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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.

PROPOSAL GRCIDS III

BACKGROUND AND OBJECTIVES

Our initial premise is that within each genetic resource unit, and among all genetic resource workers, there is an extant system to communicate, document and manage the flow and analysis of information about extant genetic resources, whether in collections, undergoing improvement or concepts concerning further genetic resource collection, evaluation, storage, improvement, utilization, etc. There is also a basic need to analyze the functional activities within the current system and to investigate the probable increase in demand for genetic resource information and for genetic resources. We also wish to determine the role of genetic resources in crop improvement and to better understand their probable utilization. There is an additional need for a decision-making analysis using the information developed for those using or working with genetic resources. Many individuals feel that there is a definite need for improvement in the current system, and that the system can be improved with new computer-assisted methods which can be cost effectively implemented for users. We (and others) assume that if all genetic resource workers had similar operating systems and concepts of information flow, effective

utilization of genetic resources and communication of genetic resource work would be facilitated considerably.

It is our intention to discover what current genetic resources communication documentation information system is presently employed and by what means it might be best improved, given the availability of very limited resources to execute such improvement. We have defined the concept of genetic resources as broadly as possible, fully realizing that the primary initial responsibility is to insure that the detailed information about the world supply of genetic resources be made available through the use of computer at some international central point. We anticipate that an international center can be developed where information may be freely exchanged about global activities in genetic resources, where genetic resource material can be evaluated for any given characteristic, and where methodological assistance in genetic resource information or data processing, etc. can be obtained.

Systems Analysis

The starting point for any systems improvement is a detailed and rigorous systems analysis. From such an analysis suggestions for some systems modifications or redesign will be possible. The starting point in this specific case is the extant genetic resources network, which is already partially global in nature. Such an analysis will provide a descriptive understanding from which a cost effectiveness evaluation can be made of the operation of the network. The network is visualized as consisting of genetic resource operating units. These units are, in fact, individual genetic resource workers either

operating individually or at centers which have a genetic resource component.

There are two interrelated components of this analysis, the macro, that analyzes the interactions between units (or between different centers), and the micro, that analyzes information flows and processes between individuals within a single center.

The macro analysis of this network basically will describe the following:

(1) What is the composition of the network?

a. what (who) are the units

b. what does each do

c. what does each unit plan to do within the next reasonable time period

d. what genetic resource material does each unit have

e. what information concerning genetic resource material is available

f. what more information is needed

g. what more material is considered necessary

h. what specific expertise with regard to genetic resources does each unit possess.

(2) How do these units communicate with each other concerning the exchange of information, materials or technical expertise?

(3) In evaluating this exchange mechanism, what is the desire of the individual units to improve this information and material transfer?

(4) For those units which are essentially decision-making units concerning genetic resources for a nation or a multi-nation region or

globally, what information is required concerning the interoperation of these genetic resource units to direct funds and resources to assist the cooperation of these units in their work? Furthermore, what is the redundancy among such units and how can these units be helped to make conscious decisions based on the value of such redundancy?

The micro analysis of the network is concerned basically with the operating system within any given unit with respect to genetic resource work. Although one might consider the work at the unit level to be beyond the scope of the work at the International Board for Plant Genetic Resources, it is essential to point out that what occurs within the unit system is what will essentially create the macro demand for material and communication. A fairly good understanding must be available of the work at the micro level in order to perceive the need for genetic resources and the communication of information about genetic resources on a global level. Further, regardless of the effectiveness of a macro system, a micro system must be relatively effective and should have some of its components in common with other units, if indeed there are to be effective macro systems at reasonable costs. It is therefore necessary that a good analysis be made concerning the decisions that in any way relate to genetic resource material at the micro level and an analysis of the need for information (type, validity, reliability, quantity, methods of processing, inference, timing, sources, etc.) to and within the individual units and the methods that are used to handle this information flow for and to the decision points. Although this analysis would appear to be long and costly, it need not be since there are general commonalities among the functional operations of units.

Development of strategies for systems redesign

From the analysis and evaluation of the current GRCIDS macro-micro, several points emerge. The first is the determination of whether or not improvements (changes in effectiveness) of the extant GRCIDS can be made and at what costs (the cost factors must include the essential resistance to change). If at any level it is determined that increased benefits or improvements can be derived, what strategies can be used to develop and implement the mechanisms for realizing benefit changes and again at what cost levels?

These strategies must be based on currently available techniques such as the use of the computer including computing software to effect change as well as developments that can be derived and made operational in the very near future and the capacity of any operating group (or groups) to transfer this technology for actual use at the unit level and for use by any units on the international level.

Also the feedback response will be used in a continuing analytic function t determine whether the strategy is appropriate and thus the methods of utilization and transfer are effective and that the procedures or methods are actually meeting the needs of the operating units. Often the primary or preliminary needs will be met but due to the availability of new techniques, users recognize what might be termed secondary needs and create a demand for additional and sometimes very important assistance. This can be viewed as the "technology awakening process" and is valid even among relatively sophisticated scientists. It is essential to recognize these secondary needs and it is often very, very profitable and possible to meet these needs.

Such feedback response can effect the development, transfer, planning and implementation as required with some central means of determining the priorities of such changes as suggested in the development.

GRCIDS I

This phase was carried out and supported by David J. Rogers and Gilbert N. Hersh and to some small extent by the National Science Foundation with the cooperation and assistance of UN/FAO, CIP, USDA, the University of Colorado and especially the Computing Center, and the Commonwealth Potato Collection. Professor Jack Hawkes studied the overall concept and framework described above, and in essence produced a working analysis which was presented at FAO in Rome in March, 1973. This paper will be published by Cambridge University Press in 1975.

They also demonstrated the relative effectiveness of the system TAXIR to be used on a macro/micro basis to assist information flow and processing as well as to be used as a primary analytic tool. During GRCIDS I and as a result of the conference in Rome, certain tentative strategies were set forth for the analysis, development and transfer of an improved GRCIDS, at both the micro and macro level. (See technical footnote 2.)

GRCIDS II

The second phase of GRCIDS analysis and improvement began in January of 1974 with the hiring of David J. Rogers by FAO first as a consultant then as a Senior Officer. Gilbert Hersh and others continued their work supported by themselves with the assistance of the University of Colorado until May of 1974

when they became consulting staff to FAO. During this phase further analyses of the genetic resource problems were made, this time concentrating more on the macro aspects. The work culminated in a proposal of the undertaking of pilot projects and a formal contract from FAO regular program funds again with the assistance and support of the University of Colorado. During this contract the initial strategies were to be tested basically on a specific crop (Zea mays) and for a multi-national regional center (Izmir) and for the work at a major National Seed Storage Center, USDA, Ft. Collins. Further concepts and information concerning GRCIDS were to be compiled and presented to the newly formed International Board for Plant Genetic Resources in order to request their assistance and generally to explain the nature and concept of the GRCIDS analysis and improvement on a larger scale. An attendant part of the contract was also to determine the means by which additional national and international support could be gained from many sources. (These will include private corporations, such as IBM, national centers such as USDA and ICA, and institutions of education and research such as the University of Colorado.) Further, organizational concepts to develop a relatively small but effective operating team to carry out phases of analysis, development, and transfer in this field were developed. An effort was made to make the organizational unit and personnel as broadly based as possible.

GRCIDS III

This is in essence a continuation and expansion of the initial work suggested in the GRCIDS I and II and is specifically described in the Statement of Work, Services and Specifications and in the Statement of Estimated Expenditures. It should be noted that GRCIDS II brings into being an operating team which should have the capacity of rapidly expanding the GRCIDS concept and implementing improvements in the GRCIDS system at international and national centers around the world. The GRCIDS III is seen to be a 3 to 5 year project of which three years have been approved in general by the International Board for Plant Genetic Resources. During the first and second years an international staff will be formed, methods will be tested and evaluated, and an organizational structure will be built. This structure will be amenable to physical transfer to any site in the world during the fifth year.

During the first three years and possibly the fourth, the work will be centrally at the University of Colorado, Boulder, Colorado, due to the availability of staff, facilities, and the previous investment by the University and due to the continued interest of the University in this problem (both for national and international purposes).

THE STATEMENT OF WORK, SERVICES AND SPECIFICATIONS

A. GRCIDS Work Program (See Administrative Footnote 1)

1. Work Program Components:

a. Building an organization of a GRCIDS development staff to execute the detailed program below. This to include the training of international personnel.

b. Development of the EXIS system (see technical footnote 1) to include:

(1) addition of external modules for analysis and taxonomic processing;

(2) a generalized report generator;

(3) a general cartographic module;

(4) development of the TAXIR/STIRS Data Storage and Retrieval core module

c. Continued systems analysis of the extant GRCIDS using the EXIS system as an analytic tool.

d. Transfer of the EXIS system to operate on large scale computers of the following manufacturers: CDC, IBM, Univac.

e. Transfer of the EXIS system to operate on the Data General NOVA mini-computer, and, if possible, the demonstration of this system at one of the international policy workshops.

f. Transfer of the current EXIS version to all plant based International Centers (CIP, CIAT, CIMMYT, IITA, IRRI, ICRISAT).

At each center specific projects will be identified in interaction with analysts and center personnel. Each of these problems should represent a general case. In all cases primary attention will first be paid to the genetic resources data banks that exist. (See technical footnote 2)

g. Transfer and utilization of EXIS in solving problems at multi-national and regional centers or organizations (Izmir, EUCARPIA); national centers to include EMBRAPA (Brazil), ICA (Colombia), INIA (Mexico), USDA (United States), HIRATSUKA (Japan); the maize program in Peru and another designated center in Asia.

h. Formation of a multi-center GRCIDS data bank on maize, wheat, groundnuts, potatoes, and beans.

i. Continued investigation of the best transfer methods of the system for both individual genetic resource unit use including service bureau assistance to any unit that cannot gain access to the system EXIS on a computer in its area and the multi-center utilization at first answering questions of who is where, doing what, with what. Hopefully, a guide for workers on projects related to genetic resources will be published by FAO as a result of this work.

j. Assistance in developing and presenting a major substantive portion of the International Wheat Conference (Leningrad, July, 1975), the Groundnut Conference (Gainsville, September, 1975), and a maize conference (details of which will be

proposed to the IBPGR in May).

k. Presentation of the work completed and proposal for continued work to the International Board for Plant Genetic Resources Executive Committee and Full Board Meeting, April-May, 1975. This to include specific questions posed by the Chairman of the International Board to assist in future genetic resources planning.

l. Upon request from FAO and with the mutual consent of the Operational Advisory Group on GRCIDS work, advisory consultation on aspects of the regular FAO program concerning any aspect of genetic resources will be provided.

m. Development of and negotiation of and acceptance of pilot projects for resources and support for organizations, both national and international, public and private in support of GRCIDS development will be undertaken. Each project will be reviewed by the Operational Advisory Group. At a minimum this is to include projects begun during GRCIDS Project (FAO Contract RP/HQ/1974-1/AGP) with specific reference to IBM Corporation, Codevintec Pacific, Inc. (mini-computers), USAID and USDA.

2. Work Programming and Scheduling:

Programming and scheduling will be undertaken by the staff in consultation with the Operational Advisory Group during the course of the contract. This is especially required due to the experimental nature of the project and the difficulty of causing schedules of the number of groups involved to mesh.

B. Organizational aspects and communication and reporting pathways (See Organizational Chart 1, page 17)

1. Operational Advisory Group for GRCIDS Work: This group is an informal communication and decision making body. It does not make policy decisions but consults on operating decisions that cannot be made alone by the Project Director and Project Deputy Director. In order to facilitate making decisions in this newly developed project, the Operational Advisory Group will consist of the Project Director (David Rogers), the Project Deputy Director (Gilbert Hersh), the Executive Secretary of the International Board for Plant Genetic Resources and the Chief of UNFAO/AGPE (Robert Pichel), and the Chairman of the IBPGR (Richard Demuth). In order to facilitate the decision making flow, the Project Director and the Project Deputy Director will first discuss any subject that comes up with the Executive Secretary, Robert Pichel, and in turn discuss the matter with the Chairman, Richard Demuth.

Aside from this innovation, the basic decision structure remains the same as would be expected. Rogers, representing FAO, will be the overall Project Director and due to his tenure at the University of Colorado will be a co-principal investigator with the Project Deputy Director, Hersh, of the University of Colorado. Decisions and execution will flow from Rogers to Hersh to the staff.

2. University of Colorado Genetic Resources and Bionomic Systems Principal Investigator Group: Over the past several years

an informal group composed of Professors Rogers and Slater and Research Associates Hersh and April, and more recently Professor Schiffman, have been involved in various aspects of food nutrition planning, decision analysis, information flow analysis and development, quantitative decision technique development. This group has worked exceptionally well in the past and has provided a core around which the University of Colorado has formed a Program Committee. It is from this Genetic Resources and Bionomic Systems Principal Investigator Group that most of the concepts for GRCIDS have emenated (Hersh and Rogers) and later April and Slater. Dr. Schiffman has been responsible for assistance in the development of EXIS. This group will basically be advisory and may participate in aspects of the project.

3. GRCIDS Planning, Systems Analysis and Design: This core function directed by Hersh will be responsible for aspects of GRCIDS analysis and from the analysis design of core module and external module development to meet genetic resources workers' needs and the design of the transfer function.

The GRCIDS planning function will be in three areas: (1) the actual development and implementation of the overall GRCIDS function through receipt of data from all centers and genetic resources units with which work is done; (2) development of strategies for transfer of the system and communication of information among all genetic resources units; (3) the development of sources of support for continued assistance in GRCIDS work;

and (4) the continued preparation and presentation of GRCIDS ideas and concepts as they can be inferred from the systems analysis, including those of importance to decision makers at national and international levels for agricultural research and development.

4. GRCIDS Development and Implementation: This function is under the direction of J. R. Hanley and will be responsible for the execution of development design and the implementation of software on various computers of different sizes to solve GRCIDS problems.

5. Transfer: This function under the probable direction of Joan Louis concerns itself with reporting and communications including the development of Newsletters to keep all participants abreast of the ongoing activities, development of user instruction manuals on the EXIS system, development and execution of workshops at various sites of varying complexity, transfer in association with the implementation group of the EXIS system and service bureau operations which provide assistance to any group requiring interim or long-term use of EXIS that may not have available a computing machine.

6. Communication and Reporting:

The responsibility for the execution of the project resides in the Project Director and Project Deputy Director and attendant staff. Support and assistance is expected from UNFAO as indicated

in Administrative Footnote 2. Exclusions, exceptions and other items are covered in Administrative Footnote 3. The Project Director will report directly to the Executive Secretary for the IBPGR and Chief of UNFAO/AGPE, Robert Pichel.

As described above and in Chart 1, the Operational Advisory Group consists of Rogers, Hersh, Pichel and Demuth. It must be noted, however, that the members of the International Board for Plant Genetic Resources and the Director of the Plant Production and Protection Division, F. Albani, indicated that the Project Director and the Project Deputy Director have free and unlimited access to seek information and advice from any member of the IBPGR or any individual working in genetic resources work globally.

All reports verbal and oral will be made to the Executive Secretary of the IBPGR. He will, using his own discretion or in consultation with the Chairman, determine which reports will be sent to the members of the IBPGR and will dispense these reports with the aid of the Secretariat in Rome.

Mr. Pichel, as Chief of the AGPE, will receive all reports concerning FAO and will reproduce and distribute these reports as necessary. Reporting will not be formalized at this time, but will be the subject of continued discussion among the members of the Operational Advisory Group.

A conference telephone call should be made by members of the Operational Advisory Group at least once every three weeks

or at such times as there is specific need.

Other members of the Board requesting information should go through either the Chairman of the Board or the Executive Secretary concerning aspects of this contract. If there are questions of a substantive nature on GRCIDS, such questions can, of course, be directly communicated to Rogers or Hersh.

Organizational Chart 1

International and National Organizations