DEVELOPMENT OF THE BOTANICAL ACCESSIONS RECORDS SYSTEM

by

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Dedicated to

Mr. and Mrs. James W. Lambert, my parents,

who opened the doors of learning.

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INTRODUCTION

There are approximately 250 botanical gardens and arboreta in North America. While the institutions differ in specific activities, each is generally devoted to at least three major purposes, which are 1) to collect and preserve plants, 2) to conduct research in plant science, and 3) to increase awareness of plants through educational programs and plant displays. The relative emphasis placed on these purposes depends on the institution's location, history, budget, and personnel. Hence, although they share common goals, each institution is unique.

No matter how they differ in philosophy or operation, botanical gardens and arboreta have one essential aspect in common, the need for keeping complete and accurate records of accessions in their plant collections. Records support every facet of an institution's activities to some degree. This principle is readily apparent when considering the maintenance of plant collections, but good records are also essential to successful research and educational activities.

Complete, accurate, and rapidly accessible records that are in a readily understandable and usable form are also essential to effective information sharing among colleagues. Most of the North American botanical gardens and arboreta are affiliated with the American Association of Botanical Gardens and Arboreta (AABGA) for the purpose of cooperation and information exchange within the field. Improved records management has often been a matter of concern for the AABGA.

The purpose of the work presented here is to assess the need and develop the software for a model computerized accessions records management system applicable to needs and goals of the botanical garden and arboretum field.

LITERATURE REVIEW

Richard Brown, who helped develop the Plant Sciences Data Center (PSDC) for the American Horticultural Society, outlined some basic premises for a plant records system as follows (3):

> The basic purpose of a botanic garden record system must be to accurately reflect and support, in a convenient manner, the status of the living plant collection. Every plant which warrants a reserved space within the collection, deserves, and should be guaranteed, accurate representation within the plant records system. Given a particular plant, one must be able to readily locate the counterpart within the collection or record file. Once this requirement is satisfied then each part- the record or the plant- justifies the existence of the other. ...It must be easy to use, requiring a minimal amount of information to enter the system...The components should be durable enough to withstand years of use and large enough to contain all the information associated with projected collection size.

These comments refer to the traditional card-and-file systems, typical of most botanical gardens and arboreta, but they can also be applied to a computerized records system.

Increased information handling capability and productivity through computerization have been mainly limited to large businesses and institutions in the past. However, quickly advancing technology has resulted in increasing computer ability at a declining cost. Small businesses with records management needs similar to botanical gardens and arboreta are now joining the ranks of computer owners who have realized the benefits of computerization (9).

Most botanical gardens and arboreta are not currently employing institution-owned computer systems for their records management, but there are examples where records computerization has been employed. The Matthaei Botanical Garden at the University of Michigan in Ann Arbor computerized their records system in 1976. They use an existing information system, available on the Michigan Terminal System, called TAXIR (Taxonomic Information Retrieval). Although TAXIR has proved to be very valuable in the daily operations at Matthaei Botanical Garden, the system was not designed specifically for botanical garden records management and is unavailable to institutions not on the Michigan Terminal System (7).

The Plant Sciences Data Center (PSDC) was established in 1968 with the cooperation of the AABGA, the American Horticultural Society and the Longwood Foundation. Its purpose is to serve as a national data collection center for information on living plants at the major botanical gardens and arboreta of North America. Plant records are maintained by a computer which enables the records to be manipulated and disseminated to interested researchers, garden managers, and amateur horticulturists. Cooperating institutions submit coded record forms to the PSDC for entry into the data base. The data base can be utilized to produce a variety of reports, or listings of plant records, depending on the information requested (1,3).

The Royal Botanic Garden in Edinburgh, Scotland and the Kew Botanic Gardens in Great Britain have also found computerization to be a valuable tool. James Cullen, at the Royal Botanic Garden, has cited examples where computerization of the plant records at Edinburgh has aided in collection planning (5). The Kew Botanic Gardens have cooperated with the National Trust in Great Britian to computerize a national survey and cataloging project of the trees on National Trust properties. This effort resulted in the "Woody Plant Catalogue", a centralized national plant record system which has enabled the National Trust to examine its many vegetative holdings in the national context (11).

JUSTIFICATION

The direction for this project was influenced by the perspectives and philosophies of many professionals in the field of botanical gardens and arboreta who have expressed concern for the future of their field.

A major concern for botanical gardens and arboreta, and for most institutions in these times, is economic survival. Roy Taylor, of the University of British Columbia Botanical Garden, stated (10):

> There is no question that dwindling budgets put increased pressure on botanical gardens and arboreta to develop better management procedures for programs that may soon disappear.

Records management is a basic supporting activity for nearly all other programs of an institution. It follows, then, that improved efficiency in records management would result in increased productivity and better management of record-dependent programs. By lessening the burden of manual records management, valuable personnel time could be devoted to more productive programs.

Howard S. Irwin (6), president of the New York Botanical Garden, in his keynote address to the 1979 AABGA National Meeting addressed the issues of balancing budgets and the accountibility of institutions to their constituents. According to Mr. Irwin, botanical gardens and arboreta are accountable to their users and supporters for the quality, efficiency and productivity of the institutions activities. Richard Lighty, director of the Longwood Program of the University of Delaware, also emphasized this point during his term as president of the AABGA (8):

> THE HANDWRITING IS ON THE WALL. As funds for cultural properties become scarce and demand for the remainder increases, we are going to be asked to justify not only what we do, but how well we do it...in twenty years we will know which of our institutions have met this challenge - they will be the ones remaining. ...The use and care of collections, exploitation of revenue resources, the efficient use of resources, public service roles, exhibits and attractions are all areas where we must critically examine our performance.

Since records are supportive of most activities and better records management implies potential improvement of these activities, institutions which choose a course of progress and improvement through computerization will increase their overall quality and accountibility to their constituents. This in turn improves the potential for future success both economically and professionally.

John L. Creech, past director of the U.S. National Arboretum in Washington D.C. stated (4): "We cannot escape the responsibility of making our resources widely available." When records accession is a time-consuming process, botanical gardens and arboreta are less likely to encourage public inquiries for information. Responsiveness to public needs, though, can potentially lead to public involvement and awareness and, ultimately, a larger reservoir of economic support. Computerization of records can provide the quicker, more efficient response to information requests from amateur and professional sources. Also, with increased ability in records management, institutions could increase accountability to users by expanding services.

James Cullen, of the Royal Botanical Garden in Edinburgh, stated (5):

> In many ways the record system is the heart of collection planning in a botanic garden. Without a record system of some kind, a garden cannot really be considered as a scientific collection. The record system allows the collection to be planned in a scientific manner, in accordance with the policies and purposes of the institution, whatever they may be.

This need for comprehensive planning of plant collections has also been expressed by Roy Taylor (10) of the University of British Columbia Botanical Garden. He encourages institutions to review their collections in light of the goals and objectives they have established. He points out that increased pressure from decreasing budgets and rising costs, and the fact that a large percentage of personnel time is devoted to caring for individual specimens, should be reason for garden managers to review the function of each plant with regard to the overall purpose of each collection.

This is, of course, a monumental proposition considering the numbers of plants involved in some collections. Nevertheless, the endeavor merits consideration, and computerization could alleviate the inhibiting effects of a cumbersome record system in carrying it out. The Royal Botanic Garden at Edinburgh has found that computerization of their records has enabled examination of collections and development of a planning strategy. Their strategy includes the establishment of a priority list to aid in acquisition of new specimens and in removal of duplicated or out of place specimens (11).

James Cullen indicates that the scope of this need will become increasingly broad (5):

> In the future, as resources become even more scarce, the planning of collections will have to move from the sphere of the individual garden to that of umbrella organizations like the AABGA.

A centralized national data base of plant records offers many opportunities for planning on the national scale. This has been demonstrated both by the establishment of the "Woody Plant Catalogue" of the National Trust in Great Britian and the PSDC in North America. However, since the institutions participating in PSDC's data collection cannot readily access the computerized records, daily operations and management decisions are not greatly benefitted by this service.

The trend of developing specialized, unique computer software systems for each institution will inevitably continue as institutions realize the advantages of computerization. On the other hand, a standardized, computerized accessions records system adopted by the AABGA and then implemented in AABGA-member institutions would provide local and national planning opportunities at the same time. By using the same basic computer software, participating institutions could access records from other institutions by direct phone transfer. This eliminates both the middleman and the mailman and streamlines the sharing of valuable accessions information among institutions. A system such as this would open a new world of information exchange to botanical gardens and arboreta, and as stated by Richard Lighty (8):

> Efficiency can be gained by working together on aspects of mutual interest and benefit- isn't that what association means?

METHODS AND MATERIALS

CONCEPT DEVELOPMENT

The concept for this project originated in the winter of 1980 with the author's involvement in the Virginia Tech Arboretum restoration project. During the mapping and inventory of existing plant material, the benefits of computerizing these records became obvious.

An initial review of the literature revealed that few botanical gardens or arboreta had computerized their records. Upon attending the national meeting of the AABGA in the spring of 1980, the author found the idea of computerization on the mind of many curators and directors. At that point the scope of this project was established. It was realized that development of a computerized accessions records system, adaptable and available to any institution, could lead to increased efficiency in the records management throughout the botanical garden and arboretum field.

TRAVEL AND CORRESPONDENCE

A general lack of literature directly related to plant records led to direct correspondence with those involved in records maintenance at botanical gardens and arboreta. Several institutions were visited to examine their record systems first hand and develop a perspective on the records management needs and problems. Both large institutions, such as Longwood Gardens, and small institutions, like the Orland E. White Arboretum at Boyce, Virginia, were visited. The marked contrasts in size of collections, number of staff and available funds were noted.

EXAMINING RECORD TYPES

Record types include all the individual information entries included on the record for a given plant in the collection. Inquiries revealed that many types of plant accession records are possible and that institutions differ in some of the record types used. This results from the varied interests and activities found in the field. Certain record types were found in all record systems and were considered essential for inclusion in the proposed system.

Computerization should increase capability within time limitations. Therefore, some of the less common record types, which were not included in some systems for lack of staff time, were determined to be valuable enough for inclusion in a computerized system. To account for the many unique record types that may occur, but which could not be anticipated, a degree of openendedness was proposed for the system. This flexibility was attained by utilizing some general categories that would enable institutions to include their unique record types. The record types selected for inclusion will be discussed in Chapter 5.

HARDWARE CONSIDERATIONS

Computer software (the programs) must be designed for implementation with specific hardware (the machine). This fact made it important to establish the magnitude of the records to be managed. The total number of plant accessions that institutions maintain is quite variable. A very "small" computer may be sufficient for one institution, where another institution may require a considerably "larger" computer.

If only plant accession information is to be maintained by computer, it would be appropriate to develop separate software packages to accomodate both "small" and "large" applications. However, it is important to note that a numerous software packages are available to aid institutions with their business responsibilities also. These accounting, payroll and word processing packages could make as significant an impact on the operations of botanical gardens and arboreta as a computerized plant records system. In addition, the availability of hardware capable of handling larger volumes of research data and having statistical analysis capabilities would lead to improved research productivity. To allow for these projected multiple uses, the small, single-user micro computers were ruled out, and the decision was made to utilize larger hardware adaptable for many applications of computer technology.

This might appear to exclude smaller institutions whose business records may not warrant the increased cost of computerization. An optional approach does exist for them. Large institutions, capable of justifying the initial investment in hardware, could offer timesharing opportunities to other institutions for a fee. This would help reduce the overhead costs for the purchasing institution and enable the cooperating institution to afford the increased capabilities. Cooperating institutions would only need to purchase terminals, printers and acoustic couplers to have the advantages of the "larger" hardware's capabilities.

THE SELECTED HARDWARE

After a period of consultation with computer scientists, the appropriate hardware was selected for the proposed system. The Hewlett-Packard Model 3000 "family" of computers (H-P 3000 family) were selected since these computers were shown to be "large" enough for all projected uses and have a good reputation in the computer field. Within the H-P 3000 family, there is a wide range of hardware to suit the needs of the botanical garden or arboretum. The H-P 3000 computers have multi-terminal capabilities and expandable memory capacity. In addition, software designed for the H-P 3000 family is compatible with any of the larger Hewlett-Packard hardware, allowing for nearly unlimited timesharing opportunities.

DEVELOPMENT OF THE SOFTWARE

In order to assure that the most current technology and data base design methodologies were incorporated into the proposed software, the assistance of an experienced computer systems analyst was required. The aid of Mr. Robert Larkin, a member of the Radford University Computing Center staff, was solicited for this segment of development. Mr. Larkin's training and experience in data base design (with Hewlett-Packard computer systems) provided valuable insight for the successful design of the proposed system.

After establishing the initial criteria for the system, such as ease-of-use, flexibility and expandability, the specific criteria for the system content and capability were developed. Computer-related limitations and practical considerations encountered during the software development led to the constant need for cooperation between the author and Mr. Larkin. This cooperative effort insured that both horticultural needs and operational criteria were met.

THE BOTANICAL ACCESSIONS RECORDS SYSTEM

INTRODUCTION

The Botanical Accessions Records System, hereafter referred to as BARS, is a computer software system. BARS consists of a data base, containing all of the plant accession records and computer programs which enable the records in the data base to be managed. The organization of the system is illustrated in Figure 1. Five features, which will be discussed in this chapter, are included in the initial system, but supplementary, special purpose programs, or subsystems, may be readily added to the system as needed.

The Hewlett-Packard "IMAGE" interface control was used in the data base design and the programs were written in Cobol. "IMAGE" is supported on the H-P Model 3000 and "larger" hardware such that expansion of memory capacity is readily accomplished without software updating.

THE RECORD TYPES

The four principle categories of information for each accession record are presented in Figure 2. The first category is called "Accessions" and includes the accession number and the scientific name of the plant. The first two digits of the accession number denote the year of acquisition and the following six numbers are assigned sequentially throughout the year. An accession number can

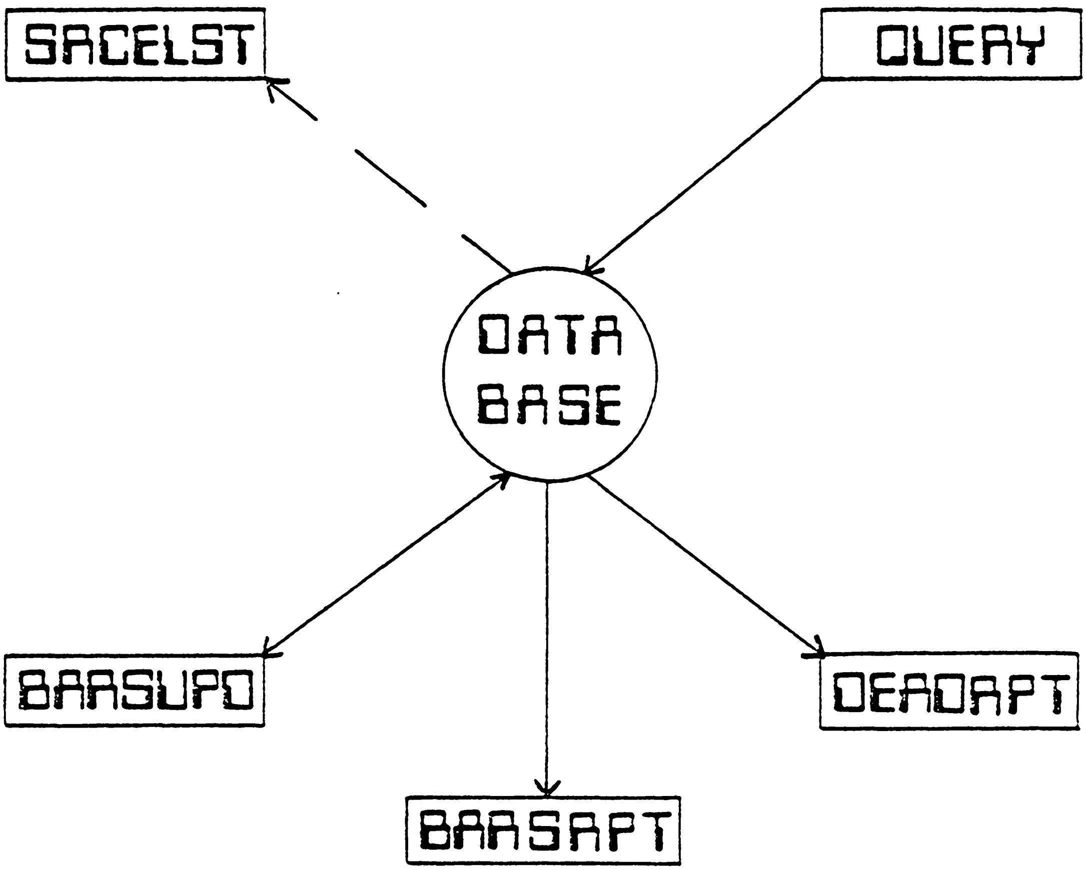


Figure 1: System Organization

"ACCESSIONS"	"BOTANICAL"
ACCESSION NUMBER	COMMON NAME
GENUS	FAMILY
SPECIFIC EPITHET	BOTANICAL AUTHORITY
VARIETY	
CULTIVAR	

"SOURCE/STATUS"	
CODE & INITIAL	DESCRIPTION/HABIT
SOURCE	LOCATION
PURPOSE	LABEL
COST	DEAD

"COMMENTS"

Figure 2: Records Included in System

be assigned for an individual plant or a lot of cuttings, seeds or seedlings. When an individual plant from the lot is put in the permanent collection it would be given its own number and the source noted as the accession number of the lot. The scientific name includes genus, specific epithet, variety and cultivar. For infraspecific categories and such designations as forma, the record can be entered in the spaces designed for cultivar and preceded by an abbreviation or code such as fm. for forma.

The second category is called "Botanical" and includes the common name, family, and botanical authority. A single common name must be designated for use in the data base.

The third category of records is called "Source/Status" and includes a code designating the accession as collected, a gift, an exchange, or a purchase, plus a space for entering the initials of the receiver, collector, etc. Source, description, purpose, location and label status are also included in this category as standardized reference codes selected by the user institution. A cost record is included as an aid in assessing the value of collections. The dead record enables an expired accession to be included in the "dead file" which will be discussed later.

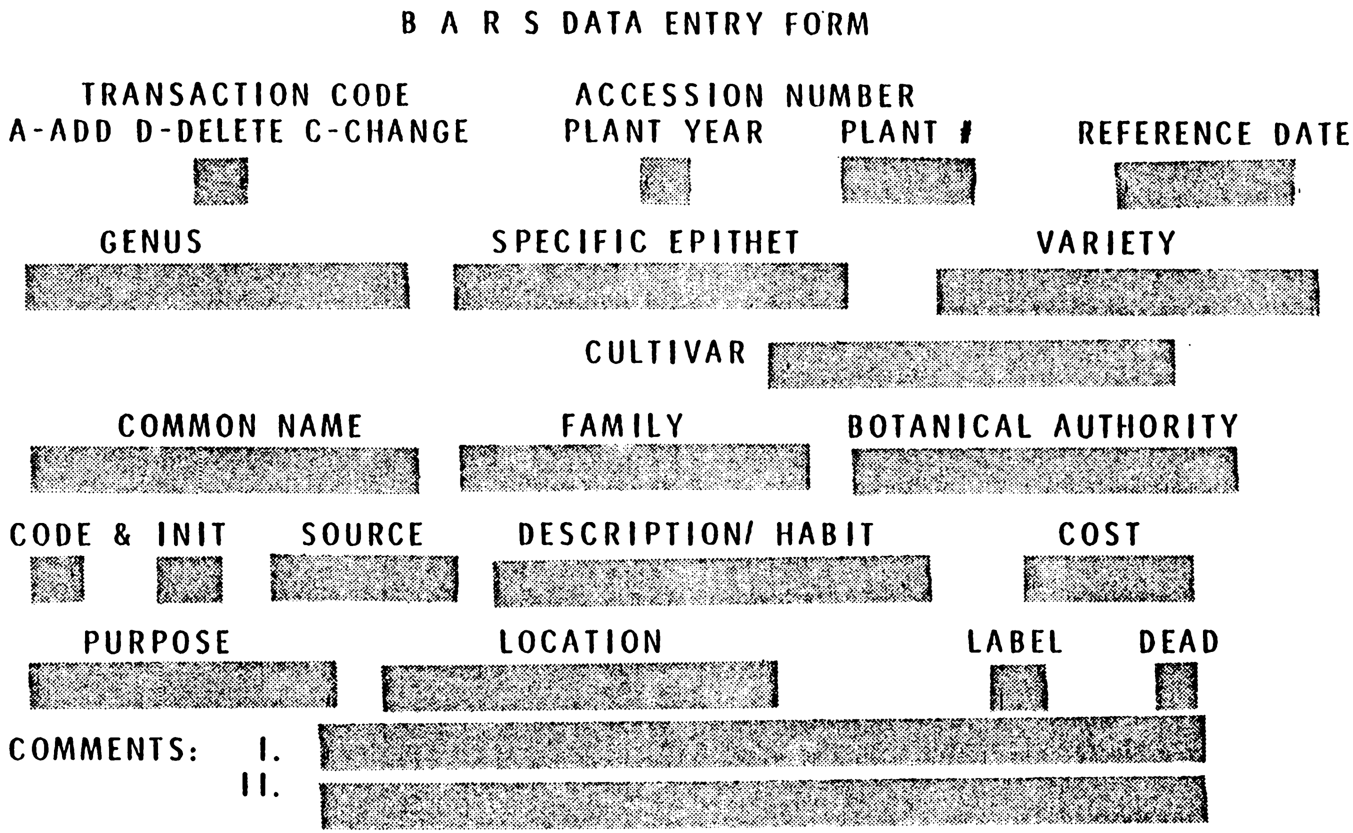
The final category of records is called "Comments". There are two comments possible of 50 spaces each. This record category lends an openendedness to the data base since it can be used for any record type not included in the previous categories. Plant evaluation information, identification characteristics, or pest problems are examples of potential record types that could be included in "Comments".

BARSUPD

BARSUPD, the BARS updating program, enables records in the data base to be added, deleted, or changed. When BARSUPD is requested, a blank BARS DATA ENTRY FORM (illustrated in Figure 3) appears on the terminal screen. Headings for each record type appear over shaded boxes into which the appropriate record is typed.

The initial function of BARSUPD is to enter records into the data base. This function is initiated by typing "A" (add) into the transaction code. The current year and next sequential plant number available are automatically assigned as the accession number for the entry. The automatic assignment of accession number may be manually overridden by simply typing the desired accession number over the assigned number.

All functions of the BARSUPD program are designed to operate in the block mode. This means that the whole data entry form must be "entered" before any additions, changes or deletions are performed in the data base. This feature allows for "proofreading" the entire form, and for making subsequent corrections, before the data base is altered.


B A R S DATA ENTRY FORM

TRANSACTION CODE
A-ADD D-DELETE C-CHANGE

ACCESSION NUMBER
PLANT YEAR PLANT #

REFERENCE DATE

GENUS SPECIFIC EPITHET VARIETY

CULTIVAR

COMMON NAME FAMILY BOTANICAL AUTHORITY

CODE & INIT SOURCE DESCRIPTION/ HABIT COST

PURPOSE LOCATION LABEL DEAD

COMMENTS: I.
II.

Figure 3: Screen Display for BARSUPD Program

Improved accuracy and efficiency are realized when block mode is utilized for data base interaction.

Existing records are readily updated with this program. Upon entering the transaction code "C" and the desired accession number, the desired plant's information is displayed. Changes are then made, and the corrected records are safely filed back in the data base by entering the form.

The deletion function of BARSUPD is accomplished by entering "D" in the transaction code and the desired accession number. The information for that plant will appear on the screen. When the form is entered, this record is completely deleted from the data base, and the accession number previously assigned would be available for use with a new plant record.

Each record type is necessarily limited to a certain number of characters or digits. The scaling of all botanically related record types was accomplished by reference to Hortus Third (2) as the authority. The number of spaces assigned for each botanically related record type is sufficient to accept all but a very few scientific names. Standardized abbreviations are suggested to remedy this limitation. The remaining record types were scaled by anticipating usage.

To ensure successful, complete access to the desired records in the data base, it is imperative that standardization be maintained. A user institution must establish the botanical authority that will be referenced and standard codes, where applicable, for all entries. The computer will recognize even the smallest variation in a name or code as a new item. The significance of such variation will be evident with the explanation of the report generator program.

BARSRPT

BARSRPT, the report generator program, enables the operator to generate lists of accesion records. These lists will include all of the accessions which have the same entries in the record types designated by the operator. They may be broad in scope, such as all accessions in a given year, or very specific, such as holdings of a particular species. Contents of a listing are determined by selection from the report, sort type, and selection criteria options (Figure 4).

The operator specifies the report content and organization through three steps. The report type is selected first from seven available combinations of the four categories of information on each record. Since the accession number is the unique description for each record, that category is always included in reports. The sort type is selected next from four options to establish the numerical or alphabetical arrangement of the listings. Finally, up to three selection criteria are specified to determine which records and information from each record

```
REPORT TYPE?

REPORT 1  ACCESSIONS
       2      "       , BOTANICAL
       3      "       , SOURCE/STATUS
       4      "       , COMMENTS
       5      "       , BOTANICAL, SOURCE/STATUS
       6      "       , BOTANICAL, COMMENTS
       7      "       , SOURCE/STATUS, COMMENTS

SORT TYPE?

SORT TYPE 1  ACCESSION NO. SEQUENCE (ASCEND)
          2       "      "     "    (DESCEND)
          3  SCIENTIFIC NAME
          4  FAMILY

SELECTION CRITERIA TYPES? (UP TO 3)

ALL-PRINTS ALL ACCESSIONS
  1-PLANT YEAR               10-CODE
  2-REFERENCE DATE           11-COLLECTOR INITIAL
  3-GENUS                    12-SOURCE
  4-SPECIFIC EPITHET         13-DESCRIPTION/HABIT
  5-VARIETY                  14-PURPOSE
  6-CULTIVAR                 15-LOCATION
  7-COMMON NAME              16-LABEL STATUS
  8-FAMILY                   17-COMMENT I
  9-BOTANICAL AUTHORITY      18-COMMENT II

PRINT LIST
```

Figure 4: Procedure for Generating Reports

will be listed. An example of this last option might be specifying the name and purpose for a listing of the institution's holdings of that plant species in a particular use.

DEADRPT

DEADRPT, the dead report program, is a "housekeeping" feature of BARS. Its use is in periodic listing of accessions previously noted on the record as dead. It also is used to generate lists of accessions which have not been updated for some time (as noted by the reference date which is updated each time changes are made to an accession record). Records of dead accessions may be deleted from the data base with this program to free memory space in the computer. As in BARSRPT, report type and sort type are specified by the operator when generating lists.

SRCELST

This feature, added to the first generation of BARS, illustrates how a special purpose program, or subsystem, can be readily added to BARS as needed. SRCELST is an independent subsystem which utilizes the coded entry in the source record of the BARS data base for access to an expanded source record. The operator simply notes the source code of an accession from the BARS DATA ENTRY FORM or a BARS report and enters this code in SRCELST for a listing of the source identity, address, phone number and zip code.

QUERY

QUERY is a standard Hewlett-Packard program which provides for manipulation of the whole data base, easier correction of large-scale errors in the data entries, and addition of new programs into the BARS package.

SECURITY CONSIDERATIONS

Access to the BARS data base is controllable for security purposes. The initial system provides for assignment of two security levels. Individuals assigned the lower level of access can only "read" the records. The higher access level allows performance of any function for which BARS was designed. Additional available levels allow for other security considerations, such as timesharing.

CONCLUSIONS

The Botanical Accessions Records System was designed and developed because of the need for a computerized accessions records management system that would increase the efficiency and capabilities of records managers in botanical gardens and arboreta. The additional need for a system which could be easily adapted to, and would be available to, all institutions led to the design and development of a somewhat generalized system in terms of the record types included. However, because of the flexibility of the system, this generalized structure should not be a significant limitation to its use. Indeed, BARS is a base upon which special purpose programs can be added when an individual institution's activities could benefit from additional functions.

The choice of the hardware to be utilized for the development of the software will have a most significant impact on the possibilities for implementation of BARS. The hardware chosen does require a sizable initial investment to realize the benefits of computerization. Cost-related considerations will no doubt slow the progress of implementation. However, the alternative hardware choices, the various micro-computers on the market, would limit the capabilities, especially the memory capacity, to the point where micro-computer software would soon be outdated (when its limitations were realized).

The Hewlett-Packard hardware will allow institutions to utilize the business-related software and to have a valuable tool for future research activity. The timesharing possibilities with this hardware will require cooperation among sharing institutions. These ramifications were important considerations in both hardware selection and the development of the system concepts.

The capability to generate specified lists of accessions greatly facilitates local planning opportunities. When manual sorting of index-card records is required for planning, it is not hard to understand how directors would just as soon leave things the way they are. As economic pressure increases, the considerable cost of maintaining existing collections should lead to increased planning of additions to these collections. Regional planning is also appropriate to prevent duplication of efforts in cooperating institutions. The AABGA could provide direction and organization for regional and national planning of plant collections if member institutions had readily accessible records. This monumental task would, of course, require computerization for successful and practical completion. BARS is designed so that these opportunities could exist.

If the larger scope of these opportunities for BARS is to exist, the AABGA should act soon before too many institutions develop their own specific software. The limitations that exist with standardized software, such as

BARS, are more than offset by the planning opportunities that would not exist with several independent systems.

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(ABSTRACT)

Card-and-file plant records systems are typical for most botanical gardens and arboreta. The few examples of records computerization now in use demonstrate that more efficient access to records increases productivity and leads to local planning opportunities. This study presents justification for development of a standardized, computerized plant records system applicable to the needs of botanical gardens and arboreta. A model standardized system called the Botanical Accessions Records System, BARS, is described. Since records are supportive of most activities in botanical gardens and arboreta, improved efficiency and ability in records maintenance and management should improve the quality of record-dependent activities. In addition, the adoption of a standardized record system by cooperating institutions may enhance regional and national planning.