staff.
3. Write manual for TAXIR - documentation and flowcharts - for IBM hardware.
4. Write general manual for users of TAXIR - rewrite Brill's Primer.
5. ~~Training of computer-center staff at Centers~~ individual GRC.

5 = Survey of CC at or near GRCs.

   a) Find the comp center for GRCs -
   b) Determine the (or contract the) services of CC for ea. GRC -
   c) Survey comp cntr capabilities near not cooperating GRCs. - write to Cummins IBM would trade for info - also write to ea ~~comp. cntr~~ GRC directors for same -

6. Survey of IBM IR systems - capabilities and costs and compare with TAXIR.
7. Determine means for remote terminals, if at Rome using system at other city.
8. Get in-house key-punch

A- cont.

9. Get a statement from FAO CC for their operating procedures - what they require before we can work
10. Training of CC programmers - FAO and at GRCs.

Work plan - TASKS

B. Data-related - in-house FAO

1. Determine what data banks in FAO, for ~~the~~ AGPE, and other AGP offices -
2. Set up priorities for gathering data.
3. Determine which personnel can be used for data gathering. Anna? Who else.
4. Devise systems analysis of all requisite functions.
5. Manual for:
   a) Devising appropriate data banks -
   b) " " descriptors -
   c) Data preparation.
   d) " standardization.

In GRC's -

Examine objectives of ea. GRC.
Determine data needs for all functions
Determine means to provide info to others.
" relation to FAO documentation center.
(what will be transmitted).
Help establish a budget for documentation functions.
Train documentation staff - and others in GRC who gather data.
Devise classification schema for types of data.

Work plan:

Set up of Documentation Function in Rome -

1. Personnel needs - Separate from Aichel.
2. Housing needs -
3. Equipment needs -
4. Separate Budget

1 - Personnel

Planning Functions -

Priorities and Needs - at FAO

1. - Systems analyst - management sci -
2. " " - computer programs -

Requirements:

1. Establish in each GRC
   a. documentation specialist
   b. software packages + computer specialist -
   c. procedures for capturing data + sharing with "network".

none of the GRCs have budgetted this function at the necessary level (see TAC Report).

2. Determine exact concepts of networks
   How function:
   " determine additional needs
   Who decides what crops, and
   which areas for ea. crop.
3. Determine how to proceed w/ Documentation -
   1. Start w/ present accessions? - each GRC?
   2. " " new accessions only?
4. How to work with GRCs in ~~established~~ developed Countries - Italy, France, Holland, Belgium, Germany, U.S, USSR? Will these want to use TAXIR? - How do they pay for installations?

Personnel Needs

1. Within FAO - see TAC paper DDDR: IAR/73/16
   1. O.I.C - Expl. + Conserv. - ??-R.P.?
   2. O.I.C - Doc. + Info. - DJR.

      Systems analyst.

      " Programmer

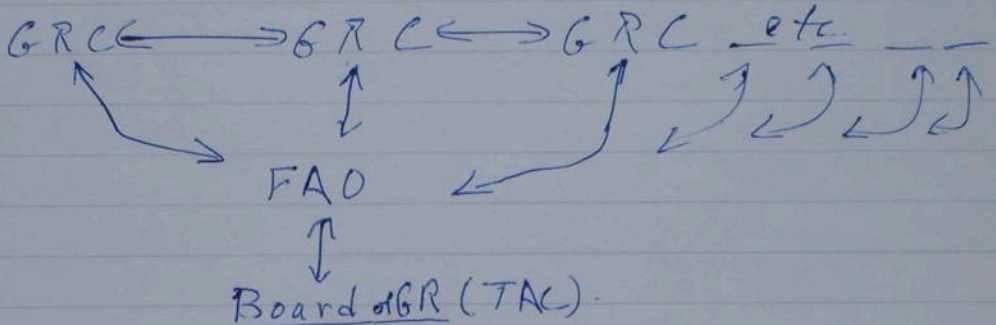
      Data Management Specialists.

      Secretaries + key punch operators.

To establish consultancies for Hersh and Hanley

Procedure –

Flow Chart of Info/Data Movement



How many GRC's?

Documentation functions - FAO

1) - Develop training manuals for CIDS

2) Develop Software manuals for TAXIR

3) Institute regional training systems
(That is - for any/all GRCs in the network from some cohesive geographic regions -

How does this coordinate with Hawkes request.

Use of facilities of International Research Centers.

4) Determine means of ~~Docs~~ CIDS for each GRC - what hardware?
" software?

5) Continuing software developments
Needs - Modularization of TAXIR
- Merging of data banks / on descriptors
- Plotting routines

6) Establish TAXIR for in-house functions -
Seed exchange / lab.
Lists of specialists - pl. breeders, GRC experts
" " GR units and their present contents.
Bibliography - descriptions of GRC functions.
Lists of crops + GR present -

Mitandol 3817
Kraelit-3610

=> Types of personnel needed in GRC's.
=> " " " " " FAO for coordination —

- TAXIR - Cost is a one-time cost - not a continuing rental.

CROP ECOLOGY AND GENETIC RESOURCES UNIT
PLANT PRODUCTION AND PROTECTION DIVISION

QUESTIONNAIRE ON CONSERVATION FACILITIES FOR PLANT GENETIC RESOURCES

1. Is your institute prepared, subject to further clarification of details and the participation of other institutions (which it is expected will number approximately 20-25), to participate in the proposed cooperative genetic conservation programme, and to provide facilities for a "base collection" (see reference B attached[1/]) of seed stocks?

yes ☐ no ☐

2. Does your institute already maintain "active collections" (see references A2 and C attached)?

yes ☐ no ☐

3. Does your institute already have collaborative arrangements with other institutes regarding exchange or duplication of collections?

yes ☐ no ☐

4(a) Are you prepared to enter (a) ALL or (b) specified PARTS of your collections into the proposed cooperative genetic conservation programme?

ALL ☐ PART ☐

(b) If (b) above, which part? (a brief reply would suffice at this stage)

.....

.....

5. Are you prepared, in principle, subject to your approval in each case, to accept for safe-keeping collections derived from elsewhere? (see reference B2(iv) attached)

(a) from expeditions? yes ☐ no ☐

(b) from other collections for duplicate storage?

yes ☐ no ☐

[1/] References in brackets refer to the corresponding sections of the attached "Definitions and Functions of an International Network of Genetic Resources Centres".

WI/E7853

6. If yes to 5(a) or 5(b) above, what is the size of the storage space which could be made available?

☐ cubic feet

or

☐ cubic metres

7. Please describe the physical conditions in your seed storage facilities.

(i) Is temperature controlled?

yes ☐ no ☐

(ii) What range of temperatures can be used?

(iii) Is humidity controlled? yes ☐ no ☐

(iv) What range of humidities is possible?

(v) Are your seed storage facilities subdivided into separate units, each with different sets of conditions?

yes ☐ no ☐

(vi) If yes, please give details.

(vii) How, and of what material, are your seed containers constructed? (e.g. cans, envelopes, jars, etc.)

(viii) Are the seed containers permanently sealed?

yes ☐ no ☐

(ix) When distributing samples, (a) are container seals broken, or (b) are samples already stored as sealed sub-samples?

(a) ☐ (b) ☐

(x) Of what capacity or capacities are your seed containers?

(xi) Are containers evacuated or partially evacuated?

yes ☐ no ☐

(xii) Are seeds maintained under a gas other than air

yes ☐ no ☐

(xiii) What gas? ☐

(xiv) Is seed moisture content reduced before storage?

yes ☐ no ☐

(xv) What moisture content/contents? ☐

(xvi) What is your total seed storage capacity?

☐ cubic feet

or

☐ cubic metres

8(a) Please give information on any present documentation system, or data gathering or storage techniques employed.

.....

.....

(b) Do you have a data specialist?

yes ☐ no ☐

9. Additional information or comments.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

10. Please attach any published or unpublished descriptions of your collections, if available.

1. Whether your centre would be prepared to enter into a collaborative agreement with other centres in other parts of the world, in cooperation with which you would aim to maintain significant world collections of plant germoplasm according to minimum standards specified from time to time by the FAO Panel of Experts on Plant Exploration and Introduction or any other internationally established body or committee. In affirmative case, please state in which crops your centre is especially interested.

2. Whether your centre would be prepared to engage in a systematic exchange of germoplasm samples, or if there is any important limitations, (not including number and size of samples or seasonal availability of materials or quarantine and other legislative mesures in your country).

3. Whether your centre would be willing to accept duplicates of certain important world collections of germoplasm and to maintain these and make them available for exchange through the proposed network.

4. Whether your centre would be willing to cooperate in the interchange of genetic information, if your centre has facilities for storage of genetic information, and in which crops you would be interested in storing information for maintenance and interchange.

5. Whether you possess at present the technical capability and the personnel to enter into such collaborative agreements, or would require assistence to attain the necessary technical or logistic levels.

from 5th Panel meeting report, March 8-10, 1973

RECOMMENDATIONS

I. GENERAL CONSIDERATIONS

It is recognized that in a general way the genetic resources remaining to be assembled are to be found in the developing countries, while some of them are extremely valuable to the developed countries. There are many ways in which the developed countries can repay the developing countries for their valuable contributions to the world's genetic resources. One of these is by providing expertise, or by helping in the training of local staff, for the assembly, maintenance, evaluation and utilization of the national genetic resources of developing countries. The developing countries require these collections for their own plant breeding programmes. The Panel agreed that in the case of any plant collection made with the support of public funds it should be a condition of such support that a duplicate collection be offered to the host country. In the case of all other collections the same practice should be strongly encouraged.

In the course of exploration work, every effort should be made to involve local personnel and to provide in-field training and experience in order to enhance indigenous expertise.

It is recognized that most of the easily accessible material has been collected and that future emphasis must be directed to the most remote and least accessible regions containing primitive races and wild crop relatives. This situation will require more organization and fuller collaboration with local personnel than has usually been the case in the past.

The Panel further recognizes that institutions and individuals will independently plan and conduct explorations to this end and that there will be FAO-sponsored collecting trips which may involve scientists of several countries. Coordination and exchange of information concerning these several efforts is very necessary to avoid duplication and to increase efficiency. It is, therefore, recommended that the Crop Ecology and Genetic Resources Unit provide strong leadership in the coordination and exchange of information so as to bring about successful collaboration.

It is envisaged that there will be a variety of donor organizations, institutes and foundations providing financial support to exploration both through contributions to a general fund and through bilateral agreements to support portions of a general plan. There will also be a variety of national and regional Genetic Resources Centres, Agricultural Colleges, Research Stations, and other organizations involved in the actual execution of the programme. All of this will require coordination and planning. It is, therefore, recommended that the Crop Ecology and Genetic Resources Unit begin without delay to mobilize financial resources, develop agreements with operational centres, institutes and organizations and identify, where possible, the scientists and technicians available to carry out the programmes along the lines detailed below.

II. GENETIC RESOURCES CENTRES

The Panel accepts the concept of an international network of genetic resources centres, linking together institutions in regions of genetic diversity with institutions elsewhere.

A. Definitions

1. Centres for the conservation of plant genetic resources are to be termed genetic resources centres.

2. Genetic resources centres comprise either or both of the following components:

(i) "base collections" (previously termed "conservation centres") for long-term conservation;

(ii) "active collections" (previously termed "working collections") for

(a) medium-term storage;
(b) regeneration;
(c) multiplication and distribution;
(d) evaluation;
(e) documentation.

These two components are necessary for the continued maintenance of germplasm collections. If they are not situated in the same institutions, collaboration links between them will be necessary.

Breeders' working collections are regarded as outside the framework of genetic resources centres, but use of genetic resources by breeders will generate valuable information which could be incorporated in genetic resources records.

B. Base collections

The Panel recognizes the following categories of base collections:

(i) substantial collections of a wide range of species;

(ii) substantial collections of a limited range of species;

(iii) significant and original special purpose collections;

(iv) replicates of any of these.

Base collections, except for replicate collections stored under similar conditions, normally will be subject to periodic germination tests.

Requirements related to base collections are specified in the report of the Fourth Session of the Panel of Experts on Plant Exploration and Introduction, paragraphs A2(a), (e), (f), and (h).

The Panel notes preliminary steps by FAO towards securing the participation of major seed storage laboratories in an effort to provide first-class storage facilities for the world's germplasm collections. "See Appendix B". It urges that this effort be pursued with all possible speed. Agreements should be sought on technical standards, access, regeneration, quarantine measures and any other matters required to secure long-term storage for existing collections and for those which will be assembled in the coming years.

The Panel will propose one or more scientists who will advise FAO on the [illegible] needs.

C. Active collections

Requirements related to this function are specified in the report of the Fourth Session of the Panel of Experts on Plant Exploration and Introduction, paragraphs A2(c), (d), (g), and (i).

D. Genetic resources centres in regions of genetic diversity

In order to meet the needs of a world programme of genetic conservation the Panel supports the creation of an international network of genetic resources centres. This network will be based on centres in areas of great crop genetic diversity, and on international crop research institutes. In addition some national institutions in developing countries which have already extensive international activities would be expected to participate in the network.

Within the network these centres and institutions would collaborate with organizations in the developed countries such as CSIRO, Canberra, Australia; National Agricultural Research Institute, Versailles, France; the Institute of Crop Science and Seed Research, Braunschweig-Völkenrode, Germany; Central Institute for Research on Cultivated Plants, Gatersleben, German Democratic Republic; Institute of Agrobotany, Tapioszele, Hungary; Germplasm Laboratory, Bari, Italy; National Institute of Agricultural Sciences, Hiratsuka, Japan; Royal Botanic Gardens, Kew, U.K.: the USDA Agricultural Research Service, Beltsville, Maryland and the National Seed Storage Laboratory, Fort Collins, Colorado, USA; the N.I. Vavilov Institute of Plant Industry, Leningrad, USSR, etc.

The functions of the genetic resources centres will include some or all of the following, as defined in the Beltsville report of 1972 as follows:

1. Exploration and collection of material, and collaboration with national centres;

2. Identification and preliminary evaluation of materials;

3. Initial planting of introduced material according to the quarantine laws of the country in which the centre is located;

4. Exchange and distribution of seed and vegetative stocks, including, where appropriate, the introduction of breeding lines and advanced cultivars;

5. Maintenance and storage of seed and vegetative stocks for medium or long-term preservation;

6. Documentation and exchange of information with other centres in the network in an internationally accepted form. Some centres will be able to take advantage of existing local facilities for computerized information storage and retrieval;

7. Organization of genetic stock rejuvenation by national centres wherever possible, or otherwise by regional centre;

8. Organization of training programmes for personnel in collaboration with national or international training schemes;

FAO

LIST OF INSTITUTIONS WILLING TO COLLABORATE
IN THE FAO GENETIC RESOURCES NETWORK

National organizations

ARGENTINA

Instituto Nacional de Tecnologia Agropecuaria (INTA)

AUSTRALIA

Commonwealth Scientific and Industrial Research Organization (CSIRO)

CANADA

Department of Agriculture, Research Branch, Ottawa Station

GERMANY

Institut für Pflanzenbau und Gartenkulturforschung, Braunschweig-Völkenrode

GHANA

Crop Research Institute, Kade

INDIA

Indian Agricultural Research Institute (ICAR)

ISRAEL

Agricultural Research Organization, Volcani Centre

ITALY

Consiglio Nazionale delle Ricerche, Laboratorio del Germoplasma, Bari

POLAND

Polish Academy of Sciences, Department of Crop Germplasm Conservation, Warsaw

SWEDEN

The Swedish Seed Association, Svalof

Most of them have established some reservations

TURKEY

Agricultural Research and Introduction Centre, Izmir

U.K.

Royal Botanic Gardens, Kew

U.S.A.

United States Department of Agriculture, Beltsville

U.S.S.R.

N.I. Vavilov All-Union Research Institute, Leningrad

International organizations

Centro Internacional de Agricultura Tropical, Cali, Colombia

Interamerican Institute of Agricultural Sciences, Turrialba, Costa Rica

International Rice Research Institute, Los Baños, Philippines

International Institute of Tropical Agriculture, Ibadan, Nigeria

International Potato Centre, Lima, Peru

2nd Draft JTS/ss
4.6.74.

COORDINATION OF A WORLD NETWORK OF GENETIC RESOURCES CENTRES

by

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INTRODUCTION

International activities in genetic resources, whether directly supported or monitored by the International Board for Plant Genetic Resources, or independent of it, will benefit from the various genetic resources programmes being coordinated and, where appropriate, integrated within an International Network. Precisely what is involved in such a coordinating function should, however, be clearly specified, firstly by defining the terms in the above title.

Coordination is defined as "to bring into a common action, movement or condition" (Webster) or "to place (things) in proper position relative to each other and in the system of which they form parts" (Oxford).

"An inter-connected or inter-related chain, group or system" (Webster) is a network or, alternatively, "work in which threads, wires or the like are arranged in the form of a net (Oxford).

Genetic Resources Centres are "centres for the conservation of plant genetic resources and which comprise either or both base collections and active collections", as defined by the FAO Panel of Experts on Plant Exploration and Introduction (Fifth Report 1973, p.4.)

The inter-relationship or inter-connection in a network implies a certain commonality - a common denominator - present in the links of the network, some of which are the genetic resources centres. Ideally, effective coordination will enable each of these centres - in certain aspects of their work, to participate and act together in a smooth and concerted way. FAO shares with the International Board the same fundamental objective of this coordinating function. It is to ensure that the genetic resources of the major world crop plants are collected, conserved and made available for utilisation in plant breeding and other programmes. Arrangements must be made for collecting them wherever they are found. Collecting and then collating the information* on the crops and areas of the world will ensure that there are no significant gaps in the global strategy which is decided upon.

This operation must be undertaken on a world-wide scale. Therefore, the merits of a central organisation to make the coordinating links are self-evident. Certainly, contacts must be equally possible with developed and with developing nations in the tropical, subtropical and temperate climatic regions. Most of the genetic resources are found in the developing countries of the world and FAO, through its member nations, already has a network of communication and liaison links with these, and the developed countries.

Naturally, because financial and other resources are not unlimited, the establishment of priorities for both crops and critical areas is essential. This responsibility has been undertaken by the FAO Panel of Experts on Plant Exploration and Introduction which has made specified priorities and recommendations to FAO and its Crop Ecology

* For the purposes of this paper, data and information are included in the term "information".

and Genetic Resources Unit. Based on a global survey of genetic resources, their present status has been evaluated. In addition, the limiting restraints - either in knowledge or trained personnel have been preliminarily identified in the reports of the Panel.

In the proposed global network, which organisations and programmes will be coordinated? Certainly, genetic resources centres at regional and national level will be included, together with certain programmes of the international agricultural centres; for example, those in the exploration and conservation of crop germplasm. All these centres and institutes have a common objective in their genetic resources programmes: there is a similarity in the principles - a "common thread" in the diverse technical aspects of their work, some of which are described below.

GENERAL ASPECTS OF COORDINATION

However, before outlining the coordination requirements of these technical functions, the general aspects of the overall coordinating function are considered under the following headings: inventory, information, financial support and the management of the global network.

Inventory: The development of effective future plans critically depends on up-to-date knowledge of the resources what are at present available. One example is the survey of crop genetic resources which, by identifying specific crops and areas, has delineated the present status of genetic resources. The questionnaire directed to certain international centres and gene banks, attached as Annex I, is another inventory item. Information was requested on the capacity and characteristics of their storage facilities for the long-term conservation of genetic resources. Similarly, a detailed knowledge of current genetic resources research programmes, and of the personnel actively engaged in them is essential background information, based upon which future policy decisions will be taken.

Information: It will be impossible to identify gaps - one vitally important aspect of a coordinating function, unless accurate and easily-processed information is first obtained from a wide range of sources and then centrally assembled. Obtaining this information and arranging for its retrieval and exchange are the base on which coordination works. Included would be published information, data on accessions, exploration missions to be undertaken and the explorers, taxonomists or plant breeders interested in specific areas and crops. The definitions given above of a network certainly imply a web-like structure composed of cords, wires or links which cross and are joined together. In this context, at least in part, it is analagous to an inter-connecting communication system for the transmittal and exchange of data and information.

Financial support: It is anticipated that one component of coordination will be knowing the sources of funds which support genetic resources activities in different parts of the network. Funding may have several different forms and will be derived from various private, national or international bodies or agencies. For example, multilateral funds have been made available by the FAO Regular Programme

and by UNEP. It is expected that bilateral funds for centres in Ethiopia, and Turrialba, Costa Rica, and the Izmir Centre in Turkey will be provided, respectively, by the Federal Republic of Germany and by SIDA. Furthermore, in its fund-raising capacity, the International Board, either through its own Central Fund or bilaterally, will mobilise financial support in future for additional programmes or centres. Therefore, the commitments of donor countries or agencies should be known, together with the programmes being supported in different countries. This is as another coordinating function. It will facilitate an overall perspective if the several components of a global network if the several components are known together with the level of support which each of them is receiving.

Management of the global network: This is perhaps the most complex aspect of any coordination function. But, however difficult it may be to achieve effective management of the network, doing so is essential if the development of genetic resources activities is to be continued and expanded. The concepts of the management function are provided in more detail in the paper on "The Documentation of Plant Genetic Resources".

The principles of management must be applied, first to evaluate the efficiency levels of various operations and, second, to identify the constraints in any of the links which inter-connect to form the network. Furthermore, because several different disciplines are involved, it is a multi-dimensional network which includes expertise in many disciplines, for example, plant taxonomy and breeding, documentation and exp aspects of management science. The major input will be well-defined information or data derived from anywhere in the world, from the different types of genetic resource centres and plant breeding programmes.. Ideally, such a system should be sufficiently flexible to permit easy access to crop germplasm, and the information which relates to it, by any institution which is itself an integral part of the proposed network. It should be as free as possible of political constraints and to ensure maximum efficiency it must operate at a location where this can be achieved. Through the operation of such a central coordinating function, it will be known what is available, where it is stored and under what conditions, and the quarantine and political barriers which may limit its dispersal. Information must be easily, reliably and relatively rapidly obtained or further processed through a computerised operation for informaion retrieval. Similarly, data which are accumulated when material is evaluated, regenerated or utilised are "feed-back" types of information. They too must be added cumulatively when and wherever this data becomes available to the various data banks.

All this requires, therefore, not one but two or three levels of coordination; because some decentralisation will enable much of the recording to be done in situ at the centres where the accessions are collected, stored, evaluated or utilised. The general overall coordination would be carried out as a central function by the FAO.Genetic Resources Unit. It would include coordinating the operations, but not the data handling done at the Centres, and providing the necessary help and expertise for the establishment of documentation systems at the Centres. In addition, a second stratum of coordination for example at regional level, and even a third for national operations will be required for the management, processing and general handling of data by the regional, national or other centres.

OPERATION OF TECHNICAL ACTIVITIES

There are several technical operational activities which constitute vital components of the overall objective which is the conservation and utilisation of the world's diminishing supply of plant germplasm. Survey, exploration and collecting activities are included in one phase of field operations, documentation and information retrieval are other aspects while additional examples are the management of the global network, conservation of the genetic resources and their evaluation and utilisation.

It may be unrealistic and overambitious, at least at the present time, to expect any one group or organisation either to undertake or to coordinate all these activities for the major world crops. However, some activities in five of these areas - exploration, documentation, conservation, information and training, has been undertaken by the Crop Ecology and Genetic Resources Unit of FAO.

EXPLORATION

The exploration missions which have been supported or undertaken during 1971-73 are itemised in Appendix II. Collections have been made in the Near East, Latin America, Africa and the Far East.

The Near East and Mediterranean regions were specified by the FAO Panel of Experts in Plant Exploration and Introduction as the number one targettarea, particularly for the collection of endangered cereals and vegetables. Support from SIDA has been forthcoming for a Near East Region Project (REM/5). Turkey, Afghanistan, Iraq, Iran, Pakistan and Syria are expected to participate in this Regional Project with its headquarters in Izmir, Turkey. A programme for is to be formulated for the exploration and collection of germplasm in critical areas within this region. Field activities are due to start during 1974 and additional financial support for exploration is available, if required, from FAO Regular Programme funds and from UNEP.

Ethiopia is the second target area designated by FAO's Expert Panel in 1973. Here, arrangements are proceeding for establishing a genetic resources centre with support from bilateral funds of the Federal Republic of Germany. Expeditions have been made there recently by the Bari Germplasm Laboratory for Cereals, Purdue University and IAR (UNDP) for coffee and oats.

Tropical crops have been given the third order of priority. A large number of different species is threatened in Tropical America, Tropical Africa and Southeast Asia and the FAO Panel recommended that attention should, within these regions, firstxbex first be directed towards Meso-America.

TROPICAL AMERICA

A Conference on the Utilisation and Conservation of the Genetic Resources of the Caribbean region was held with FAO support at Turrialba, Costa Rica in December 1973. The report of this conference will specify the crops and the areas of highest priority for collection in the region. Arrangements and discussions are

proceeding with the Federal Republic of Germany for establishing a genetic resources centre at the Interamerican Institute of Agricultural Sciences (IICA) in Turrialba.

It has been proposed that a working group of the FAO Panel be invited to specify in some detail the exploration priorities, in crops and areas, in Latin America. Their recommendations will be made to FAO's Crop Ecology and Genetic Resources Unit for transmittal to and consideration by the International Board.

Other activities in the region have included: Advice and assistance given to the Brazilian government on the establishment of a regionally-based plant introduction service. Proposals have been received from CIAT with respect to their programmes and regional responsibilities for Phaseolus, tropical grasses and grain legumes, in addition to their present work with Cassava.

TROPICAL AFRICA

Since the First Report of the Survey of Crop Genetic Resources in their Centres of Diversity was published in 1973, IITA at Ibadan, Nigeria has been active in plant exploration in Nigeria and nearby countries. These activities may be supplemented in future by exploration missions in certain crops undertaken by ICRISAT in Africa.

Support is available from UNEP funds for a field training course in West Africa, to be arranged in the 1974/75 period.

In addition, the collection of Oryza glaberrima in Liberia and yams in West Africa has been undertaken in the past two years by Carpenter and Martin respectively. A report of J.R. Harlan has indicated the crops in Mali, Guinea and Liberia, and in areas of East Africa, which require urgent collection.

SOUTHEAST ASIA

The Botanic Garden of Indonesia at Bogor has been endorsed by the FAO Expert Panel as a suitable location for a genetic resources centre in Southeast Asia, a decision endorsed by Dr. J.T. Williams of Birmingham University in his recent report. In addition, the crop-specific programmes of IRRI in the Philippines for rice must be considered within the activities occurring in this region.

The particular areas and species for exploration still need more precise definition within this region. Then, possibly with Bogor as a centre, arrangements could be formulated for the collection and conservation of the many species of vegetatively propagated crops, for example tropical fruits in Indonesia and other countries of the region. UNEP funds are available to support a Symposium in Genetic Resources in Southeast Asia when exploration priorities could be more precisely determined.

The Indian Agricultural Research Institute (IARI) in New Delhi is one of the ten locations designated by the FAO Panel and named in the Beltsville report as requiring financial support. Furthermore , in a crop-specific context, ICRISAT

is now approaching full operational status. It is assumed that this Institute will assume responsibility for the genetic resources of chickpea, pigeon pea, sorghum and millet on the Indian sub-continent.

General aspects of exploration

There are two additional general aspects of exploration activity. These are, first, the availability of technical expertise in exploration either in specific areas or as taxonomists in certain crops and, second, the exploration missions to be undertaken by centres, institutes and national organisations. One aspect of any coordination function is to first assemble information on both these aspects, then to integrate it as and where it is appropriate.

With these aims in view, a committee of the British Botanical Society has provided information on the taxonomists and ecologists in UK universities who may be available for exploration missions. These data, together with that from institutions and universities in other countries will be assembled, cumulatively as a data bank on the exploration expertise which is available to assist collection missions.

Equally important is to know the present and future exploration plans of the various centres, institutes and national organisation which are active in genetic resources work, in particular the following:

The International Agricultural Research Centres, e.g. CIAT, CIMMYT, CIP, ICRISAT, IITA and IRRI.

National exploration missions, for example, those undertaken by USAID, Japan, Russia and the Peoples' Republic of China.

Private Seed Companies, for example, Pioneer Seeds, Agrow, Dekalb in the U.S.A. and Nicholsons in the U.K.

INFORMATION

Part of the coordinating function, particularly in exploration and in conservation, will continue to occur through the medium of the Plant Genetic Resources Newsletter. In addition, on a crop-by-crop basis, especially with a computerised documentation system, inventories of genetic resources will be published, in the future as in the past, in the Newsletter. The FAO Regular Programme budget permits the publication of the Newsletter in English three times a year. Its popularity has been such that discussions have taken place regarding the possibility of producing the Newsletter in addition in French and Spanish.

A tri-lingual filmstrip has been produced on genetic resources. Negotiations have occurred on the production of a short documentary film which will have training, educational and general informational interest. Several contacts have also been made with national radio and TV networks which want to feature the collection and conservation of genetic resources as documentary items.

It is anticipated that, increasingly with the development of programmes sponsored by the Board, there will be an increase in the requests for publications and articles which describe the genetic resources centre network, the activities and objectives of the centres and ~~the~~ how the coordination of their programmes will be implemented. Consideration must also be given, in a public relations sense, to other articles in the various scientific journals on the establishment of the International Board and its policy, activities and objectives. An awareness among the international scientific community of the structure and wide-scale objectives of the Board will enhance its effectiveness by strengthening - through information exchange - the functions of its many itegral components in the different regions of the world.

CONSERVATION

There are three parts of the coordinating function as this affects the conservation of genetic resources. These are knowing, first, what materials have been and are being collected; and, second, the location, capacity, characteristics and administrative procedures of conservation centres where the long-term viability of genetic resources may be guaranteed. Based upon these two sets of data, the third function of coordination logically follows - developing the procedures to ensure that correctly-documented genetic resources, either of collected material or that which presently exists in collections, are placedoin secure storage for present and future utilisation.

The genetic resources in world collections have been surveyed. Data on three million samples have been received from 2000 institutes and plant breeders in different countries. For specific crops some of these results, together with those from recently conducted expeditions, have been published in the Plant Genetic Resources Newsletter. Furthermore, the coordination of exploration activities, as described above, will identify present and future collecting missions and therefore complement the information that has been derived from past surveys.

A questionnaire, Annex I, has been sent to almost 50 major institutes and centres which have a large capability for germplasm conservation. The results of this survey will indicate items such as their storage capacity, conditions of seed storage and their facilities for controlled regeneration and documentation of accessions. Therefore, on a global scale, gaps - either in storage capacity or the specific conditions of seed storage, will be identifiable from this type of inventory. First forging and then strengthening the links in the world network between each of the genetic resources centres is implied in the successful execution of the third part of the coordinating function. Terms of agreement have been drafted and will be sent to some centres for their consideration and comments. In its final form such a document would, for example, specify the terms under which germplasm was exchanged, or sent to specific centres as a duplicate collection for long-term conservation.

Specific recommendations for the optimum conditions for seed storage have been formulated by a Working Group of the FAO Expert Panel. The Panel will discuss various aspects of conservation, including the techniques to be adopted for traditionally vegetatively-propagated species. Many of these species have seeds which are

termed "recalcitrant" and have a very limited longevity; in other species, because of heterozygosity of infertility, collecting seed and conserving it is not suitable as a practical method for ensuring the germplasm conservation on a long-term basis. These problems apply particularly to tropical and subtropical areas, in staple crops, for example, cassava; industrial crops, such as oil palm, rubber and cocoa; in tropical and temperate tree fruits, for example, species in Southeast Asia and the Near East region, respectively.

TRAINING

Coordinating the training activities in genetic resources work must encompass the entire range of different training levels, from post-graduate courses to short-term field training courses. As new centres develop and existing ones expand, they will require staff well trained in the principles and practices of genetic resources work. Coordination is required to ensure that these needs are closely integrated with present, and possible future, educational and training programmes.

At present there is only one graduate programme in genetic resources. This is the one year M.Sc. course in Conservation and Utilisation of Plant Genetic Resources at Birmingham University under Professor J.G. Hawkes, which has operated since 1969. During this five-year period, between five and twelve M.Sc. students have graduated annually and, in addition, several students have completed research studies and the Ph.D. degree. However, this total of 36 trained personnel is inadequate to service even the present needs of centres in the network. With any envisaged expansion in future, the demand for technically trained personnel will even further exceed the already limited number of graduates, unless training facilities can be considerably enlarged or expanded.

Fellowships: FAO will assist in supporting some candidates who will study at Birmingham in the 1974/76 period. UNEP funds are available for a total of nine fellowships, five for 1974/75 and four for the 1975/76 period of study. In addition, SIDA support is anticipated for a total of 12 candidates from the Regional Project in the Near East, one nominee from each of the six participating countries being nominated for a fellowship in 1974/75 and similarly for another six students in 1975/76. Although this level of fund support for training is greatly welcomed, it undoubtedly does reveal one severe restraint; the fact that only a limited number of students can be accommodated with the present facilities which are now available at Birmingham University.

Attention must be given in future to the most effective training that can be given both at Universities and at genetic resources centres in the developed or developing countries, and at the following levels:

1. Ph.D. level training, possibly in addition to that already available at the University of Birmingham.

2. Post-graduate (M.Sc. or Diploma) training and with particular reference to tropical and subtropical crops and regions. The Turrialba or Bogor centres may, in time and with some assistance in staff and facilities, be able to offer such courses.

3. Courses of three to six months duration in specific aspects of genetic resources work, for example, data management or the operational functions of a genetic resources centre. These courses might be offered at Universities independent from , or associated with, the active programme of some of the genetic resources centres.

4. Practical or field training courses of from four to six weeks duration. Ideally given in situ at the genetic resources centres, such short courses or workshops might include subjects such as key punch operating for documentation, field recording, collecting methodology, and conservation procedures. Training manuals would be required for use in conjunction with each of these short courses.

5. Refresher courses of relatively short duration (two to four weeks) primarily for genetic resources centre personnel. Such courses would include recent developments and advances in some of the specific subjects referred to above.

6. Reference should also be made to a seminar and a training course, the arrangements for which have yet to be finalised. Support for these two courses is likely from UNEP and FAO regular programme funds.

   1. "Symposium on Genetic Resources in the Far East" at Bogor, Indonesia in 1975 (May?)

   2. "Training in field collecting activities in West Africa". As a regional short course, IITA at Ibadan may be a suitable centre, the date of which has yet to be determindd (late 1975?)

SUMMARY

Five activities have been specified above, exploration, documentation, conservation, information and training, by which the programmes of genetic resources and other centres may be coordinated into a world network. Cooperation between each of the centres in the exchange of information and, in some cases, plant materials, is essential for truly effective coordination of all of these activities.

Certain activities or disciplines, for example, plant breeding and the utilisation of genetic resources, must at present remain outside the scope of the FAO coordinating functions described above. However, and increasingly as the network develops, it would be hoped that, particularly through a fully-operational documentation system, the inputs from different aspects of utilisation would be assimilated into the totally integrated pattern of coordinated activities.

The development of fully operational communication, information and documentation systems, including data management is of paramount importance as a coordinating function, because this relates not only to the computer processing of data and information retrieval, but also th the assembly of other data banks on conservation facilities, explorers and the programmes which utilise genetic resources.

Just as there are, and would be in future, different levels of expertise and specialisation at the genetic resources centres, similarly it would be expected that different levels of coordination would operate at each of them, and in relation to their functions within the centrally international network.

Relationship of the Board to FAO and its Panels of Experts on Plant Exploration and Introduction, and Forest Gene Resources.

Extracts of relevant documents since the Beltsville Meeting in 1972 and which define the role of FAO either - as originally intended - in a Coordinating Centre or in providing the Secretrat of the Board, are quoted below.

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"Beltsville Meeting": The Collection, Evaluation and Conservation of Plant Genetic Resources PAB:IAR/72/11 4 April 1972 p.9-10.

34. The Central Staff will be the executive agent in implementing the policy of the Coordinating Committee. It should consist of a small core of three scientists with broad experience in field relevant to genetic resources. They should, in total, provide leadership in the areas of exploration, conservation, information and documentation, oneof them being designated as the leader. It is proposed that the Central Staff be located at FAO Headquarters in Rome.

35. The Staff will assist regional and other centres in the planning and execution of joint programmes and will supervise the use of funds allocated for their implementation. Staff members will be required to maintain personal contact with centres and to report to the Coordinating Committee as requested on the operations of the network.

(iii) Relations of the Central Staff with the Crop Ecology and Genetic Resources Unit of FAO

36. The FAO Unit has responsibilities for meeting the needs of its member countries (in particular the developing countries), in the conservation, exploration and use of crop genetic resources. However, the scope of these responsibilities is far in excess of the resources available, or likely to be available to it because of the increasing demands generated by the needs indicated in the introductory section.

37. The proposed central staff has been planned with a view to complement and cooperate with the existing staff of the Unit, particularly with respect to exploration, conservation and publications. It will rely on the Unit for the central distribution of seed and other stocks. The size of the central staff for the Coordinating Committee has been determined accordingly.

38. The FAO Unit has been assisted by an international advisory panel of experts. This panel has repeatedly stressed the inadequacy of resources to enable the Unit to fulfil its mandate effectively, and this was one of the main reasons for submitting a proposal to TAC for independent support to complement its activities. We believe the organization we propose would assure more effective participation of non-governmental institutions and other international agencies (e.g. foundations, IBP, universities, etc.).

(iv) Association of the Network with FAO

39. Recognizing the need for associating the proposed network with an appropriate international organization to provide the essential administrative support, we recommend that FAO be invited to assume this responsibility. It is proposed that a trust fund be set up for this purpose. Its articles should safeguard the technical and administrative autonomy of the Coordinating Committee and Central Staff compatible with the requirements of the Organization.

40. To ensure good liaison between the network and the Crop Ecology and Genetic Resources Unit, we recommend that the head of the Unit be an additional (non-voting) member of the Coordinating Committee.

41. FAO is expected to present nominations for appointment to the Central Staff to the Coordinating Committee.

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A Proposal for the Establishment of an International Network of Plant Genetic Resources Centres PAB:IAR/72/15 July 1972, p.1-2.

5. The coordinating centre will consist of a coordinating committee, or management board of nine members - six from the regional centres and three independent scientists; with supporting technical staff, consisting of three scientists - one in conservation, one in exploration, and one in documentation, plus administrative and secretarial staff. The main functions of the coordinating centre will be to:

(a) promote the cooperation of all interested institutions in a world-wide network of genetic resources;

(b) plan and supervise the activities of the new centres to be established, and the distribution of funds for their regional work in exploration, conservation, training and other activities;

(c) promote and assist in technical meetings;

(d) arrange for the maintenance of replicate storage of seeds and vegetative stocks;

(e) establish an information system with standard procedures in documentation, recording, storage and retrieval.

The central staff will be the executing agents of the Coordinating Committee and will be located at the FAO Headquarters in Rome, attached to the Crop Ecology and Genetic Resources Unit of the Plant Production and Protection Division under a Trust Fund with specific provision to ensure maximum flexibility for its activities. The Coordinating Centre will be responsible for the distribution of the funds for the world network of genetic centres, in exploration, conservation, documentation, training, publications and meetings. The appropriations will be established by the Coordinating Committee every year.

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A Revised Proposal for the Collection, Evaluation and Conservation of Plant Genetic Resources. DDDR:IAR/73/16 May 1973. p. 2-3

12. The Director-General of FAO has, therefore, decided that the resources of the existing Crop Ecology and Genetic Resources Unit of the Plant Production and Protection Division will be greatly strengthened and its work programme largely re-oriented, to enable it to undertake the coordinating functions proposed by the Beltsville meeting.

13. This unit, which at present has three professional officers, will accordingly be reinforced by three more professional officers, two of them at the senior level. The new staff will include one officer responsible for work in plant ex-

ploration and conservation (working in cooperation with the existing professional officer in charge of exploration); one for documentation and information services; and one for seed exchange and distribution working with an existing professional staff member. The staff will assist regional and other centres in the planning and execution of joint programmes and will supervise the use of funds allocated for their implementation.

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CGIAR Subcommittee on Genetic Resources: Report of the First Meeting, Rome. DDDR:IAR/73/31. 1-2 October 1974, p.3.

7(b) Mode of Operation

iii) In response to a suggestion from the CGIAR that a substantial role should be played by FAO in any global genetic resources programme, the Director-General of FAO has proposed that FAO's capability in this field should be strengthened. Given appropriate approvals, this will enable FAO to provide the secretariat and other central services to the Board, and, if necessary, the Board may arrange that additional resources be provided to FAO for that purpose from the special fund referred to in para. 11 above.

iv) The Headquarters and the Secretariat of the Board will be located at FAO headquarters in Rome.

8. Following consideration of the above proposals the Subcommittee was informed that, subject to the approval of FAO's Governing Bodies, it would be possible for the Organization to fulfill its anticipated role in a coordinated programme organized along the lines proposed by the Subcommittee.

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Report of the Seventeenth Session of the FAO Conference. November 1973, p.18.

Area of Emphasis 2.4 - Conservation of Resources and Control of Diseases and Pests - Genetic Resources

59. The Conference recognized the basic importance of genetic resources in agricultural development, and recommended that the activities in this field should be supported and strengthened.

60. The Conference welcomed and strongly supported the very high priority given to strengthening the unit of Crop Ecology and Genetic Resources to permit it to coordinate a worldwide programme in collection, conservation, exploration, evaluation and documentation of crop genetic resources, as well as in the related fields of publications and training; also in promoting the establishment of genetic centres in the areas of crop diversity in the developing countries.

61. Recognizing FAO's role in activities in the genetic resources field and the importance of coordination, the Conference endorsed the recommendation that FAO should provide headquarters facilities for the International Board of Plant Genetic Resources, established by the Consultative Group on International Agricultural Research, as well as the location of the Secretariat of this Board in the Genetic Resources Unit with financing by the Board through its extra-budgetary funds, and requested that the Council be kept informed of the Board's activities.

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CGIAR Subcommittee on Genetic Resources: Report of the Second Meeting, Rome. DDDR:IAR/74/19, p.4.

Secretariat for the Board

14. The Subcommittee noted with appreciation that the 1973 FAO Conference had endorsed the provision of the Board's Secretariat by FAO and had agreed that the headquarters of the Board should be at FAO headquarters.

15. The Subcommittee approved, in general, the arrangements proposed by FAO for providing a Secretariat for the Board. Those arrangements contemplated that Mr. R. J. Pichel, Chief of the Crop Ecology and Genetic Resources Unit of the Plant Production and Protection Division, should act as Secretary to the Board with Mr. J. T. Sykes, an agricultural officer in the Unit, having continuing responsibility for servicing the Board as its Assistant Secretary. In addition, the expertise of the Unit would be made available to the Board. These Secretariat services would be provided without charge to the Board, which would, however, be expected to pay the costs of Board meetings, of a secretary and direct operating costs, such as cables and travel. The Secretariat, supplemented as necessary by FAO or the Board, would have the power of independent action in autonomously servicing the many needs of the Board. Appropriate modifications or additions to these arrangements for the Secretariat could be made if and as required.

Other relationships with FAO

16. Assurance was provided by FAO that priorities as recommended by the Board would be observed to the maximum practicable extent in formulating the programmes of the Crop Ecology and Genetic Resources Unit. The Board's recommendations would be directed of course to many different organizations and governments. However, in the particular case of FAO, close juxtaposition and maximum consultation should ensure that the FAO Regular Programme activities and those recommended by the Board were implemented to the mutual satisfaction of FAO and the Board. Furthermore, the recommendations of the FAO Panels of Experts, on Plant Exploration and Introduction, and on Forest Gene Resources, would be conveyed to the Board.

COORDINATION OF A WORLD NETWORK OF GENETIC RESOURCES CENTRES

Prepared by J.T. Sykes and D.J. Rogers of the Crop Ecology and Genetic Resources Unit of FAO

The purpose of this paper is to specify the coordination funtions of a genetic resources network, as background information for discussion by board members. International activities in genetic resources, whether directly supported or monitored by the International Board, or independent of it, will ~~[illegible]~~ benefit from the coordination of and, where appropriate, the integration of the various programmes.

From the outset, it is imperative that precisely what is involved in such a coordinating function should be clearly understood by defining the terms in the title above.

Coordination is defined as "to bring into a common action, movement or condition"(Webster) or "to place (things) in proper position relative to each other and in the system of which they form parts" (Oxford). "An interconnected or inter-related chain, group or system" (Webster) is a network or, alternatively "work in which threads, wires or the like are arranged in the form of a net (Oxford).

Genetic Resources Centres are "centres for the conservation of plant genetic resources and which comprise either or both base collections and active collections," as defined by the FAO Panel of Experts on Plant Exploration and Introduction, Fifth report 1973, p.4.

The inter-relationship or inter-connection in the definition of a network implies a certain commonality - a common denominator - present in the links of the network, some of which are the genetic resources centres. Ideally, effective coordination should enable each of these centres in certain aspects of their work to participate and act together in a smooth, concerted way. FAO shares with the

International Board the same fundamental objective of this coordinating function. It is to ensure that the genetic resources - wild species and primitive races of the major world crop plants are collected, conserved and made available for utilisation in plant breeding and other programmes. Arrangements must be made for collecting them wherever they are found. Collecting and then coordinating the information* on the crops and areas of the world, and personnel should ensure that there are no significant gaps (- either of crops or areas) in the global strategy which is decided upon.

This is an operation which must be undertaken on a world-wide scale. Therefore, the merits of a central organisation to make the coordinating links are self-evident. Contacts must be equally possible with developed and with developing nations, in the tropical, subtropical and temperate climatic regions. Most of the genetic resources are found in the developing countries of the world and FAO, through its 136 member nations, already has a "network" of communication and liaison with these, and the developed countries.

Naturally, because financial and other resources are not unlimited, the establishment of priorities for both crops and critical areas is essential. This responsibility has been undertaken by the FAO Panel of Experts on Plant Exploration and Introduction which has made specified priorities and recommendations to FAO and through its Crop Ecology and Genetic Resources Unit. Based on a global survey of genetic resources, their present status has been evaluated. In addition, the limiting restraints - either in knowledge or trained personnel have been preliminarily identified in the reports of the Panel.

In the proposed global network, which organisations and programmes will be coordinated? Certainly, the genetic resources centres ~~either~~ at regional ~~national~~ and national or regional level would be included, together with some programmes of the international agricultural centres; for example, those in the exploration and conservation of crop germplasm.

* For the purposes of this paper, data documentation and information are included in the term "information".

All these centres and institutes have a common goal in their genetic resources programmes ~~and~~ there is a similarity in the principles - a "common thread" in the various technical aspects of their work, some of which are described below.

However, before outlining the coordination requirements for these technical functions, the general aspects of the overall coordinating function are considered under the following headings: inventory, information, financial support and the management of the global network ~~and its management~~.

Inventory: The development of effective future plans critically depend upon up-to-date knowledge of what is available at present. The survey of crop genetic resources is one example which, by identifying specific crops and areas, has delineated the present state of genetic resources. The questionnaire directed to certain international centres and gene banks, attached as Annex I, is another inventory item. It seeks ~~sought~~ to obtain information on the capacity and characteristics of their storage facilities for the conservation of genetic resources. Similarly, a thorough knowledge of detailed current ~~present~~ genetic resources research programmes, and ~~the~~ of the personnel actively engaged in them ~~these~~, is essential background information by which future policy decisions may be taken.

Information: It will be impossible to identify gaps - one vitally important aspect of a coordinating function, unless accurate and easily-processed information is first ~~available centrally, after being~~ obtained from a wide range of sources and then assembled centrally. Ob- taining this information ~~obtained~~ and arranging for its retrieval and exchange are ~~is~~ the basis on which coordination works. Included would be published information, data on accessions, exploration missions to be undertaken, and the explorers, taxonomists or plant breeders interested in specific areas and ~~or~~ crops. The definitions given above of a network certainly

imply a web-like structure composed of cords, wires or links which cross and are joined together. In our context this is analagous, at least in part, to an interconnecting communication system for the transmittal and exchange of data and information.

Financial support: It is anticipated that one component of coordination will be knowing the sources of funds which support genetic resources activities in the network. Funding may have several different forms, being derived from various private, national or international bodies or agencies. For example, funds have been made available multilaterally by the FAO regular programme and by UNEP. Bilateral funds for centres in Ethiopia and Turrialba, Costa Rica, and the Izmir Centre in Turkey are to be provided, respectively, by the Federal Republic of Germany and by SIDA. Furthermore, in its fund-raising capacity, the International Board, either through its own Central Fund or bilaterally, will in future mobilise financial support in future for additional programmes or centres. Therefore, if the commitments from of donor countries or agencies are known, together with precisely what is being supported where this is as another coordinating function. It will facilitate an overall perspective of the several components in a global network and the level of support which each of them is receiving.

The management of the global network. This is perhaps the most complex aspect of any coordination function. But, however difficult it may be to achieve effective management of the network, doing so is essential if the development of genetic resources activities is to be continued and expanded. The concepts of the management function are provided in more detail in the paper on documentation.

The principles of management must be applied to evaluate, first on the one hand, to evaluate the efficiency levels of various operations and, on the other, second to identify the constraints in any of the links which interconnect to form the network. Furthermore,

because several different disciplines are involved, it is a multi-dimensional network, embracing expertise in many disciplines, for example, plant taxonomy and breeding, documentation and ~~as part~~ aspects of management science. The major input will be well-defined information or data derived from anywhere in the world; from the different types of genetic resource centres and plant breeding programmes, ~~together with~~ and on the personnel involved in each of these diverse programmes. Ideally, such a system should be flexible ~~and~~ enough to permit easy access to crop germplasm, and the information which relates to it, by any institution which is itself an integral part of the proposed network. It should be as free as possible of political constraints and, to ~~achieve~~ ensure maximum efficiency, it must operate at a ~~place~~ location where this can be ~~best~~ achieved ~~ensured~~. Through the operation of such a ~~The~~ central coordinating function, ~~would operate to know~~ it would be known what is available, where it is stored and under what conditions, and the quarantine and political barriers which may prevent its disposal. Information must be easily, reliably and relatively rapidly obtained or further processed through a computerised operation for information retrieval. Similarly, ~~the~~ data which are accumulated when material is evaluated, regenerated ~~and~~ or utilised is a "feed-back" type of information. It must be added cumulatively ~~as~~ when and wherever it becomes available to the various data banks. too

All this requires, therefore, not one but two or three ~~be~~ levels of coordination; because some decentralisation ~~would facilitate~~ will enable much of the recording, ~~being made~~ to be done in situ at the centres where the accessions are collected, evaluated or utilised. The general overall coordination would be carried out as a central function by the FAO, ~~This would~~ Genetic Resources Units. It include coordinating the operations, but not the data handling ~~at~~ done at the centres, and providing the necessary help and expertise for their establishment. In addition, a second ~~level~~ stratum of coordination, for example at regional level, and even a third for national operations, ~~would~~ will be required ~~in addition~~, for the management, processing and general handling of data by the regional, national or other centres .

OPERATIONAL ACTIVITIES

There are several technical operational activities which constitute vital components of the overall objective: the conservation and utilisation of the world's diminishing supply of plant germplasm. Survey, exploration and collecting activities are included in one phase of field operations, documentation and information retrieval is another aspect and other examples are the management of the global network, conservation of the genetic resources and their evaluation and utilisation.

It would indeed be unrealistic and overambitious, at least at the present time, to expect any one group or organisation either to undertake or to coordinate all these activities for the major world crops. However, since its inception in 1968, FAO's Crop Ecology and Genetic Resources Unit has been and continues to be active in five of the areas specified above. These are exploration, documentation, conservation, information and training, each of which is discussed below under separate headings.

EXPLORATION

Nineteen exploration missions have been supported or undertaken in the 1971-73 period by the Unit and these are itemised in Appendix II.) The Near East, Latin America, Africa and the Far East, collections have been made, in

The Near East and Mediterranean regions were specified by the FAO Panel of Experts in Plant Exploration and Introduction as the number one target area, particularly for the collection of endangered cereals and vegetables. Support from SIDA has been forthcoming for a Near East Region Project (REM/5). Turkey, Afghanistan, Iraq, Iran, Pakistan and Syria are expected to participate in this Regional Project with its headquarters in Izmir, Turkey. A programme for the exploration and collection of germplasm in critical areas within the region is to be formulated. Field activities are due to start in May 1974 and additional

financial support for exploration is available, if required, from FAO regular programme funds and from UNEP.

Ethiopia is the second target area designated by FAO's Expert Panel in 1973. Here, arrangements are proceeding for establishing a genetic resources centre with support from bilateral funds of the Federal Republic of Germany. Expeditions have been made there recently by the Bari Germplasm Laboratory for Cereals, Purdue University and IAR (UNDP) for coffee and oats.

Tropical crops have been given the third order of priority. A large number of different species are threatened in Tropical America, Tropical Africa and Southeast Asia and the FAO Panel recommended that attention should first be directed towards Meso-America.

TROPICAL AMERICA

A Conference on the Utilisation and Conservation of the Genetic Resources of the Caribbean region was held with FAO support at Turrialba, Costa Rica in December 1973. The report of this conference will specify the crops and areas of highest priority for collection in the region. Arrangements and discussions are proceeding with the Federal Republic of Germany for establishing a genetic resources centre at the Interamerican Institute of Agricultural Sciences (IICA) in Turrialba.

It has been proposed that a working group of the FAO Panel be invited to specify in some detail the exploration priorities, in crops and areas, in Latin America Their recommendations will be made to FAO's Crop Ecology and Genetic Resources Unit for transmittal to and consideration by the International Board.

Other activities in the region have included: Advice and assistance given to th e government of Brazil on the establishment of a regionally-based plant introduction service.

have been received

~~Africa~~ Proposals from CIAT in Columbia with respect to their programmes and regional responsibilities for Phaseolus, in addition to their present work with Cassava.

TROPICAL AFRICA

Since the First Report of the Survey of Crop Genetic Resources in their Centres of Diversity was published in 1973, IITA at Ibadan, Nigeria has been active in plant exploration in Nigeria and nearby countries. These activities may be supplemented in future, in certain crops, by exploration missions undertaken by ICRISAT in Africa.

Support is available from UNEP funds for a field training course in West Africa, to be arranged in the 1974/75 period.

In addition, the collection of Oryza glaberrima in Liberia and yams in West Africa ~~to be arranged by Carpenter and Martin respectively have been~~ has been undertaken by Carpenter and Martin respectively in the past two years. The crops in Mali, Guinea and Liberia, and in areas of East Africa, which require urgent collection have been itemised by Harlan.

SOUTHEAST ASIA

The Botanic Garden of Indonesia at Bogor has been ensorsed by the FAO Expert Panel as a suitable location for a genetic resources centre in Southeast Asia and this site was approved in a recent report from Dr. Williams of Birmingham University. In addition, the crop-specific programmes of IRRI in the Philippines for rice must be considered within the activities in this region.

The particular areas and species for exploration ~~in this region~~ still need to be defined within this region. Then, possibly with Bogor as a centre, arrangements could be formulated for the collection ~~activities~~ and ~~the~~ conservation of the many species of vegetatively propagated crops, for example tropical fruits in Indonesia and

other countries of t he region.

UNEP funds are available for supporting a Symposium in Genetic Resources in Southeast Asia at which the exploration priorities could be more precisely determined ~~and future programmes formulated at this meeting~~.

~~INDIA~~

The Indian Agricultural Research Institute (IARI) in New Delhi is one of the ~~new~~ ten locations designated by the FAO Panel and named in the Beltsville report as requiring financial support.

Furthermore, in a crop-specific context, ICRISAT is now approaching full operational status. It is assumed that this Institute will assume responsibility for the genetic r esources of chickpea, pigeon pea, sorghum and millet on the Indian sub-continent.

There are two additional general aspects of exploration activity. These are, ~~on the one hand~~ first, the availability of technical expertise in exploration, either in specific areas or as taxonomists in certain crops and, ~~on the other~~ second, the exploration missions to be undertaken by centres, institutes and national organisations. One aspect of any coordination function is, ~~firstly~~, to first assemble information on both these aspects ~~and, secondly~~, to integrate ~~them~~ it as and where then it is appropriate.

With these aims in view a committee of the British Botanical Society has provided information on the taxonomists and ecologists in UK universities who may be available to assist in exploration missions. These data, together with that from institutions and universities in other countries should be assembled, ~~in time~~ cumulatively as a data bank on the exploration expertise which is available to assist collection missions.

~~It is~~ Equally important is to know the present and future exploration plans of the various centres, institutes and national organisations which are active in genetic resources work, ~~and~~ in particular ~~attention is made to~~ the following:

The International Agricultural Research Centres, e.g. CIAT, CIMMYT, CIP, ICRISAT, IITA and IRRI.

National Exploration ~~activity~~ mission, for example those undertaken by U.S.A.I.D., ~~U.S.~~ ~~A.I.D.~~, Japan, Russia and the Peoples' Republic of China.

Private Seed Companies, for example, ~~such as~~ Pioneer Seeds, Agrow, Dekalb in the U.S.A. and Nicholsons in the U.K.

INFORMATION

Part of the coordinating function in conservation ~~and~~ particularly in exploration and will continue to occur through the medium of the Plant Genetic Resources Newsletter. In addition, on a crop-by-crop basis, especially with a computerised documentation system, inventories of genetic resources will be published, in the future as in the past, in the Newsletter.

The FAO Regular Programme budget permits the publication of the Newsletter in English three times a year. Its popularity has been such that discussions have taken place regarding the possibilities for producing the Newsletter in addition in French and Spanish.

A tri-lingual film strip has been produced on genetic resources. ~~and~~ Negotiations have ~~taken place concerning~~ occurred on the production of a short documentary film which will have educational and general information al interest. ~~in this subject~~. ~~In addition,~~ Several contacts have also been made with national radio and TV networks ~~who~~ which want to feature the collection and conservation of genetic resources as documentary items.

It is anticipated that, increasingly with the development of programmes sponsored by the Board, there will be ~~a demand~~ an increase in the requests for publications and articles

~~in the various scientific journals~~ describing the genetic resources centre network, the activities and objectives of the centres and ~~the overall aspects~~ implementation, how ~~the~~ coordinating ~~of the~~ programme will be implemented. ~~Amongst these articles,~~ Consideration should also be given, in a public relations sense, to other articles in the various scientific journal on the establishment of the International Board and its activities. An awareness among the international scientific community of the structure and wide-scale objectives of the Board will enhance its effectiveness by strengthening - through information exchange - the functions of its many integral components in the different regions of the world.

CONSERVATION

There are three parts of the coordinating function as this affects the conservation of genetic resources. These are knowing, first, what materials have been and are being collected; and, second, the location, capacity, characteristics and administrative procedures of conservation centres where the long-term viability of genetic resources may be guaranteed. Based upon these two sets of data, the third function of coordination logically follows - developing the procedures to ensure that correctly-documented genetic resources, either of collected material or that which presently exists in collections, are placed in secure storage for present and future utilisation.

The genetic resources in world collections have been surveyed. Data on three million samples have been received from ~~two thousand other~~ 2000 institutes and plant breeders in different countries. Some of these results for specific crops, together with those from recently conducted expeditions, have been published in the Plant Genetic Resources Newsletter. Furthermore, the coordination of exploration activities, as described above, will identify present and future collecting

missions and therefore complement the information derived from past surveys.

A questionnaire, Annex I, has been sent to almost 50 major institutions and centres which have a large capability for germplasm conservation. The results of this survey will indicate items such as their storage capacity, conditions of seed storage and facilities for controlled regeneration of accessions. Therefore, on a global scale, gaps — Gaps in the global conservation position, either in storage capacity or the specific conditions of seed storage under which seeds are stored, will thus be identifiable from this type of inventory. First forging and then strengthening the links in the world network between each of the genetic resources centres is implied in the successful execution of the third part of the coordinating function. Terms of agreement have been drafted and sent to some centres for their consideration and comments. In its final form such a document would specify the terms under which germplasm was exchanged, for example, or sent to specific centres for its long-term conservation.

Specific recommendations have been formulated by Roberts for the optimum condition for seed storage in a paper prepared for the FAO Expert Panel, which will be considered further by a working group of the Panel when it meets in 1974. The Panel will discuss various aspects of conservation, including the techniques to be adopted for traditionally vegetatively-propagated species. Many of these species have seeds which are termed "recalcitrant" and have a very limited longevity; in other species, because of heterozygosity or infertility the collection and conserving of seed is not suitable as a practical method for ensuring the long-term conservation of germplasm. These problems apply particularly to tropical and subtropical areas, in staple crops, for example cassava; industrial crops, such as oil palm, rubber and cocoa; and tropical tree fruits, for example, species in Southeast Asia and temperate tree fruits, e.g. in the Near East region, respectively

TRAINING

~~The~~ Coordinating ~~function for the~~ training ~~of personnel~~ in genetic resources work must ~~include a~~ range of different levels ~~of~~ training, from post-graduate courses to short-duration field training courses. As new centres develop and existing ones expand, they will require staff well trained in the principles ~~or~~ and practices of genetic resources work. Coordination is required to ensure that these needs are closely integrated with present, and possible future, educational and training programmes.

At present only one graduate programme in genetic resources ~~is in existence.~~ This is the one year M.Sc. course in Conservation and Utilisation of Plant Genetic Resources at Birmingham University under ~~P~~rofessor J.G. Hawkes, which has operated since 1969. During this five-year period, between five and twelve M.Sc. students have graduated annually and, in addition, several students have completed research studies and the Ph.D. degree. However, this total of approximately 40 is inadequate to service even the present needs of the centres in the network. With any envisaged expansion in future, the demand for technically trained personnel will even further exceed the limited ~~supply~~ of graduates, unless training facilities can be considerably enlarged ~~and~~ or expanded.

Fellowships: FAO will assist in ~~the selection of~~ supporting some candidates ~~to attend the~~ who will study at Birmingham ~~course~~ in the 1974/6 period. UNEP funds are available for a total of nine fellowships, five for 1974/75 and four for the 1975/76 period of study. In addition, SIDA support is anticipated for a total of ~~twelve~~ 12 candidates from the Regional Project in the Near East, with one nominee from each of the six ~~participating~~ participating countries being granted a fellowship for 1974/75 and similarly

for another six students in 1975/6. Although this level of fund support for training is ~~although~~ greatly welcomed, it undoubtedly does reveal one severe restraint; the fact that only a limited number of students can be accommodated with the present facilities which are now available at Birmingham University.

Attention must be given in future to the most effective training that can be given both at Universities and at genetic resources centres in the developed or developing countries, and at the following levels:

1. Ph.D. level training, possibly in addition to that already available at the University of Birmingham.

2. Post-graduate (M.Sc. or diploma) training and with particular reference to tropical and subtropical crops and regions. The Turrialba or Bogor centres may, in time and with some assistance in staff and facilities, be able to offer such courses.

3. Courses of three to six months duration in specific aspects of genetic resources work, for example data management or the operational functions of a genetic resources centre. These courses might be offered at Universities independent from, or associated with, the active programmes of some of the genetic resources centres.

4. Practical or field training courses of from 4 to 6 weeks duration. Ideally given in situ at the genetic resources centres, these short courses or workshops might include subjects such as key punch operating for documentation, field recording, collection methodology, and conservation procedures. Training manuals would be required for use in conjunction with each of these short courses.

5. Refresher courses of relatively short duration (2 to 4 weeks) primarily for genetic resources centre personnel. Such courses would include recent developments

and advances in some of the specific subjects referred to above.

6. Reference should also be made ~~here~~ to a seminar and a training course, the arrangements for which have yet to be ~~made~~ finalised. Support for these courses would be forthcoming from UNEP and FAO regular programme funds.

1. "Symposium on Genetic Resources in the Far East" at Bogor Indonesia in 1975 (May?).
2. "Training in field collecting activities in West Africa" As a regional short course, IITA at Ibadan may be a suitable centre ~~for this course~~, the date ~~for~~ of which has yet to be determined (late 1975?).

SUMMARY

Five activities have been specified above, exploration, documentation, conservation, information and training, by which the programmes of genetic resources and other centres may be coordinated into a world network. Cooperation in the exchange of information and, in some cases, plant materials, between each of the centres is essential if truly effective coordination of each of these activities is to be achieved.

Certain activities or disciplines, for example plant breeding and the utilisation of genetic resources, must at present remain outside the scope of the FAO coordinating functions described above. However, and increasingly as the network develops, it would be hoped that, particularly through a fully-operational documentation system, inputs from different aspects of utilisation would be assimilated into the total integrated pattern of coordinated activities.

Just as there are, and would in future be, different levels of expertise and specialisation at the genetic resources centres, similarly it would be expected that different levels of coordination would operate at each of them, and their relation to their functions within the centrally coordinated world network.

The development of fully operational documentation and data management systems is of paramount importance as a coordinating function, because this relates not only to the computer processing of data and information retrieval, but also to the assembly of other data banks on conservation facilities, explorers and the programmes which utilise genetic resources.

J.T. Hughes.

The coordination activities for a world network of genetic resources centres

Definitions of coordination, network and genetic resources centre

The objectives and components of coordination; the centres and programmes to be coordinated.

The global network: inter-relationship between developed and developing countries and the merits of a central locus for international contacts and collaboration.

General aspects of coordination, by which gaps may be identified:

1. Inventory - crop genetic resources
   - conservation facilities
   - genetic resources personnel and programmes

2. Information - easily processed from a wide range of sources
   - retrieval and exchange

3. Financial support - various forms of multilateral and bilateral funding
   - needs of current and future programmes

4. Management - to evaluate efficiency of operation
   - to identify constraints in the links of the network
   - to accumulate and make available data and information whenever it may be required
   - some decentralisation of coordinating functions to regional centres.

Operational activities

Identification of common objectives in the objectives of the following genetic resources activities:

Exploration

1. Support of exploration missions in the Near East, Ethiopia and Tropical America in relation to established priorities.

2. Recent developments in Tropical Africa and Southeast Asia, including India.

3. Availability of technical expertise in exploration.

Information

1. Genetic Resources Newsletter: inventories of genetic resources, exploration missions.

2. Films, TV and radio features

3. Scientific publications, reviews, books and general articles.

Conservation

1. Data on material collected and at present in world collections.
2. Location, capacity, characteristics and administration of conservation centres.
   - Questionnaire to determine capability for germplasm conservation in 50 major world institutions.
   - Terms of agreement and collaboration for exchange of germplasm and to have duplicate collections.
3. Vegetatively propagated species - problems in their conservation
   - species with recalcitrant seeds, infertility
   - space and maintenance limitations of living collections

Documentation and data management

Equipment - software and hardware requirements of TAXIR.

Staff for systems analysis, training and computer programming.

Design of data banks in relation to input (from GRC's) and retrieval requirements (i.e. in evaluation)

Collections at centres	Explorers, Genetic resources personnel
Assignment of assessions	Storage and regeneration
Quarantine regulations	Conservation centres

Accumulation of evaluation data as "feed-back"

Plotting of collections to indicate gaps, in areas and crops.

Training

Coordination to integrate present and future demands of GRD's with output from training courses.

Levels of training: 1. Ph.D. and M.Sc.
2. Postgraduate M.Sc. or Diploma: tropical and subtropical regions.

3. Short courses in operational functions, or data management in GRC's.

4. Practical field training courses at GRC's or Universities.

5. Training manuals, i.e. in collection procedures, data processing, etc.

Summary

The need for coordination at different levels and in the various GRC's.

Management in the network and a documentation system as a central coordinating function.

Aspects of coordination in evaluation and utilisation of crop germplasm.