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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.

DEFINITION OF SOME COMMONLY ENCOUNTERED TERMS IN COMPUTERIZED INFORMATION RETRIEVAL. (For a much more complete glossary, see: Vocabulary for Information Processing, published by American National Standards Institute, and/or CDP Review Manual. A Data Processing Handbook, Eds.: R. A. MacGowan and R. Henderson. Auerbach Publishers, Princeton, N. J., 632 pp.)

batch mode. (contrast inter-active). When using the computer, program and data banks are submitted to computer to be run at the convenience of the computer center. There are no possibilities to alter the program, nor to ask further questions during the computer processing of the data. Batch mode is much less expensive to use, and is most often employed when large or long print outs are expected.

character. In the computing milieu, a single letter or numeric symbol.

compiler. A softward package which converts a set of instructions (program) to machine language.

data bank. A collection of items (a set) with associated descriptors and descriptor states (q.v.). The proper design of a data bank is very critical in cost-effective use of any computer-aided information retrieval system.

descriptor. In TAXIR, a single basis for description of an item. Example: collector, collector number, generic name, species name, country where collected, flower color, date of collection, etc., etc.

descriptor state. In TAXIR, a series of non-overlapping (mutually exclusive) descriptive statements (values) under each descriptor for each item (q.v.). Examples:

Descriptor	Descriptor State
Flower Color	red blue white red-blue
Leaf Length	10 cm. 11 cm. 15 cm.
Collector	Smith, R. Smith, J. Rogers, D. Rogers, W.

Note that the combination descriptor, descriptor-state conforms to the same construction as genus (noun), species (adjective).
Note also that descriptor states may be alphabetic, numeric, or combinations of these two. In TAXIR, there is no limit to the number of either descriptors per item, nor descriptor states per descriptor. The length (number of letters or numbers) per descriptor state is presently set at 90, but may be lengthened if need be.
In TAXIR, descriptors may be names, coded, or ordered (from - to), to give complete flexibility in description of the items.

field. With reference to the number of letters or numbers used in any descriptor state, the place on the punch card (paper or magnetic tape) where one places data.
a. fixed-field. A predetermined number of spaces allotted on the punched card (frequently used in coded data).
b. free-field. Within limits, any number of spaces allotted on the punched card. This is a feature of the TAXIR system.

hardware. (contrast software). All the physical components of a computing machine, including input and output devices, central processing unit, storage units, cathode ray tubes, etc.

inter-active. Any set of software and hardware computer configurations which permits the user to ask questions and receive answers sequentially, without resubmitting his program and data each time a new question or direction is submitted.

input. Any method of data preparation for computer manipulation and the machines that accept data in the computer.

item. In TAXIR, any thing or concept which may be defined as a basis for description, i.e., a specimen or a taxon.

"k." (as in 15 K). Shorthand, or jargon, in the computer milieu, standing for 1,000. Thus, 15 K = 15,000. Refers generally to the size of memory in any computing machine.

on-line. When a user employs a computer with a remote terminal or time-share capabilities, he is said to be "on-line."

output. Any means of presentation of the results of computer manipulation of some input under control of the computer program--may be "hard copy" (typical computer print-out), a display on a cathode ray tube, or microfilm.

program. (see also software). A set of instructions that direct the function of the computing machine to accomplish some task or set of related tasks.

remote terminal. A piece of hardware connected at some distance from the computer via telephone line or microwave transmission. A means by which a computer user may communicate with the computer without having to visit the computing center. There are many levels of complexity of remote terminals.

software. (see also hardware). A generic term that includes all types of programs that direct the functions of a computing system.

time-share. The more sophisticated computing systems provide means by which several users may have programs running nearly simultaneously in a single computer.

Some attributes of TAXIR

-- TAXIR is an information retrieval compiler. That is, with the sets of instructions included in the program, differing data banks may be input to the computing system and from these, a specified information retrieval system designed by simple, common language instructions, with associated vocabulary, are achieved.

-- TAXIR is designed in modular fashion, with several "add-on" subroutines for various requirements. Examples of add-on routines are: plotter programs to make maps and graphs; report generators to print columnar data with headings; editing routines; and various statistical packages (at the moment, the statistical packages attached were designed by the Institute of Behavioral Sciences at the University of Colorado).

-- TAXIR is written in FORTRAN IV, the most common compiler language found in the world. Because of the exclusive use of FORTRAN IV, it is relatively easy to convert from computing machines of one manufacturer to computing machines of another manufacturer (the only requirement being that the machine possess a FORTRAN IV compiler). At present, TAXIR is running on Control Data Corporation machines (6400 and 6600), on International Business Machines (several 360 and 370 series) and on UNIVAC 1106 and 1108. Because of the modular design, it is possible to use smaller computing systems than those mentioned above, such as the IBM 1130, or the IBM 360/20 models. The only requirement for the smaller machines is that they have associated random-access peripheral storage devices.

-- The TAXIR version on the University of Colorado CDC 6400 is adapted to run on the inter-active, time-share system, from remote terminals. It also runs on "batch" mode for long runs with extensive print-out to take advantage of lower cost operations.

-- The TAXIR system achieves extraordinarily efficient storage and retrieval capability by employing as a base of design set-theoretic functions which guarantee the most efficient use of storage capacity of the computer, and at the same time provide extremely rapid access to the stored information.

-- The TAXIR system alone occupies about 15 K 32 bit words of memory, and sizeable data banks can be contained within 32 K memory. Large data banks take advantage of drum, disc and/or tape peripheral memory to extend the size of the banks almost indefinitely. The largest data bank ever tested on TAXIR had 106,000 items, with 50 descriptors per item. Time to retrieve a single item in answer to a complex question from the bank with 106,000 items in storage required ca. 2 seconds of central processor time.

-- Any modern language using the Latin alphabet may be used as input to TAXIR with rapid, accurate translation to other languages possible.

-- TAXIR does not require a predetermined thesaurus of terms. Because of the design of data input as descriptor/descriptor state, the descriptions of each item becomes the language by which the data bank may be questioned.

-- Items, descriptors and/or descriptor states may be added, deleted, or corrected with a single instruction that is contained in the TAXIR compiler.

-- Data banks may be merged or reformatted under control of the TAXIR compiler.

-- TAXIR will (within the next 3 months) be completely flow-charted and documented, and a user's manual available. Complete flow-charts and documentation, along with listings, and the user's manual will be available at cost. Since the system was built with public funds, the system is in the public domain. No request from a serious user will be turned down. It is requested that any user who adapts the system become a member of a "user's group", and that any further development of the system made by any user be shared with the developers of the system. (This is, of course, not enforceable by any means, but it is anticipated that the spirit of free scientific exchange will prevail).

Taximetrics Lab.
Dept. EPO Biology
Univ. of Colorado
Boulder, Colorado 80302
USA
Nov. 7, 1973

Mr. J. P. M. Brenan
Royal Botanic Gardens
Kew, Richmond, Surrey TW9 3AE
England

Dear Pat:

I am sending a manuscript, "Information Management and Use of Taxir in Herbaria", by separate mail. I trust it reaches you in good order. I trust you will exercise editorial reorganization as you see fit. You will see that I do not use the Queen's English very well.

I thoroughly enjoyed the meeting last month. Best regards to your colleagues.

Sincerely,

David J. Rogers
Professor of Biology

NOV 7 1973

Royal Botanic Gardens
Kew Richmond Surrey TW9 3AE

Telegrams Kewgar Richmond Surrey Telephone 01-940 1171

Please reply to The Director
Your reference

Our reference

Date 31 October 1973

Dr D J Rogers
Dept. of Epo. Biology
University of Colorado
Boulder
Colorado 80302

Dear Dr Rogers

INTERNATIONAL MEETING ON THE USE OF ELECTRONIC DATA-PROCESSING METHODS IN MAJOR EUROPEAN COLLECTIONS - ROYAL BOTANIC GARDENS, KEW, OCTOBER 1973

As I am sure you will remember, publication of the papers read at this meeting, and its results, will be undertaken by the NATO Eco-Sciences Special Panel. The Organising Committee, under a resolution passed on the last day, was asked to remain in being for a further period of time to make detailed arrangements for publication. At a meeting of the Organising Committee on 25 October, a small editorial group was established, with myself as co-ordinator. I am already in contact with NATO over publication, but am anxious to have the text of the papers ready as soon as possible. May I please ask you whether you would be kind enough to let me have a text of your paper on TAXIR at the latest by 31 December 1973. If you have already sent it to me, please, of course, disregard this request. May I take this opportunity, on behalf of the Organising Committee, of expressing our deep thanks to you for the valuable contribution you made to the above meeting.

Yours sincerely

J P M Brenan
for Organising Committee

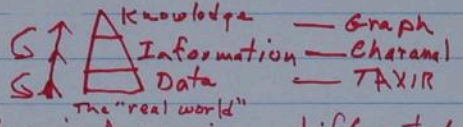
Outline of Paper delivered at Kew Oct. 6. 1)

Put out monographs-
Hand out mimeograph.

I Classification of Problems in Information Management
A. Substantive information to be included in a "system".
B. Methods of using computers.
C. Use of whatever information is included.
That is - what do you do with what you have.

II Management - meaning and needs
A. Each step above must have decisions made on most efficient, and least costly, basis.
B. Decisions at each step should be considered in context with every other step.
C. To lead through these, a competent specialist - a management scientist - is invaluable.

III Imbedding an IR. system in an overall context
A. The knowledge triangle - why we bother at all.



B. Each step in A requires a different type of computer program -
1) IR systems serve at base.
2) Taximetrics systems at each of these levels. integrated.
C. Since this meeting concerns international types of endeavor - a very large endeavor, we must be ready to employ the very best management personnel and systems To insure success.
D. Our concern here deals with The base of the triangle,

IV- TAXIR- modelled after systems already understood.

A. To be general, separates substance from structure
Ex. ALL information is either letters, numbers, or combination

B. Structure of means of input-
1) The item-
2) The descriptor / descriptor state

See attached sheet - definitions and summary

C. Input devices - various, some more efficient / costly than others- choice depends on ~~data~~ management decision.

D. Employs in all parts compiler language FORTRAN-IV.
1) Most general compiler on more computers for scientific purposes.

E. Executes all (or most) required functions-
1) Efficient use of machine memory storage units.
2) Rapid, precise, querying system-
3) Contains editing routines, correction, addition or deletion

F. Operates on a variety of computer machines- not limited just to one MAKE.

G. Has been thoroughly tested for many different applications.

V Using TAXIR - for the herbarium-

A. Concept of logical divisions of data into data banks-

1. Curatorial data banks- various types discussed yesterday by each discussant- Requires very careful design for cost/effectiveness

2. Substantive data banks
phenology, morphology, cytology,

B Use of TAXIR instructions to make different banks, merging data banks, etc.

C. Example of curatorial data bank-

1) "finding" ~~information~~ descriptors-

(a) family (b) genus (c) species (d) lower taxon-
(e) Collector (f) Collector # (g) date of collection [= month, day, year] each a separate descriptor].
(h) Country (i) State or province (j) specific locality [including, if given, lat. and long.].
(k) Ecological province (l) altitude (m) soil type-
(n) Uses (o) common or vernacular names.

Test on 5000 Bryophytes with these Av. 3-5 min per spec.

II Summary-

By careful management - no amount of data impossible-

Makes possible the dreams we all have had - to take full advantage of one of the most powerful information resources in the world — the herbarium.

Dr. Hawkes + I figured that, at this rate, the 4,000,000 specimens ~~of~~ of Kew would take 100 man years to capture, or 10 people 10 years - not an impossible nor improbable, given the value of the work.

Royal Botanic Gardens
Kew Richmond Surrey

Telegrams Kewgar Richmond Surrey
Telephone 01-940 1171

Please reply to The Director
Your reference

Our reference
QA 737
Date 7/5/73

EDP.
Eur. Coll. - Kew
3-6 Oct '73

Dear Mr Rogers,

INTERNATIONAL MEETING ON THE USE OF ELECTRONIC DATA PROCESSING METHODS IN THE MAJOR EUROPEAN COLLECTIONS

I am writing to thank you for your letter of expressing a wish to participate in the meeting at the Royal Botanic Gardens, Kew from 3rd to 6th October 1973.

I shall arrange to send you all relevant papers as soon as possible.

Yours sincerely

J P M Brenan
for Organising Committee

Royal Botanic Gardens
Kew Richmond Surrey

Telegrams Kewgar Richmond Surrey Telephone 01-940 1171

Dr D J Rogers
Department of Botany
University of Colorado
BOULDER
Colorado 80302

~~Please reply to The Director~~
Your reference
Our reference
Date 22 March 1973

Dear Dr Rogers

INTERNATIONAL MEETING ON THE USE OF ELECTRONIC DATA PROCESSING METHODS IN MAJOR EUROPEAN TAXONOMIC COLLECTIONS

Taxonomic and biogeographical research on plants increasingly requires data from specimens stored in a number of institutions located in different countries. At present it is difficult or impossible to acquire and survey this information completely. EDP methods offer an opportunity of making it more widely and more easily accessible.

With growing awareness of the value of such methods and the increasing readiness of institutions to adopt them for recording data from specimens in their collections, there is a danger that institutions may act in isolation and adopt differing and incompatible systems of EDP which will result in making the stored information internationally unavailable.

Funds have been allocated by the Eco-Sciences Panel of NATO to support an international meeting to consider this problem, to take place at the Royal Botanic Gardens, Kew, England, from 3-6 October 1973. The objectives of this meeting will be to define the problems in herbaria and other plant reference collections requiring EDP methods, to survey the systems at present in use, to assess them, and, if possible, to reach agreement on a system for future general adoption among the major European institutions. This meeting is being organised by a committee comprising the Royal Botanic Gardens, Kew, the British Museum (Natural History), the Royal Botanic Garden, Edinburgh, the Nature Conservancy and the University of Birmingham. Attendance will be by invitation.

I am writing to you to ask you whether you would be prepared to consider giving a contribution to this meeting on the TAXIR system, with special reference to herbarium collections . The programme is still at an early stage of formation and at present I am mainly concerned with obtaining your approval in principle. I do hope that you will be able to agree, and of course I will send you further details and information as soon as possible. May I add that the funds at our disposal will enable us to meet your travelling and subsistence.

Would you kindly address your reply to the Secretary, EDP Meeting Organising Committee, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AE, England.

Yours sincerely

Professor J G Hawkes
Chairman
Organising Committee

March 30, 1973

The Secretary
EDP Meeting Organising Committee
Royal Botanic Gardens
Kew, Richmond
Surrey TW9 3AE

Dear Sir:

I shall be pleased to contribute a paper on the TAXIR system with special reference to herbarium collections at the International Meeting on the Use of Electronic Data Processing Methods In Major European Taxonomic Collections. I look forward to further details concerning the meeting.

Please note my address, as follows:

Taximetrics Lab.
Department of EPO Biology
University of Colorado
Boulder, Colorado 80302
USA

Sincerely,

David J. Rogers
Professor of Biology

NATO ECO-SCIENCES PANEL EDP MEETING

TO BE HELD AT ROYAL BOTANIC GARDENS, KEW 3rd - 6th OCTOBER 1973

PROGRAMME

Wednesday 3 October

am	8 30	Participants met at Post House Hotel by Dr W D Clayton of Royal Botanic Gardens, Kew.
	8 45	Coaches leave Post House Hotel for Kew.
		Morning Sessions: to be chaired by Professor J Heslop-Harrison, Royal Botanic Gardens, Kew.
	10 00	Welcome by Professor J Heslop-Harrison
	10 15	Introductory remarks by Professor J G Hawkes (Birmingham University) Chairman of Organising Committee.
	10 30	NATO Involvement: Dr A Rannestad (NATO Scientific Affairs Division)
	10 45	Coffee
	11 15	Mr J P M Brenan (Royal Botanic Gardens, Kew), EDP in major Herbaria. The priorities
	11 45	Mr D Henderson (Royal Botanic Garden, Edinburgh), The Herbarium Data for EDP
pm	12 15	Discussion
	12 30	Lunch
		Afternoon Session to be chaired by Professor Kalkman
	2 30	Mr R Ross (British Museum, Natural History): Relations between Herbarium Records and other Records
	3 00	Dr A Gomez-Pompa and Mr J A Toledo (University of Mexico): Data Processing of Herbarium Specimens for the Flora of Veracruz Programme.
	3 30	Mr A V Hall (Bolus Herbarium, Cape Town): The uses of electronic data processing for Herbarium specimen - label information.
	4 00	Tea
	4 30	Discussion: To be led by Dr R S Cowan (National Museum of Natural History, Washington).
	5 00	End of Session
	5 30	Transport leaves Kew for Post House Hotel.

Thursday 4th October

am 8 45 Coaches leave Post House Hotel for Kew.

Morning Session: Chairman ~~to be announced~~ Dr. Riegel (Vienna).

9 30 Dr S G Shetler (Smithsonian Institution, Washington): The Flora North America Information System.

10 15 Dr F H Perring (Biological Records Centre, Monks Wood, England): EDP in the Herbarium.

11 00 Coffee

11 30 Dr S W and Mrs D M Greene (British Antarctic Survey, Birmingham): The Data Bank of the British Antarctic Survey's Botanical Section.

pm 12 15 Discussion

12 30 Lunch

Afternoon Session to be chaired by Professor Dr K Walther (Institut fur Allg. Botanik, Hamburg).

2 00 Dr R A Brown (American Horticultural Society): The recording system used by the AHS Plant Records Centre.

2 45 Dr J L Cutbill (Cambridge University England) General Purpose Filing Systems.

3 30 Tea

3 45 Dr D J Rogers (University of Colorado): Description and Application of Taxir

4 30 Dr J F Mello (Smithsonian Institution, Washington): The SELGEM System.

5 15 Discussion to be led by Mr B J Harwood (Ministry of Agriculture, Fisheries and Food, London).

5 30 Session ends

6 00 Transport leaves Kew for Meeting dinner at "Turks Head", Twickenham.

9 15 Transport leaves "Turks Head" for Post House Hotel.

Friday 5th October

am 8 45 Coaches leave Post House Hotel for Royal Botanic Gardens, Kew

Morning Session to be chaired by Professor R Santessen (Uppsala)

9 30 Dr J H Soper (National Herbarium of Canada): The Application of EDP to the mapping of Plant Distributions.

10 15 Dr J Cullen (Royal Botanic Garden, Edinburgh): The Plant Record System at the Royal Botanic Garden, Edinburgh

11 00 Coffee

Friday 5th October (Continued)

am	11 30	Dr D B Williams (British Museum, Natural History): The use of EDP in Zoological Collections.
pm	12 15	Discussion
	12 30	Lunch
	1 30	Short tour for all participants of Royal Botanic Gardens, Kew
	2 30	Transport leaves for visit to the Section, British Museum Natural History
	2 30	Alternative programme (for delegates who request it) Longer tour of Royal Botanic Gardens, Kew.
	5 30	Coaches leave British Museum, Natural History and Royal Botanic Gardens, Kew for Post House Hotel.

Saturday 6th October Hawkes, Chairman.

am	8:15	Transport leaves Post House for Royal Botanic Gardens, Kew
	10 00	onwards Discussion and ratification of recommendations. End of Meeting
	12 15	Transport leaves Kew for Post House Hotel.

Recommendations from participants in the meeting will be welcomed and invited until mid-day on Friday 5th October. Thereafter it is proposed that a drafting committee shall be appointed to work on the recommendations on the afternoon of Friday 5th October and to cast them into a form which is suitable for discussion and ratification by the Meeting on the morning of 6th October.

EDP MEETING AT KEW

OCTOBER 1973

Summaries of Papers to be Presented

J.P.M. BRENAN (Royal Botanic Gardens, Kew):

EDP in Major Herbaria - the Priorities

Most herbaria have not introduced EDP methods. It is essential for their advantages and disadvantages to be carefully assessed. An attempt is made to do this with particular reference to the Kew Herbarium. An account is given of the Kew Herbarium and its arrangement. Most herbarium arrangements permit of a more or less efficient information retrieval system to be operated by conventional means and within limits. It is doubtful whether any major herbarium can afford to computerise all its holdings, or whether the result will be worth it. Some suggestions for priorities are given based on needs at Kew. These may be summarised as follows:

1. Inventory of type material.
2. Inventories of specimens and geographical areas of outstanding conservation importance.
3. Listing of economic uses.
4. Listing of vernacular names.
5. Recording of vouchers for non-taxonomic research.
6. Limited recording of specimens in defined areas, systematic or geographical, of special research interest to Kew.
7. Listing of genera and species with their geographical ranges.
8. Comprehensive listing of genera and their position under families.

R. ROSS (British Museum, Natural History):

Relations between Herbarium Records and other Records

In considering the design of EDP records of herbarium holdings it is necessary to take account of the need for compatibility between such records and those of other types of collections, viz.:

Associated material, such as spirit specimens, pollen specimens, carpological and other bulky specimens and anatomical preparations;

Other botanical collections, including collections of living plants, collections of microscopic organisms, and palaeobotanical specimens;

In some institutions, zoological collections.

The various points that need to be borne in mind in connection with each of these will be discussed.

A. GOMEZ-POMPA and J.A. TOLEDO (National University of Mexico):

Data Processing of Herbarium Specimens for the Flora of Veracruz, Mexico

The Flora of Veracruz programme is a comprehensive study of the plant resources of this Mexican state. It involves a series of studies that go beyond the common

objectives of the classical floras as it includes ecological and environmental studies and it is utilizing electronic data processing methods for the entire project.

The main objective is the production of a Flora of the same type of an ordinary good modern one. At the same time could serve as a basis to create a data bank on the plants and the environments of Veracruz which could have many uses through the time of preparation of the Flora and afterwards.

A brief discussion of the kinds of data that are being introduced in the data bank will be explained here. We will present a more ample discussion of the data from herbarium specimens.

Even though most of the effort has been concentrated on new collections, we have made a survey of the collections already present in the herbaria of several institutions. As an example of this effort we will present the pilot project that has been accomplished to compile the data from Veracruz specimens from the herbarium of the Royal Botanic Gardens at Kew. We will show examples of the kind of processing that we are doing with them.

A comparison of the collections of two families (Piperaceae & Araliaceae) in selected European herbaria will be presented as another example of the kinds and numbers of Veracruz collections housed in these herbaria.

A discussion on the future of herbarium data processing in future botanical research will be presented in the context of our floristic research programme.

A.V. HALL (University of Cape Town):

The uses of electronic data processing for Herbarium specimen-label information

The need for more effective ways of using the data on herbarium specimen-labels is briefly reviewed. Very large numbers of individual geographic-taxonomic records exist in the herbarium. Full use cannot be made of these very important records by standard methods. Indeed, there is no easy way of answering the most basic question one may ask of an herbarium Curator, on what plants have been found in a particular set of areas. This leads to poor support for collectors wishing to build up regional herbaria, and for field botanists and workers in related subjects such as environmental studies. Similar considerations apply to ecological data, and to the information that assists one in finding type-specimens. One may indeed say that with respect to label information, the herbarium is a 'data crypt' rather than a data bank.

Computer based data-banking for label information, with full retrieval and catalogue-making facilities, offers a solution to these fundamental problems. The approach for using such systems is critically discussed. It is noted that the usefulness of the herbarium could be profitably extended by the optimal use of these methods.

S.G. SHETLER (Flora North America):

The Flora North America Information System

The Flora North America (FNA) Information System, as designed, consists of a precisely defined set of data files, collectively referred to as the FNA Data Bank, and equally well defined processing strategy and operating procedures based on the use of IBM's commercially marketed software known as the "Generalized Information System" (GIS). Each data file forms a module of the Data Bank and links by appropriate codes to related files. The files are designed to be used

as parts of a whole or independently as authority files in their own right. The keystone of the Data Bank is the taxonomic name file to which every other file is referenced. During the initial development phase of FNA, the major file in terms of size and significance will be the one containing species-by-species summaries of morphological characteristics, habitats, and geographical distributions. The processing software, GIS, operates on System/360 and System/370 in batch mode under the supervision of IBM's standard teleprocessing monitors. GIS calls for formatted records defined in the system by data description tables and performs all of the basic functions of a generalized information-processing system, including report generation. It can interface with preprocessing and other special programmes. Two of its features of great significance to the FNA Information System are its capability of handling hierarchical data structures and its capability of processing multifile queries.

F.H. PERRING (Biological Records Centre, Monks Wood Experimental Station):

EDP in the Herbarium

Experience of running a botanical data bank for nearly 20 years leads to the belief that the majority of questions can be answered if the data are available by species or by locality.

If records which carry data additional to locality are filed separately within the species file and all these data are supplied to any questioner, who can thus make his own selection of the data he requires, a two-way index is all that is necessary.

Such a simple system requires the minimum of EDP and allows the majority of our slender resources to be used for collecting the data.

We question whether comprehensive EDP provides the output which the user requires. The ideal for answering questions about species is the folder of specimens, but if that cannot be made available a photograph of the sheet or photocopy of the label contains much information, including handwriting, which is lost in a computer print out.

Microfilm and microfiche provide a system which ensures the safety of the record, is the basis of species and locality oriented information retrieval, and results in a format which can be sent economically by post throughout the world.

D.M. and S.W. GREENE (British Antarctic Survey):

The Data Bank of the British Antarctic Survey's Botanical Section

A description will be given of the use of a coded computer file and an in-clear card index to retrieve data from a medium-sized, special-purpose herbarium. The computer programme uses a fixed-field format for selected collecting data, state of specimen information and herbaria holding duplicates. It is possible to sort on all fields and therefore the file can be used for different purposes. The card index contains the full information on every specimen on the computer file and provides an instantly available reference source.

The herbarium contains specimens from all plant groups but is largely confined to one geographical area, the Antarctic, with a small proportion of taxonomically important specimens from neighbouring areas. It differs from a normal herbarium in having a high percentage of unidentified material.

The file is used to retrieve records of identified and unidentified material for taxonomic and phytogeographical work and to plan each year's field work. The existence of such a data bank has provided a means of permanently storing [illegible] specimens in an area where conservation is important.

R.A. BROWN (American Horticultural Society):

The recording system used by the Plant Records Centre

Established in 1970 by a grant from Longwood Foundation, Inc. to the American Horticultural Society (AHS), the Plant Records Centre (PRC) has made considerable progress towards the development of a national centre for horticultural information. The PRC has developed a standardized system for the recording and reporting of information related to plants cultivated within major North American botanical gardens and arboreta. Utilizing modern data-processing techniques, the PRC has developed a system of reports or inventories which provide managers of botanical collections with timely, inexpensive reports on their living collections. In addition, the PRC offers to its cooperating institutions other services, including keypunching, programming, and statistical processing.

While much of the resources of the PRC is directed toward development of projects related to botanical garden records, the PRC is actively investigating other services. The PRC has recently announced its file-researching service to botanists, horticulturists, and researchers. With over 170,000 records within its data files, the PRC can often direct professionals, who are seeking information about particular plants, to institutions where the desired plant is reported to be growing. The PRC is also actively investigating the field of "word processing", to assist those institutions which are engaged in the preparation of recurrent publications, such as indices, directories or registration lists. For the AHS, the PRC is developing a system to manage membership (subscription) record files. Once established, this system will be offered as a service to other horticultural organizations located at the AHS headquarters.

J.L. CUTBILL (Cambridge University):

General Purpose Filing Systems

The problem in designing a filing system for a herbarium or museum is that it must accept a wide range of data whose properties and purpose are unpredictable at the start. The Information Retrieval Group of the Museums Association (IRGMA) has developed a technique that minimises this problem. It is based on the use of a number of subject-independent elements such as person, time, place, description and reference together with a method of combining these elements into descriptive records. The ideas are well suited to computer processing.

At the level of the individual collection the method provides a basis for a filing system that can grow easily with the data. At a higher level it provides a framework for developing and defining data standards. Then by making the structure self-defining, it can serve as a communication format for the exchange of data.

The ideas will be illustrated with an outline of the British Standard for herbarium material now under development.

D.J. ROGERS (University of Colorado):

Description and Application of TAXIR

TAXIR (TAXonomic Information Retrieval) is the acronym for a computer-oriented information retrieval system designed to be used in taxonomic work of all types. The system is modelled after efficient working procedures already established in the discipline of taxonomy, employing concepts familiar to most taxonomists. It is a generalized system, useful for any type of data or description of either specimens or taxa. The TAXIR system may be used by the herbarium for efficient record-keeping on loans and accessions, etc., and may also be used by individual taxonomists in the herbaria for the purpose of recording all types of classificatory information used in taxonomic work. It is thus a general-purpose system.

TAXIR programmes have been widely distributed in the USA, Europe and UK. The programme varies from place to place, and each is not equally well-developed. There are restricted versions (less general applicability) and more generalized versions, so that TAXIR has become a generic acronym with several "species".

As with any new device or method, it is necessary to have instruction in the proper use of TAXIR (or any other computer system). Adoption of the programmes should be proceeded by a short period of training to familiarize users of the system with its capabilities. Also, it is necessary to understand that TAXIR makes communications within and between herbaria more rapid and efficient, and the proper application to accomplish the goal of efficient communication implies systematic applications. Instruction aids in accomplishing this goal.

Adoption of TAXIR by any one institution does not prevent communication with other systems adopted by other institutions. Conversion of information between one computer programme and another is easily accomplished. Those institutions already working with another system (The Smithsonian, Cambridge, etc.) may easily exchange information by simple computer conversion programmes.

J.F. MELLO (American National Museum of Natural History):

The SELGEM System

A principal function of science museums is to preserve specimens for study. Care of information about the specimens is as important to science as is care of the specimens themselves for without adequate means of access to the collections they cannot be used to maximum advantage. Traditionally access has been provided by the organization of the specimens themselves, plus a serial catalogue and cross-reference card files. Computer and software developments over the last 5 to 10 years have made it possible to attack the vast amounts of information likely to be needed in a "Museum of Information".

The SELGEM system is currently being used to receive data on more than 50 separate files of information at NMNH alone. The principle of data capture for the SELGEM system is that each discrete item of information for which a record is desired in the computer file is given a tag or label. Thus the tag "genus" serves to identify any immediately following taxonomic name as a generic name. SELGEM enables the user to search all data fields for specific content and permits the inversion of the entire file of information about any tag term. Thus an index can be created by genus name, species name, collector, country and so forth.

SELGEM and other tagged systems offer several advantages to the user. Tangible benefits include the use of the computer as a tool to produce catalogues, labels or file cards, often at a considerable reduction in the amount of human labour necessary and with a substantial increase in accuracy. Intangible benefits include provision of the data in a form where many more combinations can be examined than formerly could be attempted.

It is absolutely necessary that data standards be established and maintained for as many data elements as possible. Adherence to standards will assure the interchangeability of data banks between museums and individual scientists.

J.H. SOPER (National Museum of Natural Sciences, Ottawa)

The Application of EDP to the mapping of Plant Distributions

The first part of this paper outlines the important features of distribution maps as used in Botany, describes how they are constructed and discusses the introduction of machine-mapping methods in the early 1960's. Examples are given of published maps to illustrate the variety of approaches used in presenting distribution data. The main techniques for the automation of mapping plant ranges

are described as well as the special capabilities which computers provide for mapping. A comparison is made of the different kinds of machines which can be used for machine-mapping from the standpoint of Input, Output, Control, Operation, Restrictions, Advantages and Disadvantages.

The second part of the paper describes the development of mapping programmes for plotting the distribution of the vascular plants of southern Ontario and examples are shown of output which can be used directly for publication. Reference is made to the EDP systems tested at the National Herbarium of Canada and to the current project to develop an information retrieval system linking label production and automated mapping to the formation of a data bank of botanical distribution records. The importance of improving the quality of the data on future herbarium specimen labels is stressed and attention is called to the value of local gazetteers based on collections in herbaria.

J. CULLEN (Royal Botanic Garden, Edinburgh):

The Plant Record System at the Royal Botanic Garden, Edinburgh

The structure and operation of the recently computerised living plant record system in operation at Edinburgh is described, and its advantages compared to other kinds of record system are discussed.

D.B. WILLIAMS (British Museum, Natural History):

The use of EDP in Zoological Collections

The reasons for employing EDP in a zoological collection are the same as those for any other collection. They range from assistance in collection management to the compilation of data banks for use in research. The use of EDP in collection management may be justified in two ways, the reduction of effort in initial collection of data, and the reduction of effort in later processing of data such as production of indices, and similar aids to assist in the location of material. Methods of employing EDP to effect these savings are reviewed.

The structure of the data is complex, and the requirements are discussed. The combination of the properties of the data and the processes to be performed on it require the availability of a computer system with certain well defined properties. These properties are discussed.

Finally conclusions are drawn as a result of operational experience, on the needs for an adequate data standard and its properties.

SELECTED REFERENCES ON MACHINE MAPPING

(Dr J.H. Soper)

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Two simple labeling and data retrieval systems for herbaria. Can. Journ. Bot. 50 (11): 2197-2209.

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A Machine Method for Mapping Insect Survey Records. The Forestry Chronicle, 40 (4): 445-449.

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JHS
20/9/73

THE HERBARIUM DATA FOR EDP by Dr Henderson (Royal Botanic Garden, Edinburgh)

The lecture assumes that the intention is to consider an EDP system capable of holding all the useful data in European Herbaria but excluding the specimen data necessary for numerical taxonomy. It will examine the types of data available on sheets, their validity and the problems they raise. The general suggestions are:

1 A uniform family system could be adopted easily for the phanerogams but some cryptogamic groups present problems.

2 The lack of universally applicable generic systems and the poor state of revision of herbaria present major problems for input at generic, specific and subspecific levels.

3 The volume of correction following input of collections as they are at present would be very great. Continuous revision of herbarium naming would require continuous input and would inhibit normal curatorial work. Thus the desirability of computerising data only after major revision must be considered.

4 Geographical data will present major difficulties especially with old, poorly localised collections. If any automated geographical print-out is to be possible, the compilation of special gazetteers and the conversion of geographical information to a standard grid system might well be obligatory.

5 Authorities for plant names could not be reliably copied from existing labels. The input of plant names if authorities are added would involve a major nomenclatural exercise covering the whole plant kingdom. It might be advisable to dispense with this input as there may be no good use for its output. It would parallel a revised Index Kewensis which would be more informative and valuable.

6 Ecological data on herbarium sheets is not necessarily sound. Codifying it would increase inherent error but the inclusion of this information might be marginally worth while.

7 A standard list of plant collectors would be required. The problem is not great with major collectors but minor, often local, collectors would at least double the task for very little useful return.

The general conclusion are that input of the data as it stands in herbaria is possible but major revision before input would be highly desirable. This prior revision must be added to any estimates of the assessment of work load that the project involves.

DELEGATES

Dr	H	Riedl	Vienna, Austria
Mr	A	Rannestad	Brussels, Belgium
Dr	J H	Soper	Ottawa, Canada
Mr	K	Rahn	Copenhagen, Denmark
Dr	B D	Morley	Dublin, Eire
Mr		Brady	Dublin, Eire
Dr	S W	Greene	Birmingham, England
Mrs	S W	Greene	" "
Prof	J G	Hawkes	" "
Dr	T	Williams	" "
Mr	J L	Cutbill	Cambridge, "
Mr	R J	Pankhurst	" "
Dr	F H	Perring	Huntingdon, "
Miss	D	Scott	" "
Prof	J	Heslop-Harrison	Kew, "
Mr	J P M	Brenan	" "
Dr	C	Booth	" "
Dr	B C	Sutton	" "
Mr	B J	Harwood	" "
Mr	W D	Clayton	" "
Mr	E F	Greenwood	Liverpool, "
Dr	H A	McAllister	" "
Mr	J F M	Cannon	London, "
Mr	R	Ross	" "
Dr		Williams	" "
Dr	J W	Franks	Manchester, "
Mr	F	White	Oxford, "
Mr	J C	Ledoux	Avignon, France
Mr	I T K	Kukkonen	Helsinki, Finland
Dr	J	Gerloff	Berlin, Germany
Prof Dr	K	Walther	Hamburg, "
Dr	A	Schreiber	Munich, "
Mrs	N	Goulandris	Athens, Greece
Mrs	J	Szujkó-Lacza	Budapest, Hungary
Prof	A	Gómez-Pompa	Mexico
Mr	J A	Toledo	Mexico
Prof	C	Kalkman	Leiden, Netherlands
Mr	J	Mennema	" "
Mr	L	Ryvarden	Oslo, Norway
Dr	J A R	de Paiva	Coimbra, Portugal
Mr	E J J M	Mendes	Lisbon, "
Mr	J	Cullen	Edinburgh, Scotland
Dr	D M	Henderson	" "
Dr	D F	Chamberlain	" "
Dr	A V	Hall	Capetown, South Africa
Mr	B H	Peterson	Göteborg, Sweden
Mr	O	Almborn	Lund, "
Dr	S	Snogerup	" "
Dr	R B	Nordenstam	Stockholm, "
Mr	F	Björkbäck	" "
Dr	N	Lundquist	Uppsala, "
Mr	R	Santesson	" "
Mr	J M	Mascherpa	Geneva, Switzerland
Dr (Mrs)	I	Mendoza-Heuer	Zurich, "
Prof Dr	H	Demiriz	Istanbul, Turkey
Dr	D J	Rogers	Colorado, USA
Mr	R A	Brown	Mount Vernon, USA
Prof	C H	Oppenheimer	Texas, USA
Mr	R S	Cowan	Washington, USA
Dr	S G	Shetler	" "
Dr	J F	Mello	" "
Prof	D	Brezhnev	Leningrad, USSR
Dr	G E	Shmaraev	" "
Mr		Harrison	Cardiff, Wales
Prof	A.L.	Stoffel	Utrecht, Netherlands.

OBSERVERS

Lupton	) Two observers	Cambridge, England
	) from Plant Breeding Inst	" "
Mr D Hunt		Kew "
Mr R N Meikle		" "
Dr P Thompson		" "
~~Mr B Fox~~ Mr. Davis		" "
Miss R Angel		" "
Dr D Brummitt		" "
Miss Aspland		" "
~~Mr Wilson~~ Mr. Townsend		" "
Mr P Green		" "
Dr H A Pinnock		London "
Mr J McDaniel		" "
Dr R H Hedley		" "
Dr F A Bisby		Southampton "
Dr Kollman		Jerusalem, Israel
Dr J Léon		Rome, Italy
Dr B de Winter		Pretoria, South Africa
Mr J Lundquist		Umeå, Sweden
Dr G Bocquet		Zurich, Switzerland
Miss E Lüscher		" "
Mr H S Fleming		Texas, U S A
Mr Brogden		"
Mr Helms		"

SECRETARIAT

Mr D Field
Mr J Warrington
Mr E Timbs
Mrs S Kozdon
Mrs H Hyde
Miss S Howard

NATO ECO-SCIENCES SPECIAL PANEL EDP MEETING

INFORMATION FOR DELEGATES

1. The Royal Botanic Gardens, Kew

The Meeting sessions will be held in the Jodrell Lecture Theatre at the Royal Botanic Gardens, Kew. Free transport will be provided between the Post House Hotel and sessions of the Meeting, as shown in paragraph 2 below. Entry to sessions will normally be by the Jodrell Gate of the Gardens, where free entry can be guaranteed; delegates who enter the Gardens by any other gate may be asked to pay the normal admission charge of one penny. General information on the history and work of the Royal Botanic Gardens is contained in the enclosed copies of the Souvenir Guide and of the booklet entitled "The Royal Botanic Gardens, Kew". A detailed map of the Gardens may be found at the back of the Souvenir Guide.

2. Transport facilities

(a) To Conference Sessions etc

Transport will be provided free of charge to take delegates to and from the Post House Hotel, Meeting sessions, the Meeting dinner and (on Friday) to the British Museum (Natural History): Departure times will be as shown in the enclosed programme of the Meeting. On the morning of Wednesday 3rd October, delegates who are staying at the Post House will be met at the Hotel by Dr W D Clayton of Royal Botanic Gardens, Kew at 8 30 am.

(b) Between Post House Hotel and London Airport (Heathrow)

The Post House Hotel operates a half-hourly coach service between the Hotel and the Airport. The service is free of charge for delegates who stay at the Post House and operates between 7 am and 1 am.

(c) To Central London

The Post House Hotel operates a twice-daily coach service to Central London free of charge to delegates who stay at the Post House. The Coaches leave the Post House for the Cavendish Hotel, Jermyn Street, London W 1 at 10 00 am and 5 00 pm on each day. Buses return from the Cavendish Hotel to the Post House Hotel at 11 00 am and 6 00 pm on each day. The nearest Underground Railway station to the Cavendish Hotel is Green Park. Delegates who find it more convenient to use other methods of transport to Central London should ask for information either at the enquiries desk in the Post House Hotel or at enquiries desk in the foyer of the Jodrell Laboratory at Kew. Maps of transport services operated by the London Transport Executive are enclosed.

3. Expenses

An allowance to cover the cost of hotel and other expenses will be paid to a maximum of one delegate from each institution during the Meeting. Observers are asked to pay their own expenses. Each delegate or observer is responsible for settling his own hotel account.

4. Enquiries

A general enquiries desk will be operated in the Foyer of the Jodrell Laboratory before and after each session. Enquiries may also be directed, between the hours of 9 00 am and 4 45 pm, to the Secretary of the Organising Committee, Mr E Timbs (Telephone Number 940 1171).

5. Conference Papers

A final programme of the Meeting, together with abstracts of the papers which are to be presented, are enclosed.

6. Catering arrangements

The Organising Committee will provide lunch free of charge to participants at the Meeting on Wednesday, Thursday and Friday, 3rd, 4th and 5th October. Lunch tickets are enclosed; participants are asked to present the appropriate ticket when collecting their lunch on each day. Participants who have already indicated their intention to do so are invited to attend the meeting dinner on the evening of Thursday 4th October. Breakfasts are available and included in the hotel costs at the Post House. Participants are asked to make their own arrangements for all other meals.

7. Name Labels

A label showing your name and institution is enclosed. All participants are asked to wear their labels at all meeting activities.

8. List of Participants

A list of those participating in the meeting is enclosed.

9. Messages

Urgent messages will be relayed to participants by means of a blackboard in the Foyer of the Jodrell Laboratory.

Royal Botanic Gardens, Kew
October 1973

Abstract.

Description and Application of TAXIR

David J. Rogers
Department of E.P.O. Biology
University of Colorado
Boulder, Colorado 80302
U.S.A.

TAXIR (TAXonomic Information Retrieval) is the acronym for a computer-oriented information retrieval system designed to be used in taxonomic work of all types. The system is modeled after efficient working procedures already established in the discipline of taxonomy, employing concepts familiar to most taxonomists. It is a generalized system, useful for any type of data or description of either specimens or taxa. The TAXIR system may be used by the herbarium for efficient record-keeping on loans and accessions, etc., and may also be used by individual taxonomists in the herbaria for the purpose of recording all types of classificatory information used in taxonomic work. It is thus a general-purpose system.

TAXIR programs have been widely distributed in the USA, Europe and UK. The program varies from place to place, and each is not equally well-developed. There are restricted versions (less general applicability) and more generalized versions, so that TAXIR has become a generic acronym with several "species".

As with any new device or method, it is necessary to have instruction in the proper use of TAXIR (or any other computer system). Adoption of the programs should be proceeded by a short period of training to familiarize users of the system with its capabilities. Also, it is necessary to understand that TAXIR makes communications within and between herbaria more rapid and efficient, and the proper application to accomplish the goal of efficient communication implies systematic applications. Instruction aides in accomplishing this goal.

Adoption of TAXIR by any one institution does not prevent communication

with other systems adopted by other institutions. Conversion of information between one computer program and another is easily accomplished. Those institutions already working with another system (The Smithsonian, Cambridge, etc) may easily exchange information by simple computer conversion programs.

Preliminary notes
for Kew EDP meeting
Oct 3-6, '73.

To the IR specialist - any information may be structured in only 3 ways: alphabetic, numeric, or a combination - content of information is separate from the structure.
An herbarium specimen is a document with information structured as above.

on EDP

Emphasis in presentations take many forms:

1. Means by which data are structured ~~to go~~ before going into the computer.
2. Means by which data are structured after computer processing (the print-out).
3. Technical discussions of the capacity of a ~~particular~~ particular computer system.
4. The programming languages used.
5. Details of the major functions of the programs.

Seldom do the discussions focus on the important problem of information management; or the important mangerial problems of incorporating any computer program into the overall functions of the organization(s) in which the computer program must be employed.

I should like to speak to the last of these first - management, and to details of the major functions of one computerized info retrieval system, TAXIR, second.

P.48

1. Why emphasis on management?
   a) Long exp. of TAX. Lab. in problems of herbaria, and data processing.
   b) Concept of the knowledge Δ.
   c) Much more needed than just adoption of

Experience in problems in a related area - genetic resource conservation - "gene banks".

Insert - See p. 3.

a particular computer program.

2. What needs to be managed?
   a) Purposes of use of system
   b) How does one determine need?
   c) " " " establish priorities
   d) " " " " costs and effectiveness.

Not only data, but types of officials, personnel, budgets, computers, programs

3. How does one select best system.
   a) Role of systems analyst
   b) Checking various types of problems-
      1) What needs are most critical for EDP?
         Inventory of collections (specimens) - Label data.
         Loan records?
         Taxonomic records (morphology, c-some, chemical)
      2) What computing facilities + personnel available.
      3) Which computer programs most useful.

This type of analysis, at the beginning, seems more costly, but experience has demonstrated that in the long run, a much more efficient and less costly.

Instructive in this vein is the report of Dr. G. Prance for the NY Botanical Garden. The type of investigation he made was guided in large measure by Tax. Lab.

Insert, bottom of p. 1.

Data alone are not useful - they must be communicated -

Information retrieval systems alone do not accomplish the communication -

Unless both are managed (or directed, or overseen) by competent, trained personnel, there is no use ~~beginning~~ changing the present system.

Fortunately, training in the management area, for problems in herbaria, is available.

Return to top of p. 2

TAXIR – see sheets of definition – p. 3 has a summary of the major features of the system

1. Philosophy behind development:
   a. Capable of using any and all data desired by the user – therefore a general system rather than restricted to one specified application.
   b. Capable of accomplishing all types of tasks required of any system:
      1) accept data in form most familiar and most useful to the user.
      2) respond to questions about the data of any complexity.
      3) allow additions, changes, or deletions
   c. Capable of most efficient use of computing machine technology.
   d. Be made available to any user within the context of free scientific interchange.

2. Abbreviated description of the system –
   a. The basic unit used to organize data is the item. – a specimen, or a taxon, or some concept.
   b. Each item is defined by descriptors, and the data are the descriptor states (values) under each descriptor for each item. (see definitions)
   c. Though there are practical limits, the number of items, descriptors and descriptor states is open-

management dictates that there be practical limits to the amount of information included in a single data bank.

2.d. - to make reasonable sized data banks (rather than a single enormous one) divide by logical divisions -

These banks, for specimen information, could be logically divided as

Specimen data

1. Finding + filing information, including:
   (a) Family, (b) genus (c) species (d) lower taxon designation.
   (e) Collector (f) Collector no., (g) date of collection.
   (h) Country (i) province or state (j) specific locality
   (k) Ecological province (l) altitude (m) soil type
2. Data on plant material contained, including
   (a) flower or fruiting, or both.
   (b) Morphological data -
   (c) chromosome counts + other c-some morph.
   (d) Other data.

For most purposes of the museum curator, #1 suffices.

As the data for #1 groups large - 30-50,000 - new data banks with logical groupings (by order, or by several related orders together) -

For more special purposes, several data banks, (or subsets from them) can be merged -

For the individual doing research, a different, specialized bank can be constructed, using TAXIR instructions -

Sept. 8, 1973

Mr. J. P. M. Brenan
Royal Botanic Gardens
Kew Richmond Surry
England

Dear Mr. Brenan:

I enclose a summary of my paper for the forthcoming EDP meetings.

May I suggest that, if you are sending prepaid air tickets, that the most direct and convenient schedule for me is as follows:

Denver - London via TWA 708, leaving at 1505, 1 Oct.

London - Denver via BOAC 569, leaving at 1400, 6 Oct., to Chicago.
Chicago - Denver via Continental 39, leaving at 1820.

Thank you for your considerations.

Sincerely yours,

David J. Rogers
Professor of Biology

Encl.

Royal Botanic Gardens
Kew Richmond Surrey

Telegrams Kewgar Richmond Surrey Telephone 01-940 1171

Please reply to The Director
Your reference

Our reference

QA/D737

Dear DJ Rogers

NATO SPECIAL PROGRAMME PANEL ON ECO-SCIENCES INTERNATIONAL MEETING ON THE USE OF ELECTRONIC DATA PROCESSING METHODS IN THE MAJOR EUROPEAN COLLECTIONS

TO BE HELD AT THE ROYAL BOTANIC GARDENS, KEW - 3rd to 6th OCTOBER 1973

The purpose of this letter is to give you further information about the above meeting and to seek details of your requirements for hotel accommodation.

Conference Papers

I enclose a provisional programme for the meeting. As the proceedings will be conducted entirely in English, it is likely that many delegates would find it easier to understand the discussions if they were provided with an abstract of the major contributions beforehand. The Organising Committee would therefore be very grateful if you could let the Secretary have an abstract of not more than 250 words of your paper by the beginning of September so as to allow time for the abstract to be reproduced and circulated to delegates. A final programme of the meeting, together with abstracts of other delegates' papers, will be forwarded to you before the meeting.

Hotel Accommodation and Catering

The Organising Committee will be pleased to book hotel accommodation for those delegates who would like them to do so. It has been provisionally arranged that delegates who book accommodation through the Committee will be housed in the Post House, a large modern hotel near London (Heathrow) Airport. Free transport is provided between the hotel and the Airport and the Organising Committee will provide transport between the hotel and conference sessions at the Royal Botanic Gardens, Kew. It is regretted that such transport cannot be provided for delegates who make their own hotel arrangements. If delegates wish to be accompanied by members of their families, the Committee will be pleased to make the necessary hotel bookings, but the delegate concerned would be responsible for meeting the additional cost. Lunch and mid-session refreshments will be provided on each day free of charge to all delegates.

Other arrangements

A dinner will be held for delegates on Thursday 4 October and transport will be provided; both dinner and transport will be free of charge. Delegates are asked to indicate on the enclosed form whether they wish to attend the dinner.

Between 1 30 and 2 30 pm on Friday 5 October all delegates who wish will have a short guided tour of the Royal Botanic Gardens, Kew. At 2 30 on that day a limited number of delegates will visit the electronic data processing section

of the British Museum (Natural History). The remaining delegates will have the opportunity to see more of the Royal Botanic Gardens. Delegates are asked to indicate their preference on the enclosed registration form.

Re-imbursement of Expenses

The Organising Committee will pay for a maximum of 1 delegate from each institution, the cost of travel, of hotel expenses from the evening of 2 October to the morning of 6 October only, and of incidental expenses. If any delegate requires hotel accommodation for any other night, this may be booked through the Committee at the delegate's own expense. Payment for appropriate delegates' air travel to England and back will be by means of a British Airways prepaid ticket advice which will be sent later via your local agent of British Airways. A payment based on the cost of accommodation at the Post House Hotel and incidental expenses will be distributed to appropriate delegates on arrival at the meeting. Delegates will therefore be asked to settle their own hotel accounts. As you will no doubt appreciate, the number of delegates who are expected to use the Post House Hotel has enabled the Committee to secure accommodation at a price which is considerably lower than would be charged by comparable hotels elsewhere in London. For this reason, delegates who decide to make their own hotel arrangements are asked to bear in mind that the hotel allowance, which in fairness to other delegates will be based based on costs at the Post House, may not be sufficient to meet the entire cost of accommodation elsewhere.

I would be very grateful if you could return the attached form giving details of your requirements for hotel, transport etc as soon as possible and in any case not later than the middle of August so as to give the Committee time to make the necessary arrangements.

Yours sincerely

JPMB.

J P M Brenan
for the Organising Committee

NATO ECO-SCIENCES SPECIAL PANEL EDP MEETING

At Royal Botanic Gardens, Kew - October 1973

PROVISIONAL PROGRAMME

Tuesday 2 October — Participants assemble by evening

Wednesday 3 October

am	10.00 - 10.15	Welcome by Professor J Heslop-Harrison (Royal Botanic Gardens, Kew)
	10.15 - 10.30	Introductory remarks by Professor J G H Hawkes (Birmingham University)
	10.15 - 10.45	NATO Involvement - Dr A Rannestad (NATO Scientific Affairs Division)
	10.45 - 11.15	Coffee
Focus on problems	(11.15 - 11.45	Mr J P M Brenan (Royal Botanic Gardens, Kew)
	(11.45 - 12.15	Mr D M Henderson (Royal Botanic Garden, Edinburgh)
pm	12.15 - 2.30	Lunch
Focus on Problems (cont'd	2.30 - 4.00	Speakers to include Mr R Ross (British Museum, Natural History)
	4.00 - 4.30	Tea
	4.30 - 5.00	Discussion

Thursday 4 October

am	(9.30 - 10.15	Dr S G Shetler (Flora North America, Washington)
	(10.15 - 11.00	Dr F Perring (Biological Records Centre, Monks Wood England)
	(11.00 - 11.30	Coffee
	(11.30 - 12.15	Dr S Greene (British Antarctic Survey, Birmingham)
pm	(12.15 - 12.30	Discussion
Systems and applications	(12.30 - 2.00	Lunch
	(2.00 - 2.45	Dr R A Brown (American Horticultural Society)
	(2.45 - 3.30	Dr J L Cutbill (Cambridge University)
	(3.30 - 3.45	Tea
	(3.45 - 4.30	Dr D J Rogers (University of Colorado)
	(4.30 - 5.15	Dr J F Mello (Smithsonian Institution, Washington)

Friday 5 October

am	9.30 - 10.15	Dr J H Soper (National Museum of Natural Science, Ottawa)
	10.15 - 11.00	Dr J Cullen (Royal Botanic Garden, Edinburgh)
	11.00 - 11.30	Coffee
	11.30 - 12.15	Dr D B Williams (British Museum, Natural History)
pm	12.15 - 12.30	Discussion
	12.30 - 1.30	Lunch
	1.30 - 2.30	Guided tour of Royal Botanic Gardens, Kew
	2.30 onwards	Alternative programmes: Further visits to Royal Botanic Gardens or visit to EDP Section of British Museum (Natural History)

Saturday 6 October

am 10.00 - 11.30 (approximately). Discussion and ratification of recommendations.

It is suggested that recommendations from participants in the meeting be welcomed and invited until mid-day on Friday 5th October. At that stage a small drafting committee takes them away, works on them and submits them to the meeting on the morning of 6 October (the drafting committee to submit recommendations in English).

NATO ECO-SCIENCES SPECIAL PANEL EDP MEETING

Introductory Remarks

J.G. Hawkes (Birmingham)

The purpose of this meeting is to explore areas where electronic data processing can be of help in the storage and retrieval of information concerned with herbarium and other preserved material.

In the scientific world today there is an information explosion which has to quite an extent taken us all unawares. Those of us concerned with taxonomic research have to deal with the ever-increasing volume of literature. Those of us concerned with the organization and direction of herbaria are becoming overburdened with the ever-increasing volume of specimens and the information linked with them.

There is no doubt that in European Herbaria, as in those from other parts of the world, we have reached a point when the information content of our collections can no longer be handled by the time-honoured methods of hand-written lists and simple card-index systems.

Nowadays in very many fields computers are helping us to store and handle information in a variety of ways that would have been impossible previously.

In herbaria, too, the time has already come when we need the aid of computers to store, sort and retrieve the data linked to specimens and the ways in which the specimens themselves are stored and sorted. It must be quite clear to all of us here that computers by themselves are useless. Without the proper sorting and presentation of our data and without the proper programming of the computer for handling that data we shall obtain no help from the computer at-all.

So, in reality, electronic data processing by means of computers is something we can take for granted as a concept. What is more important is the development of systems of information management. In other words, we must understand and take agreed and concerted action on how to handle the data. This is the area to which our thoughts must be directed.

There are many data management systems available, each with some advantages and some disadvantages. It is clearly most important for us at this conference to discuss these systems and try to agree on the unified use of one of them. In this way, our

information will be freely exchangeable between one Institute and another, and the methods used can be easily understood from country to country.

It is perhaps worth mentioning here that the management of information by computer-based methods is by no means confined to collections of preserved specimens. Many of us have been concerned for a number of years in establishing unified information systems for what are spoken of as plant genetic resources. By this phrase is meant the living collections of seeds or plants which are preserved for the use of plant breeders and geneticists, and which represent the end products of many thousands of years of evolution under domestication. As an example, work is in progress at Kew and elsewhere to preserve in a living state the seeds of interesting and threatened wild species in seed banks. Computer based data banks are necessary to store and sort the information on these.

Clearly these seed banks, gene banks or germ plasm collections present the same problems of data management as do the preserved collections which we are to be discussing during this present conference. And indeed, if we can find it possible to agree on the same information management systems for museum collections of preserved plants and animals as we use for collections of living seeds and tissue cultures then we shall have taken an extremely important step indeed.

So much for the general aspects of the problem. I should like to continue with a few remarks on how the organising committee has attempted to structure the programme of this meeting.

In the first place we wanted to try and focus on the problems by asking a number of herbarium directors to say what sort of problems exist and how they would like to see solutions worked out, not in detail, but in general terms. In other words we want to begin by identifying the problems, most of which will be common to all herberia. It is hoped that these papers will bring out ideas from other delegates related to the sort of information they would like to obtain from their own collections but have been unable to do so under present circumstances through lack of electronic data processing methods.

On Thursday we shall be hearing from various speakers about the various information systems they are using and how these are being applied to the information problems they wish to solve.

On Friday the discussion will lead on to other systems with which botanical information systems will need to be compared. In other words we shall look at system interfaces, or compatibility of systems.

Finally, on Saturday morning we shall be engaged in the discussion and ratification of recommendations and proposals which have been sent in to the drafting committee during the conference. In this way we hope that this meeting will provide some very clear and generally agreed conclusions. It is hoped also that it will be possible to reach agreement on a system for general future adoption among the major European institutions. If such agreement can be reached for Europe it is likely to lead on in due course to far-reaching agreements over the world as a whole.

EDP-Kew 3-6 Oct.

Notes of meeting P.L

Provide a MS – NOW!

30 Oct.

Hawkes – chmn or q. comm.

Rauneskad – NATO.

Pat Brennan

Needs + priorities of herb. –

Size of herbaria – 4-5 m spec. in Kew

30 K liquid – and seeds, photos, drawings.

Kew's living collections.

1. Types – 300,000 + in Kew.
2. Conservation of genetic resources. + herb. records –
3. Economic uses – label data.
4. Vernacular names –
5. Vouchers for non-taxonomic res.
6. Items of special research interest –
7. Geographic survey of genera + species.
8. Standardized catalog of recognized family + genera.

Cost-effectiveness – Brennan said it.

Henderson – Edinburgh

Ascert content of data in herb. + their value.

Reference to herbarium sheets –

Obviously have to make an arbitrary standard (!)(?)

Omit authority names –

Validity of input data –

Suggests a pilot scheme.

Henderson (cont) -
Started with names, went to geography, then
ecology -
collector + date.
"should do it all at once rather than
go over it again".

3 Oct, PM.

Ross -
Data other than herb. specs.
1. Alcohol (+ other) collections.
2. Box collect. - bulky material, micro slides.
3 anatomical - autonomous from herb. material.
(descript. include thickness, orientation, staining,
part of plant, etc.)
4. Collections of microscopic objects - problem of
2 types of organism on one slide.

Gomez - Pompa -
System for herb.

Thurs. Oct. 4, 1973 - EDP - Kew -

AM. Shetler - F.N.A. lost his funds.
Speaks essentially of management -
Says out but mostly wanted is
hard-copy -
Very few interactive queries -
Synonymy - of format.

Perring -
Very conservative on use of computers -
Forgets that this idea of use of computers
is the 1st new concept in handling data
since invention of the printing press.
Forgets what else besides primary user the
data processing can be used - secondary users -
such as administrators & workers
To keep costs in context, consider that
our whole efforts have cost less than
one 747 airplane -
Education needed in all phases - ~~the~~ operators,
scientists, users -
Question use of data if it were captured

Elegant presentation, apparently used
~~Arguments but not~~ a non intuitive, but excellent,
systems analysis of needs

Does not want any pilot projects! -

Oct 4 AM

Stan Greene - Data bank of Antarctic Bot. Survey.
Describes a simplified IR system for
a relatively small total data bank.
Total fixed field, coded.

Recommendations

1. A small, carefully selected, working group of European herbarium taxonomists be selected to discuss the most appropriate and economical and ~~useful~~ means to adopt EDP systems ~~to Problems for~~ Data management in herbaria.

2. The selected committee should be charged to employ a management scientist to guide its functions.

3. The selected committee should use a very precise means to compare the values of various computer programs for information retrieval on a scientific basis. Such a precise means is a so-called "bench-mark" test, in which a range of herbarium

Oct. 4 - PM

Brown - AHS - AABG - PRC

Cuthill - Cambridge

⇒ Large cost of system development - for each endeavor -

Big discussion on standards - a general algorithm for setting standards - Looks like a useful thing -

Cuthill sending tape for conversion

Wants to know how fast this can be done.

Oct. 5 - AM

Soper - mapping -

mentioned Bob Adams work at CSU.

J. Cullen - Edinburgh.

Discussion on input data format.

Williams -

NOV 26 1973

Royal Botanic Gardens
Kew Richmond Surrey

Telegrams Kewgar Richmond Surrey Telephone 01-940 1171

Please reply to The Director
Your reference

Our reference

Date

Dear Dr. Rogers,

NATO ECO-SCIENCES PANEL EDP MEETING ROYAL BOTANIC GARDENS, KEW - 3-6 OCTOBER 1973

I am writing on behalf of the Organising Committee to record my thanks for your attendance at and participation in the above Meeting.

I enclose for your information a substantive text of the Meeting's recommendations, as agreed by delegates on the last day.

Many who participated in the Meeting have asked that we should prepare a complete list of participants' names and addresses so that contacts made at the Meeting could be maintained. A copy of this list is enclosed.

You may also be interested to see the enclosed reprint of the article which appeared in the journal "Nature" (Volume 246) on 9 November as the first stage of publicising the Meeting's recommendations.

Yours sincerely

J P M Brenan
for the Organising Committee

INTERNATIONAL MEETING ON THE USE OF ELECTRONIC DATA-PROCESSING METHODS IN MAJOR EUROPEAN COLLECTIONS

SPONSORED BY NATO ECO-SCIENCES SPECIAL PANEL

ROYAL BOTANIC GARDENS, KEW, OCTOBER 1973

The following resolutions were passed:-

This Conference agrees:-

1. That data-banks related to plant collections should have an identical minimal standard set of descriptors, in the first instance based upon herbarium label-data.
2. That a Working Party be set up to advise, in the first instance, European herbaria upon the sets of descriptors referred to in proposal 1.
3. That individual herbaria should co-operate with their national organisations (where available) to create widely acceptable standards.
   That national organisations should be encouraged to work through the International Committee on Museums (ICOM) towards an international standard for documentation.
4. To recommend to the Organising Committee of the Leningrad International Botanical Congress (1976) that the matter of EDP in taxonomic collections in the widest sense, including living collections, seed-banks, etc, should be discussed at the Congress and that the desirability should be considered of setting up a permanent international Commission for the co-ordination of EDP in such collections.
5. That the Working Party, in addition to carrying out its primary function, of advising upon the sets of descriptors, should also deliberate upon software and systems, and the possibility of establishing a pilot project in one or more European institutions.
6. That the Working Party shall be empowered to consider and advise national herbaria on the appropriate steps to be taken for forming an international type-register.
7. That to promote the start of data-banks on a national and international scale, it is necessary that funds are allocated by international organisations.
   This Conference recommends that an approach be made by the relevant bodies to the appropriate United Nations agencies, in the first instance UNESCO and UNEP, in solicitation of support for work of this type.
8. That the Organising Committee responsible for the organisation of this EDP Conference remains in being for a further period of time to make detailed arrangements for publication.
9. That the Organising Committee responsible for the organisation of this EDP Conference remains in being for a further period of time to supervise the setting up of the Working Party. Suggestions will be entertained by the Organising Committee, who will set up the Working Party with due regard to geographical representation and technical qualifications.

HERBARIA

Data Processing

from a Correspondent

ELECTRONIC data processing (EDP) has hitherto been used in very few herbaria, mostly for comparatively small projects, and its scope in the larger herbaria, particularly in Europe where most are located, has been hardly considered. An international meeting at the Royal Botanic Gardens, Kew, from October 3–6, had as its purposes to explore areas where EDP can help in herbaria and associated collections, and to ensure that future developments in the larger European herbaria shall be as far as possible compatible and their results internationally available. The NATO Eco-Sciences Panel acted as sponsor.

After introductions by Professor J. Heslop-Harrison, representing Kew, Professor J. G. Hawkes, chairman of the organising committee of the meeting, and Dr A. Rannestad, representing NATO, the contributions on the first day were chiefly focused on the scope of EDP in herbaria.

J. P. M. Brenan (Kew) described the priorities for EDP in a principal international herbarium, given that staff and finance are limiting factors. R. Ross (British Museum (Natural History)) spoke on the relationship between herbarium records and others, recognising that most important herbaria are associated with ancillary collections or living collections or, in the case of museums, with collections belonging to other disciplines. D. M. Henderson (Royal Botanic Garden, Edinburgh) discussed the problems presented in adapting label data on specimens for EDP purposes. The importance of this aspect is apparent from one of the resolutions passed at the end of this meeting. A. Gomez-Pompa and J. A. Toledo (National University of Mexico) and A. V. Hall (University of Cape Town) described operational schemes in their collections; the Mexican scheme involves a computerised record of the flora of Veracruz.

The general theme of the second day was to consider various EDP systems currently in use to give delegates an opportunity of asking questions and making comparisons. S. G. Shelter (Smithsonian Institution, Washington) described the ambitious and far-reaching Flora North America project—a data bank which uses the GIS system. The general collections at the Smithsonian Institution are recorded by a general-purpose information system called SELGEM, which was described by J. F. Mello. D. J. Rogers (University of Colorado) expounded the well-known TAXIR system devised for taxonomic purposes. The principles of general-purpose filing systems as devised by the Information Retrieval Group of the Museums Association (IRGMA) were described by J. L. Cutbill (University of Cambridge). This system is basic to the programme for computerising the geological collections at the Sedgwick Museum in Cambridge. S. W. and D. M. Greene (British Antarctic Survey, Birmingham) described the principles behind the computerising of some 30,000 herbarium specimens in the Botanical Section of the British Antarctic Survey. F. H. Perring (Biological Records Centre, Monks Wood) spoke on EDP operations at the centre and made the point that many data can be handled by non-computerised methods, particularly microfilm and microfiche.

Many herbaria are linked with botanic gardens, the computerisation of whose living collections presents, of course, parallel problems. R. A. Brown (American Horticultural Society) described the recording system used at the Plant Records Center where a standardised system has been developed for recording and reporting information on plants cultivated in the principal North American botanical gardens and arboreta. At present the data files contain more than 170,000 records. This theme was later developed by J. Cullen who described the operation of the living plant record system at the Royal Botanic Garden, Edinburgh.

EDP systems in herbaria thus have an interface with similar systems for living collections. With the probable future international development of genetic resource centres, this is likely to increase in importance. Other discussions included the important application of herbarium label data to computerised mapping of plant distributions as developed in the National Herbarium of Canada in Ottawa. A further example was provided by D. B. Williams (British Museum (Natural History)) who discussed the link often found in principal museums between botanical and zoological collections, and described some of the special problems of the latter.

During the conference, recommendations were invited from participants, which were edited by a drafting committee, and put to discussion and vote by the delegates on the last day. The following is a summary of the principal resolutions which were passed, all of them either unanimously or by a very large majority:

(1) Data banks for plant collections should have a common minimal-standard set of descriptors based primarily on label data.

(2) A working party is to be set up to advise European herbaria on the set of descriptors referred to under (1).

(3) Individual herbaria should cooperate with national organisations, and national organisations should be encouraged to work through the International Committee on Museums (ICOM) towards widely-acceptable international standards of documentation.

(4) A recommendation will be sent to the Organising Committee of the International Botanical Congress, to be held in Leningrad in 1976, that EDP in taxonomic collections should be discussed and that consideration should be given to setting up a permanent International Commission to coordinate this.

(5) The working party will also consider systems and the possibility of establishing a pilot project in Europe.

(6) The working party will consider and advise on steps to form an international type-register.

(7) Relevant bodies should be encouraged to approach the appropriate United Nations agencies, particularly UNESCO and UNEP, to obtain funds for data banks on a national and international scale.

CELL MEMBRANE

Mobility of Surface Sites

from a Correspondent

MEMBRANE fluidity is certainly one of the most pervasive themes to have emerged in cell biology in recent years. The casual reader will be forgiven for believing that many cell biologists nowadays spend a considerable part of their time moving proteins around a sea of membrane lipid in a delightful molecular version of childhood pursuits. The carbohydrate binding proteins, for example concanavalin A which binds specifically to glucose or mannose-containing structures, are favourite probes for studying the mobility of molecules in the plane of the membrane. It is now widely believed that cell agglutination by con A results somehow from reorganisation of the cell surface to increase the ability of con A receptor sites to move together to form clusters and in the extreme case to 'cap' at one pole of the cell.

Tagging con A molecules with fluorescein allows application of a simple visual technique to the most sophisticated biological problems. A particularly interesting example has been described by Inbar, Ben-Bassat, Fibach and Sachs (*Proc. natn. Acad. Sci., U.S.A.*, **70**, 2577; 1973) who have found that the ability of mouse myeloid leukaemic cells to differentiate into phagocyte cells is related apparently to the fluid state of the surface membrane. Earlier work by Sachs and his colleagues had shown that normal, undifferentiated haematopoietic cells transform *in vitro* into mature differentiated

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