Longwood Program

THE ROLE OF LABELING IN PUBLIC GARDENS

by

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ABSTRACT

In botanical gardens, arboreta, and other public gardens labels are used to accession plants, to identify them for the public, and to interpret them for the visitor. Permanent record labels are a necessity for the botanical garden that is accumulating scientific data from its collection of plants. An attractive labeling system can identify plants without destroying the beauty of the garden, and a master interpretive plan for the garden that includes labels may increase the appreciation of the average visitor for the garden and its plants. In Part One of the thesis the author considers the aesthetic and educational limitations of the identification label. He places labeling in the context of interpretation, and he suggests how labeling can be integrated into a master interpretative plan. The writer presents alternatives and adjuncts to labeling as an interpretive tool. In Part Two the author examines the materials of and methods for production of legible, durable and attractive labels and their holders.

INTRODUCTION

Many, perhaps most, people who visit botanical gardens and arboreta, like those who visit museums, do so for both the aesthetic and the educational experience. Many museums have organized their collections for ease of understanding by the general public. Unfortunately the same does not apply to many botanical gardens and arboreta. It has been my experience that as an uninformed visitor I could learn very little when visiting plant collections. The beautiful garden usually lacked labels, and the labeled botanic garden usually lacked design integrity. Therefore, in this thesis I will examine the reasons for labeling a plant collection, and the limitations of the typical labeling systems. In Part One I will present a philosophy of labeling, a context for labeling, alternatives and adjuncts to labeling. In Part Two I will identify the various materials and methods now in use for labeling plants.

Unless labeling is done correctly, the beauty of the garden may be impaired. Unless it is done effectively, labeling won't be educational. Poorly made labels or an overabundance of labels in some gardens produce a conflict between communion and communication. Their presence may destroy the beauty of the garden. Even the accurately and attractively labeled plant may not be very educational. Labels transmit facts, but few visitors have any context for these facts, and few public gardens provide any background for understanding. Is the garden to be an

educational or an aesthetic experience? Are the two compatible? Many gardens should emphasize their beauty or our society may well lose important refuges from ugliness. But gardens should also be provocative and educational for the casual visitor and the interested individual. A well planned labeling system can provide the visitor sufficient information to understand the plant collections without impairing the beauty of the garden.

Labeling must be placed in its proper context. Alone it isn't very educational, but labeling can be a very important aspect of interpretation. I think that when we discuss labels we should discuss interpretation, that is, an attempt to heighten the visitors awareness. Education may be the more appropriate term applied to what is attempted in typical adult garden courses. To be effective, identification labels must be part of a master interpretive plan. The layout of many existing gardens may inhibit effective interpretation so that several suggestions will be made to overcome this problem. Some suggestions for designing new gardens with interpretation in mind will also be made.

Labeling as it is now conducted in many public gardens is of limited interpretive value, but there are other methods that may be more effective and should be considered instead of and in combination with labels. Eight adjuncts and alternatives to labeling will be described.

Some people may not accept my thesis about the limitations of labeling. Those who do accept may not have the resources to put alternative interpretive procedures to work. Some institutions may

develop effective methods of labeling, and the accession label will continue to be important. Therefore, in Part Two methods and materials of labeling will be discussed. The accession label and the identification (display) label will be treated fully, but the interpretative label will be treated only secondarily. Criteria for selecting a labeling method and material will be presented. Cost of material, difficulty of production, and durability will be discussed. The advantages and disadvantages of twenty labeling materials will be identified. Similar problems applicable to label holders and methods of attachment will be analyzed.

Very few horticulturists, to my knowledge, have written about the role of labeling in public gardens. They have written, usually in local publications, about some practical labeling problems and solutions. Therefore, I have searched the literature of the museum profession and nature center profession for ideas about the philosophy of labeling. Many of the ideas that I found are appropriate to labeling in botanical gardens and arboreta.

PART I

A PERSPECTIVE ON LABELING IN PUBLIC GARDENS

Introduction

For those who are willing to listen, plants speak for themselves, but the challenge of today's horticultural center is to awaken the uninterested visitor. In Part One of this thesis I want to present a perspective on labeling in public gardens. Such a consideration requires: an examination of the aesthetic and educational limitations of the public identification label, an investigation of new approaches to organizing information for the general public, and a review of alternative forms of interpretation based on visitor involvement.

Too many labels or poorly crafted labels and possibly any label blocks communion between plant and viewer in the pleasure garden. E. H. Wilson (Page XVII) in 1926 wrote, "As a matter of fact I know nothing more depressing than the average botanic garden with its rows of beds and army of prominent labels. It suggests too much a popular cemetery."[32] If the primary purpose of a specific garden is to exhibit beauty, the institution should not interpose informational systems between the visitor

and the beauty. If the prime purpose is educational, like the teaching gardens of many universities, then prominent identification labels are a necessity. Of course, the matter is more complex than I have stated. Many institutions are compelled to provide both aesthetic and educational experiences. In a rush to be relevant, gardens should not forget the crucial role that they play in providing green space, a restful environment and a refuge from visual blight. Gardens should not clutter their world. "Signs of Life: Symbols in the American City," a 1976 exhibition of the Renwick Gallery in Washington, D. C., declared that words and symbols rather than forms, dominate the urban environment. A garden can be an escape hatch for the harried city or suburban resident, but a sign-cluttered garden would not be a retreat.

Public gardens would be foolhardy to impair the quiet delight of the garden. Must the public be bombarded in every cultural environment with unrequested information? Marshall McLuhan[17] in a seminar at the Museum of the City of New York in 1969 stated that the public is overloaded by the information explosion. Gardens should not ignore such data as that collected by Colvin Randall (The Longwood Garden Visitor Survey 1974, unpublished) that reveal that only 24 per cent of the visitors come to Longwood Gardens to learn plant identification. Forty-seven per cent come for relaxation. Garden administrators should not lose patience with people who come without a desire to learn, and when administrators contemplate labeling they should not forget the beauty of the garden.

Aesthetic and Educational Limitations of the Public Identification Label

The Gordian knot of the aesthetic-educational experience in the garden is difficult to loosen, because most horticultural institutions must be educational to retain a preferred tax status. Some have accepted this cloak reluctantly; others have embraced it enthusiastically. Many gardens conduct fine formal educational programs such as, lectures, panels, and workshops, but few have developed a thorough philosophy for educating the general public, the people who in a small way support every cultural institution in the United States. Gardens have developed the staffs and methods of educating the interested community member, but I am interested in planning the experience for the casual visitor.

What do we want the visitor to do with the information that is commonly printed on a public identification label, i.e., scientific name, common name, family name, and country of origin? What is your impression of a museum that displays two thousand pieces of silverware, or two hundred different campaign buttons, or eighty different arrowheads? If you are a knowledgeable amateur, your interest may be high, otherwise you are likely to fatigue rapidly. I believe that the labels in botanical gardens, arboreta, and public gardens are like the tags in the dullest museums. To the uninformed visitor this information is a hodgepodge of facts. Let us follow someone walking through the garden, who stops to read a typical label attached to an attractive plant, "Mountain-Laurel, Kalmia latifolia, Rhododendron Family, East. N. Amer.," and a few minutes later, "Golden-Chain Tree, Laburnum anagyroides, Pea Family, S. Eu.," and this is repeated many times throughout the garden.

This barrage of facts is intended for the intelligent but uninformed visitor. People want to understand what they read, but without a background in horticulture, they can not learn much from such labels. If the prime purpose of an institution is to serve the general public and not other horticulturists and amateurs, it must develop a better system for interpreting its collections.

Some garden administrators think that labels are educational or at least that they speak for the plant. Some think that they have power over an object, if they know its name. Certainly, if the general public walked through gardens with a pencil and paper, a simple name would be a reference for future investigation, but this is not the case. Conversely, the name of an object for Marshall McLuhan is a "numb."[17] The name dulls perception and closes the mind. It is another fact, easily gained and easily forgotten. The staff at the Chicago Zoological Park realized that their visitors seized upon the common names of the animals exhibited, and they marched off to the next cage. Common name, scientific name, and a short text were included on the label. Plant labels express similar information. The staff devised an experiment to test the hypothesis of the name as a "numb." They produced a sign with the common name, Unicorn. The text explained the myth of the Unicorn. "One of five visitors read the sign through and reacted to the sly humor. The majority on the basis of a cursory glance, appeared to accept that such an animal exists and happened to be inside for the day."[23] I do not think that this is the only explanation for the people's behavior, but other observations strengthen the notion that the name closes the mind to perception. The

staff at art museums have observed many visitors who walk up to a painting, look at it for a few seconds, glance at the label, and move on to the next picture. Horticulturists recount their frequent experiences, as guides, of responding to the question, "What is that?" Some administrators seize upon this question as the rationale for their public identification labels, but the name is useful to only a small segment of society, and there are other methods of reaching people. If a name isn't a "numb," at least I might conclude that it isn't important to many visitors.

When providing an educational experience for visitors, administrators must expect object satiation and visitor fatigue. Arthur Melton[18] states that each object competes with others for the attention of the viewer. He recorded the length of time that people paused before objects in a museum. They paused about the same length of time for any object, they just stopped fewer times the longer they visited. Too many different plants and too many names are overwhelming. Visitors will not look at everything, and they will not read everything. When they are tired, they will stop less frequently than they did at the beginning. Gardens can not expect to teach much to the casual visitor, and they must plan precisely what is to be taught and where it will be presented.

I believe that the difficulty of integrating aesthetics and education in the garden exists because of the historical development of many gardens. Many were university founded, and they were organized for teaching Taxonomy. Few people enjoy this systematic arrangement. On

the other hand, private pleasure gardens now open to the public were not planted for today's educational needs. If aesthetics and education for the general public are not extremely compatible in public gardens, what can administrators do to fulfill their dual roles?

First, they should be willing to accept the limitation of the identification label as an interpretive tool for the general public. Secondly, administrators should decide whether aesthetics or education is their prime responsibility. For those who must fulfill both roles, they may expect limited success unless they redesign their gardens. Thirdly, but most importantly, they should reconsider the entire context of labeling from the point of view of the general public.

Organizing Information for the General Public

Labeling is one form of interpretation. Freeman Tilden (Page 8) defined interpretation as, "An educational activity which aims to reveal meanings and relationships through the use of original objects, by first-hand experience, and by illustrative media, rather than to communicate factual information."[29] Labels in many gardens offer only factual information, and they reveal neither meanings nor relationships. Edward P. Alexander in a seminar (Page 6), "What is Interpretation?" enumerated five criteria for good interpretation.[1] I want to repeat the first one, "It seeks to teach certain truths . . . ." I believe that many gardens fail to meet this first and most important criterion. They do not teach any general truths; they present only facts. Good interpretation begins with determining what the garden wants to teach, and this does not mean that the plan is to

teach that plants have different names.

Marshall McLuhan[17] suggested that museums should avoid details, but emphasize pattern recognition for the average visitor. Plant collections provide the basis for teaching many things, but the administrator should decide what he can teach with his resources. He may develop a story line for interpretation such as: booty of the plant explorers, plants demonstrating methods of pollination, plants that attract bees, plants for dry areas, or plants for the shade, etc. He may try to provoke the visitor into greater awareness of his environment by making the interpretive plan specific. People want to understand their environment, so the educator should offer an organized but voluntary experience for the uninformed visitor.

According to Fred Schroeder of the University of Minnesota, there are several ways to lead museum patrons to thoughtful interpretation on their own.[26] Schroeder wrote within the context of the history museum, but his methods are applicable to public gardens. His suggested methods increase in abstraction, and they provide varying levels of interpretation for a stratified public. I will mention some of his interpretive schemes. He used touching as a basis for the first plan. Plants of varied textures are a natural for this. His third method tried to identify the environment of the object. Gardens could use an ecological, a geographic, or a historical approach. The fourth method traced development through time. A phylogenetic approach or an evolutionary reconstruction of a contemporary cultivar could be used. This approach usually requires some

experience on the part of the viewer. The fifth recommendation made cross-cultural comparisons. Differences in staple crops, economic crops, vegetables, and color preferences in flowers could be elucidated. His seventh and most abstract principle is the interpretation of functional meanings or values, whether they be aesthetic, mythical or iconological. This last and most abstract method returns to the essence of the garden: its aesthetic value, the role of specific plants and the garden in mythology, and its symbolic role. At this point the aesthete and some educators part. Some say you can not teach aesthetics. I believe that gardens can increase awareness, but educators in their attempt to stimulate the visitor, should not stand between the visitor and the beauty of the garden.

Can the established garden through labeling use any of the methods previously discussed? People are interested in beginnings and other people. Who was the founder? The garden may be enlivened with the plans and processes of its inception and development. The cultivar is often the basic unit in today's garden, but how many gardens have attempted to explain species, variety, and cultivar. Trails of knowledge may be established through the garden discussing: fossil plants, pollution tolerant plants, plants that attract birds, hardy plants and tender plants. Since these plants are likely to be in place, the practical problem of directing people from point to point must be overcome. I've used some excellent walking guides for foreign cities by George W. Oakes.[20] The text is in English, but the cues are either architectural or in a foreign language. My command of the various languages ranged from fair

to poor. Visitors to a garden suffer a similar plight, but with a well-written guide and directional cues along the way, a person will likely find the featured plants.

If the opportunity to design a new garden or redesign an old garden should arise, and if education of the general public is foremost in the mind of the administrator, he should seek designs that incorporate interpretation into the scheme. Stuart Simon[27] of the Brooklyn Botanic Garden at the 1977 Annual Meeting of the American Association of Botanical Gardens and Arboreta stated that German botanic gardens are experimenting with functional arrangements of their collections. They are trying to demonstrate economic plants, botanic principles, ecological arrangements, and systematic relationships, and Simon showed that they are doing it attractively. Gardens should experiment with more creative arrangements than simple groupings of Holly, Rhododendron, and Viburnum collections.

Botanic gardens certainly have the responsibility to test and evaluate plants adaptable to the needs of their region, but instead of the ubiquitous Rhododendron walk, I see a web of paths with multi-purposes, offering varying levels of information, interpretation and education. The system would permit exit after a short time for the casual visitor, and it would present information on four levels: the headline, the secondary topic, the explanatory level, and the data level, which is the present identification label. Each person could take from it what they wanted. A combination of interpretive materials including

pamphlet, story label, and identification label could be used. Paths demonstrating light and shady conditions, wet and dry circumstances, native plants versus exotics, species versus cultivars, etc., could be developed, and the possible combinations are infinite. The challenge for the landscape architect and educator is to create easily comprehended educational units, which are interwoven into multipurpose paths.

Interpretation Through Visitor Involvement

As you can see, labels do not stand alone, and they should be incorporated into a master plan for interpreting the public garden, and the plan should consider several other techniques, which depend on visitor involvement. Since labeling is only one aspect of interpretation, garden administrators should be prepared to consider adjuncts and alternatives to labeling. Tilden's[29] definition is again useful to consider. He recommends the use of original objects, firsthand experience, and illustrative media to reveal meanings and relationships. Gardens have plants as their original objects. Public gardens seldom encourage firsthand experience except for horticulturists themselves. They are prime offenders of the "Don't Touch" rules; they tear off leaves, crush them, pull apart flowers, collect seeds and request cuttings. Their purpose is not vandalism, but they are using the most effective methods that they know for accumulating knowledge. However, few gardens tolerate such pilferage by the public because of the possibility of major damage.

A number of museums have observed a decrease in vandalism after

increasing visitor involvement. Stephen de Borhegyi wrote about a stuffed elephant in the Milwaukee Public Museum that visitors wore away until curators placed a section of the skin where the public could touch it.[5] This stopped the damage to the elephant. Luray Caverns, Virginia, encourages people to rub the "fried egg" formation, and this permissiveness has helped to preserve the other stalactites and stalagmites. Ray Pierotti wrote about the Museum of Contemporary Crafts in New York, "Later, we were able to assign a real cause to the destructive behavior; people were not used to touching things outside the confines of their general environment."[21] It was a lack of tactile education. "People must be taught the material and aesthetic value of things," wrote Pierotti.[22] This behavior, which many of us take for granted is apparently learned rather than instinctive. One of the benefits of involving the public may be reduced vandalism.

Gardens, to be educational, should plan areas for human-plant interactions, and program plant replacement. I have visited a garden that prohibits children even if accompanied by an adult. The area is a man-made wildflower garden, not a delicate natural environment. Some plants are valuable, some are rare, but most can be propagated and replaced. Kids, a generation ago, stole apples from orchards and picked flowers in any field. Parks, gardens, and other conservation agencies are institutionalizing plant-human interactions. Where can the public go to pick a flower, taste fox grapes, or suck the nectar from honeysuckle? People without their own garden need a place for involvement.

Most educators agree that active participation heightens acquisition and retention of knowledge. Horticulturists are aware of the comments of visitors who see the garden on a work-day for the first time. They stand and watch gardeners rototilling beds, installing plants, and pruning trees. Instead of leading visitors away from such activities, gardens should use them as educational events. Gardens could publicize tree removal, tree moving, and landscape construction as major events, and schedule some work on weekends if crowds aren't an impediment.

The term, firsthand, as used by Tilden, is also applicable to the transmitter of information. Visitors like to ask gardeners about their work, something which I have frequently observed at Longwood Gardens. They may be more willing to ask a gardener than some official-looking interpreter. I look towards the day of a different type of gardener. We will need more of them because we will expect them to be the interpreters of their garden section, but we will need fewer educators. Possibly everyone will be happier: there would not be the class distinction between gardener and educator, and the educator would have the satisfaction of working in the garden.

Tilden thought that illustrative media were effective forms of interpretation, but how could these be used in the garden? First, remember that the garden is a multisensory experience even without electronic gadgetry. Sight is overwhelmed, but the other senses are only slightly stimulated. Touch is usually limited to the sightless. Taste

must be treated carefully, but it presents many exciting opportunities. Fragrance should be used more deliberately. Sound is a challenge, i.e., sounds other than those of splashing water, twittering birds, music and the sonority of the wind in the trees. Sounds, as yet undiscovered, may be produced by the wind blowing through different groves of trees. There are opportunities for experimentation on this subject.

Audio-visual equipment, tape recorders, transmitters and pamphlets all have their role in interpreting the garden, but like Tilden I think that the best interpretation is done by people and not by mechanical devices. The skillful and sensitive interpreter has the flexibility to evaluate the audience and to draw out individuals in a group, and to relate some aspect of the garden to all of them. The guide can be our best interpreter, because he can be translator, demonstrator, historian, and horticulturist. He can be encouraging by answering any question. He can enlarge upon any subject hopefully without being didactic, but the guide must be wary of interpreting beauty. Tilden (Page 88) thought that the foremost use of interpretation was in spiritual uplift, but he said, "This end cannot be reached except through a walk with beauty of some aspect, in which the interpreter is not primarily a teacher, but a companion in the adventure."[30] A blundering guide cannot make a plant more beautiful by calling it beautiful. It is time that guides be recognized for the substantial contribution they make to interpreting the garden for the general public. As long as a guide is not a robot, he is likely to be more effective than any other interpretive device.

The discovery center is the last form of interpretation in the garden that I want to discuss. Several examples in the museum world are: the Florida State Museum Object Gallery,[9] the Exploratorium in San Francisco, and the Brooklyn Children's Museum. The first reaches all age groups; the latter two are for children. All encourage and provide the opportunity for self-directed investigation. In a garden I would have designed an area for all ages that would include propagation space, growing areas, and an indoor study area. The last would hold house plants, exhibits, books, pamphlets, taped lectures, film-strips, films, slide presentations, the coming video-disc, and study carrels. The exhibits and other media should present a distinct body of knowledge and be self-teaching. Materials and equipment should be easily accessible and easy to use to encourage self-confidence, and the staff member should be helpful but not pedantic. The staff member should not be a meddler, but an aid, helping each user to obtain the best possible experience. A visitor could read about propagation, watch a slide show, take cuttings, and plant them in a bed. Visitors could learn what they wanted to know at their own pace and on their own schedule. People want to learn skills, but most of us fall back on the lecture as our primary means of education for large numbers of people. If public gardens are to be more effective educational environments for the general public, they should be inviting the public's participation in the garden.

In my opinion the public is poorly served by institutions that depend chiefly on identification labels for what they think is interpretation. Labels do have a role in interpretation, but it is a minor one.

If the prime purpose of an institution is to serve the general public but neither horticulturists nor amateurs, it must develop better methods of interpreting its collections. To be more educational than they are now, gardens should avoid details and emphasize pattern recognition for the general public. To carry out this charge, there are exciting educational approaches and techniques, which emphasize firsthand experience and participation, that can be used in the garden to involve the visitor. There is an opportunity for landscape architects and educators to collaborate in designing educational and beautiful gardens for the casual visitor.

PART II

MATERIALS AND METHODS OF LABELING

Introduction

Part One discussed the limitations of labels, but there are several valid reasons for using them in botanical gardens and arboreta. As part of a master interpretative plan, labels provide essential data for the curious visitor. The information on them can benefit the visiting public, nurserymen, garden center operators, amateurs, students and other professionals. To be useful labels must be legible, and well-crafted so as to last and to protect the aesthetic appeal of the garden. In the pleasure garden they must be used with restraint; in the didactic garden of the future they can be used more purposefully. The accession label is essential to the running of scientific botanic gardens and arboreta. Combined with a mapping and record system, they ease the problem of inventory and identify the plants for quick reference by the staff. The Dawes Arboretum of Newark, Ohio considers labeling to be so important that they have a labeling policy statement (A. Cook, personal communication). For these reasons and because many people in public

horticulture are burdened by the decision of what label material to use, Part Two discusses the different types of labels, that impart valuable information clearly, are easy to read, durable, reasonable in cost, and easy to make. Additionally, Part Two of this thesis will serve as a draft for a revision of the 1965 American Association of Botanical Gardens and Arboreta Newsletter[7] which dealt with labeling. Hopefully this revision will provide an orderly and up-to-date presentation of information on labeling. Criteria for selecting a labeling system will be given. Accession labels and public display labels will be treated primarily, but much of the information is also applicable to interpretive (story) labels and administrative signs. Label holders and attachments will also be discussed.

Information about labeling was gathered through personal interviews with staff in botanical gardens and arboreta, through review of the literature, through a mailed survey, and through personal observation.

Types of Labels

a. Accession Label (Record Label)

The accession label is used primarily for record purposes, but only 55 per cent of the questionnaire respondents use a separate record label. Combined with a mapping system and/or a record file, the accession label is the basis for any scientific usage of the plant. A properly identified plant, including such information as: accession number, scientific name, common name, family name, botanical authority,

nativity, and date planted, is the heart of the botanic garden and arboretum. Without such records, one must depend on memory, and eventually valuable information is lost. The accession label is useful to staff members including horticulturists, instructors, gardeners, guides and to some visitors.

Because the accession label is so important for the proper operation of today's botanic gardens, it should be relatively obscure in appearance so that it isn't especially attractive to that segment of the public which does not understand its significance. The label should remain legible for decades, and it must be resistant to weather and vandalism. At present, the primary materials in use are metal tags or tape: aluminum, brass, stainless steel and zinc. Plastic isn't sufficiently durable to survive the years. The information is applied to metal with pencil, ink, paint, by embossing, and by photographic process. Raised letters are probably better than recessed letters, because the latter fill with dirt. Some gardens use only an accession number, because they believe that such a tag is less attractive to the public. Where display labels are not used, I believe that thorough documentation should be included on the accession label for all who wish to learn. Stainless steel is most durable, followed by brass, aluminum and zinc. Brass becomes very dark with corrosion, zinc corrodes slightly, aluminum unless anodized forms a white oxide, and stainless steel remains relatively clean. The most durable metal is the most expensive, but the demand for metals changes and therefore the availibility and cost of these materials is likely to fluctuate.

The life of an accession label is probably most affected by where and how it is attached to the plant. It should be placed so that it is not noticeable to the casual visitor. It should be attached in a consistent place on each plant in the botanical garden so that users can find it quickly. Most arboreta attach their record label to the north side of the trunk of trees. The north side is usually chosen because it receives less sunlight, but other sides may be chosen if local weather or air-pollution conditions are not favorable to the north side. Labels should be placed at a height of 6 - 8 feet to discourage vandalism but not so high that they must be read from a ladder. On very dense or low-crowned trees, the accession label should be attached to a main branch, because it is often extremely difficult to reach the trunk. The label is held in place with a rust-proof nail or screw or it may be threaded with rust-proof wire and then attached to a nail or screw. On a main branch a loop of wire is used. Eventually the tree will overgrow the wire or label unless it is tended every few years.

On shrubs the label should be attached to a major branch on a specified side of the shrub. Dense shrubs present the same problems as dense trees, and the solution is the same. Some gardens attach the label to a wire stake and push it into the ground near the shrub's base. It is usually easier to find than the label on a branch. The stake usually costs more and it is easily removed. A stanchion or heavy wire stake is most frequently used to hold a label identifying herbaceous perennials. A stainless steel clip seems to be the answer for accessioning potted plants.

Equipment needed to produce accession labels may be as simple as either a graphite pencil or a credit card machine, and as expensive as an addressograph machine for embossing or photographic equipment for developing small strips of photosensitized aluminum.

b. Public Display Label

The display (identification) label is used by the public, guides, gardeners, and staff instructors. In its most elaborate form it may include: common name, scientific name, nativity, family name, and a source code. The simplest form is a numbered stake. The display label should possess several essential qualities. It should be visible, but unobstrusive, legible, relatively permanent, resistant to weathering, vandals, and employees. It should be non-phytotoxic, inexpensive, lack intrinsic value, be maintenance free, and compatible with the garden environment. Obviously, the perfect label does not exist.

The four major materials in use are wood, metal, plastic, and paper. The message is applied to the materials by various means. Words may be painted on or routed in wood. The four metals commonly used are aluminum, brass, zinc and steel. Aluminum is routed, embossed, painted, or developed photographically. Brass is usually embossed. Zinc is painted, etched with a pencil, or acid ink, and it is embossed. Stainless steel may be painted or embossed. Several types of rigid or pliable plastic are in use; polyvinylchloride (PVC) laminates, phenolic laminates, laminated fiberglass, plexiglass, vinyl sheet, and Tyvek (R) a plasticized paper are available. Information is applied by routing,

embossing, developing a photographic image, typing, or by inking.

c. The Interpretive Label

The interpretive label carries more information than the basic identification label. It may explain a specific garden or a plant collection or other feature in the garden. Because it is present at all times of day and during all seasons the interpretive label may be less expensive than other forms of interpretation. The interpretive label shares all of the essential qualities of the identification label with the addition of the need for producing a well composed message. In composing the message the reading ability and knowledge of the audience must be considered. Whether or not a visitor reads an interpretive sign depends on three factors according to Paul McIntosh in the book Interpreting the Environment:[16] use of a conversational style, selection of material which likely relates to the reader, and brevity. Legibility is essential in any label, but legibility may be more difficult to attain in the interpretive label because of the increased verbiage.

Planning is necessary to prepare a legible message. The reading distance, size of print, type style, mix of upper case and lower case letters, spacing between letters, heading between lines, length of the message and the reader's visual acuity affect legibility. At a reading distance of 18" - 30", twenty-four point type is suitable, and 50 - 60 characters per line (letters and spaces) is a reasonable limit. At a greater distance, larger letters are necessary. Type size needed also

depends on the visual acuity of the reader. Although gardens have been quick to establish Braille labels for the sightless, more people suffer partial impairment of their vision rather than complete blindness. Larger letters will help the visually impaired. Elaborate type face is often difficult to read because of unfamiliarity. Bodoni, Caslons, Garamonds, Sans Serif, and Modified Clarendon are all easily read. For short labels, like the typical identification label, all capital letters are usually more legible, and since the letters are larger than lower case, the labels are readable at a greater distance. This style may offend purists, who with good reason insist on lower case letters for specific names. For any copy long enough to require speed and accuracy while reading without fatigue, upper case and lower case letters should be used. Spacing between lines should increase with length of line and boldness of type face.

d. Administrative Signs

Administrative signs mark the entrance, orient the visitor to the garden, provide information, and give direction. Signs should be designed and messages composed that serve to welcome the visitor and create an atmosphere of receptivity on his part. For example, many people are embarrassed to ask for the location of the restrooms. They should be clearly marked. Information about what to see and the hours for special events occurring that day are helpful. Visitors must be excluded from some areas in the garden, but this should be done pleasantly rather than authoritatively. Nash Castro[4] suggested turning the message from

didacticism to friendly advice, from "No Picnicking" to "Please Picnic in Designated Areas Only," from "Do Not Enter" to "Closed."

Symbols, many used internationally, are available for use instead of messages. The National Park Service[19] has produced a useful book, Sign System Specifications, that includes: A list of symbols and prescribed meaning, a section on the size of letters for pedestrians and vehicular travelers, and construction specifications for signs.

Label Selection

a. Size and Shape

There are numerous factors to consider when selecting a simple public display label for the garden. Label size is usually dictated by the amount and size of the letters. Shape has usually been rectilinear because of ease of construction and conservation of material. Psychologists and Geographers investigating human preference indicate that many people prefer natural forms versus man-made forms.[11] Some simple research could be done to determine if people prefer oval labels or rectangular labels. Size and shape are just two of the more obvious factors affecting the compatibility of labels with the garden.

b. Garden Type

Most of us have come to assume that highly visible labels are appropriate to the garden because of their educational benefits, but it is my contention that in the pleasure garden too many labels or poorly

crafted labels may impair the aesthetic experience. On the other hand, if the primary purpose of the garden is educational, then prominent labels are a necessity. In the pleasure garden, a label compatible with its surroundings should be chosen. Label compatibility may even be affected by the type of garden or gardens on display. Although consistency is a desirable trait, the same label may not be equally appropriate for a French parterre, Italian villa, English landscape, or American residential site. The same label may not serve equally in the wildflower garden, woodland garden, rock garden, perennial border, annual display garden, topiary garden, and conservatory.

c. Plant Type

The label selected may be affected by plant type displayed. A different size label and a different means of attachment may be required for trees, shrubs, and herbaceous plants. Temporary labels are appropriate for annuals, but so are permanent labels that are stored for the winter and reused each year. Bulbs and herbaceous perennials require some sort of year-round markers, but in the winter these areas resemble small burial plots. Collections of small plants, such as dwarf conifers, succulents, and insectivorous plants present the special problem of the label sometimes being larger than the plant. The National Arboretum is one institution that has successfully combatted the problem with one marker for an entire bed and numbers on the individual plants.[6]

d. Criteria for Label Selection

Appearance of a label is determined by its compatibility with a

specific garden style. A rustic label used along a native woodland trail may not be appropriate to a French parterre. Colors may be too bold or too dull. Yellow may be too bright or may contrast with a blue flower border. Dully colored labels are difficult to find in the garden. Rectangular labels are easier to form and probably easier to letter, but oval shapes may be more appealing. Finely crafted labels, neatly lettered with an accurate message, are usually attractive labels.

Wooden labels, especially routed ones, are often compatible with a garden. Painted wooden labels, or any painted labels are probably less attractive. The various metal labels when they are bright and shiny are unattractive, but most weather to a more acceptable finish. Stainless steel and anodized aluminum are highly reflective, and cause eye strain, but photosensitive aluminum can be produced with a black background. Plastics colored black, brown, or green are unobtrusive, but if high visibility is desired red, yellow, or orange colored plastics are available. Paper covered with plastic gives a neat appearance for about a year. Such flimsy material usually isn't worth the effort, unless the displays are strictly temporary.

The durability of labels is a more objective subject than the appearance of labels, but there are few published comparative studies. The durability of a specific label is not simply a matter of material selection. The most durable material isn't necessarily the all-around best material to use. Nationwide, public gardens replace 10 per cent of their labels annually. Some gardens replace 50 per cent.

Disappearance of labels is a prime reason for replacement. Theft, damage by vandals, and employee carelessness (especially with mowers) are the major reasons for loss. Where theft, vandalism, and carelessness cause significant loss, expensive long-lasting materials are a waste of money. Theoretically, if 10 per cent of all labels in a garden disappear, a label with a durability of ten years would be sufficient, but labels are lost from some sections of gardens more frequently than others.

Another cause of frequent label replacement is the change of annuals, vegetables, and seasonal displays in conservatories. If many of the same plants are used each year, a garden should compare the costs of making new labels versus retrieving and filing the labels for the off-season. If they aren't to be reused, a low cost label should be chosen.

Environmental conditions affect the durability of various materials for labels. The more moderate conditions in conservatories as compared to the outdoors tend to lengthen the life of labels indoors. Labels may be broken by vandals or by accident, but age, temperature changes, and fluctuation in humidity help to weaken materials. Insects damage wood, and fungi degrade wood and plastic.

Some labels may remain intact but lose their effectiveness because of a reduction in legibility. Splattered mud, mineral deposits, and algal coatings may obscure lettering. Peeling paint or fading may reduce legibility. The most durable labels may survive eventually to be obscured by a tree's bark. This is an attachment problem, which will be discussed later. An idea of the relative durability of various label

materials may be ascertained by the nationwide replacement rate shown in Table I.

Only a few responding gardens use zinc or photosensitive anodized aluminum labels and so the figures in Table I may be skewed on the low side. Only one garden reported use of baked ceramic. It is noteworthy that wood survives as well as some metals and most plastics. Painted metal plate is used in several older arboreta, where coincidentally vandalism is high. The replacement rate for the write-on plastic and Dymo(R) tape is explained by their use. Most are pot labels that are stuck in the soil and are easily removed. One distressing figure rises from the data. Arboreta on college and university campuses seem to suffer a higher rate of vandalism than other gardens.

There may be four major expenses affecting the overall cost of a given label. There is the raw material expense, which includes shipping, equipment needs, production time, and type of holder or attachment needed. Several factors are interrelated. The use of pre-cut blanks reduces production time but increases material costs and vice versa. Many gardens that make only a few labels buy small quantities of raw materials. Several gardens that use the same materials could reduce their costs by placing a joint order.

The cost of any label is affected by the expenditures required to purchase and maintain label making equipment. The cost may be amortized over the life of the equipment, but a relative cost per label can be determined by estimating how many labels will be made during the

TABLE I

ANNUAL REPLACEMENT RATE

FOR LABELS

Material	Per Cent Replacement
Aluminum	2.5
Zinc	5.0
Ceramic	5.0
Aluminum, anodized and photosensitive	5.5
Fiberglass	7.5
Plastic, phenolic	8.6
Brass	10.0
Wood	10.8
Plastic, gravcflex and gravoply	10.9
Metal, addressograph	11.7
Metal plate, painted	14.6
Plastic, write on	15.0
Plastic, Dymo(R)	22.5

lifetime of the equipment. Initial costs may be reduced by investigating the availability of used equipment.

Production time is probably the major expense associated with label manufacture. Gardens with volunteers, who perform this function, save this expense. If volunteers stop making labels, gardens must shift personnel from other duties to perform this often time-consuming operation. Each material has its own manufacturing steps, which usually include raw-material handling, cutting sheets to label size, computing label size, production of a draft copy, and applying the message by engraving, silk-screening, inking, or developing.

Most institutions have good records concerning the time that it takes to apply a message, but few have calculated the set-up time or time to prepare the raw material. Table II gives a relative ranking of the time required to apply a message by various means. Inking and pencil-ing are the simplest process. Embossing is a one step process for apply-the message, as is typing. Engraving requires time to set-up the letter templates. The photographic process and the silk-screen process require the most steps, for example, production of the type, paste-up, exposure, developing, and fixing for a photographic process. Yet, with increased experience and improved dexterity of the label-maker, a photo-produced label takes less time than an engraved one.

A cheap or easily made label that requires an intricately produced holder is not a bargain. Simple attachments like wires, screws, or nails are the easiest to use, but special holders are sometimes

TABLE II

LABEL PROCESSING

Material	Production Time
Zinc Strip	1.0 minutes
Steel Tape	2.0
Aluminum Tape	3.5
Brass	4.0
Tyvek(R), plasticized paper	4.0
Vinyl sheet	4.0
Dymo(R), plastic strip	4.0
Addressograph plate	7.0
Phenolic plastic	10.8
Gravoply plastic	13.0
Wood	19.0
Gravoflex plastic	20.0
Fiberglass	30.0
Metalphoto	93.0
Ceramic tile	24.0 hours

necessary for placement of labels among herbaceous plants.

The last criteria to consider when selecting a label material is workability and overall practicality of the material. The material should be easy to work. Material that is brittle breaks easily; soft products bend or they are easily gouged. Rectangular shapes conserve materials. Overall wastage of material because of material failure or equipment failure and operator error increases costs. Damaged photosensitive plates are much more expensive than zinc strips. More training is required to produce photosensitive plates than embossed strips, and engraving requires substantial dexterity. There are also hazards associated with label making. Powerful cutters are used to size metal plates; the heavier the plate the more powerful the cutter required. Band saws are used to prepare plastic sheets. Engraving machines often have exposed belts that can ensnare fingers and clothing. Corrosive chemicals are used in the fixing process for photosensitive plates, and engraving of polyvinyl chloride plastic produces fumes. Finally, the best material is worthless if it is difficult to obtain. Some gardens that invested in one material were forced to change because the source of their material disappeared.

Label Production

a. In-house vs. Contract

Although purchased labels are expensive, an institution should consider all of the costs and requirements associated with setting up a label production facility. Production of labels requires equipment,

space, and personnel. Equipment costs money to purchase and maintain. It requires space that may have an alternative use. Powerful embossing machines are very noisy, and should be located away from office areas. Band saws for cutting plastic sheets are also noisy and appropriate to shop areas only. Cutters for thick metal plates are large and produce a disturbing sound in operation. Processing of photosensitive plates requires counter space, exposure light and holder, developing equipment and fixing bath. Storage space for raw materials and processed labels should be close to the production area.

To prepare a space as a label shop some modification may be required. Additional electric capacity may be needed to run engraving equipment, band saw, and photographic developing and processing units. Additional lighting is usually necessary to ease eye strain associated with reading and preparing labels. Water and drains are needed to support photographic developing and processing.

Personnel requirements are an important consideration. What skills are needed? Do present employees have the ability or desire to learn skills? People who are accustomed to active outdoor lives, as is true of many gardeners, are terribly bored by working on labels, and boredom breeds errors. Volunteers are often put to work making labels. Carefully selected and nurtured they won't become bored and require frequent replacement. The basic question remains, could employees or volunteers be more productively engaged, if labels were purchased from a manufacturer?

Most gardens do not receive significant discounts in their purchase of raw materials, because they are small users. Here is an opportunity for a small enterprise, either an individual or an institution, to supply a small but continually growing market. The Plant Sciences Data Center of the American Horticultural Society is now selling Metalphoto(R) labels.[2] There is reason here also for several institutions in a locale to band together to purchase labels from a central producer. One institution could purchase the equipment to make and sell labels to several other institutions, who agree to purchase their labels from the manufacturer for a specified period of time. There are other reasons for contracting out the making of labels. Standardization of labels among America's gardens or among regional gardens might be desirable so that they could obtain more attractive and more durable labels at similar cost. Some gardens put more than the basic information on an identification label, and we must assume their reasons for doing so are valid, but for those gardens that put only the basic information on a label, standardization and use of the same label makes sense. Labels might be designed that come with basic information applied, and space available for additional information.

b. Methods of Production

Materials

Some of the simplest but least durable labels are made of wood strips with the information applied with pencil, ink, or paint. If pencil or ink is used, wood is one of the cheapest materials, especially for temporary use. Painted wood labels in use at Arnold Arboretum for

approximately twenty years require too much time to produce. When vandalism strikes a labeling system that is manpower intensive, alternatives are soon sought, and Arnold Arboretum is phasing out its painted wooden labels. Routed wooden labels, such as Robina pseudoacacia are quite durable. Blocks (3 x 5 x 7/8 in.) are still in place and legible at least 15 years after their installation at Morris Arboretum. They look good on large trees, but they can't be scaled down for smaller trees and shrubs and too much time is required to produce them.

White Pine, Douglas Fir, Black Locust, Western Red Cedar, Yellow Poplar, and Sugar Maple are materials especially popular for large signs. Numbered wooden posts are often used along trails. Osage Orange, Black Locust, Cypress, Red-Cedar, and pressure treated lumber will resist decay and insects. The wood may be routed with a drill press or router (hand guided or machine guided). The letters may be formed free-hand and then routed, or letter templates may be used as a guide for the routing tool.

Some of these same methods may be used to apply a message to a plastic label. A pencil or indelible pen applies a quick message to plastic pot labels. For temporary use they are fine. They are very cheap, requiring only care by the writer. They are more tolerant of moisture than wood, but ultraviolet light makes some plastic brittle. Stuck into the ground or into pots, they are easily removed. Strips of plastic may be embossed on hand-held presses, like the Dymo(R) equipment. These strips are usually attached to some backing, such as, wood, plastic, or metal. Some respondents reported that the adhesive failed

in a few years, others said that it lasted for 12 - 15 years. Several noted that the plastic became brittle and broke after two or three years. A heavier gauge plastic may be used, and the message embossed on a piece of equipment like a credit card machine. Ultraviolet light is the major cause of plastic failure, the brittleness is increased by cold, and breakage is common.

Routing, or etching, is used to apply a message to heavy gauge laminated plastic. Polyvinylchloride, phenolic, laminated fiberglass and even plexiglass are in use, but the last is very expensive. The routing removes the darker surface to reveal a lighter surface beneath, producing a highly visible label. A typical 3 x 5 label may take 20 minutes to engrave. A small machine with metal letter templates and metal stylus are used to rout the plastic.

The steps involved include cutting large sheets into strips of the desired width. The number of letters per line are counted and the length of the label is determined. A batch of labels may then be cut to the necessary length. Some shops chamfer the edges to produce a framed effect. The metal (aluminum, steel, or brass) templates are set-up, the plastic is locked in place, and engraving is begun. To obtain a cleaner cut with the soft plastic, polyvinylchloride, the routing tool is run over each letter twice. One slip and the label is damaged, and routing must begin again on a new piece. Fading and breakage destroys or reduces the legibility of many routed labels in 3 - 5 years.

At least one garden uses black vinyl plastic, lettered with white

India ink and sprayed with clear acrylic. A few places type a text onto a plasticized paper product marketed as Tyvek(R). The latter is rapidly worked, quite attractive, but may last only two seasons.

The Los Angeles State and County Arboretum has been using a laminated fiberglass label[13] since 1960. The information is typed on a sheet of 29 pound weight alpha cellulose overlay paper. Six 3 x 5 plant labels are typed on a 9 x 10 sheet. The typed sheets are placed in the fiberglass components and laminated. The material is composed of the following solid components from bottom to top: 1) one sheet of Fiberglass reinforcement mat, 1 oz. per sq. ft.; 2) two sheets of Fiberglass veil (mat); 3) two sheets of 60 lb. wt. T-02 pigmented alpha cellulose paper; and 4) two sheets of 29 lb. wt. alpha cellulose overlay paper, one of which has the desired typewritten information. Letter height is 7/32 of an inch.

The label lay-up is saturated with an Acrylic modified Polyester resin blend which includes an ultraviolet absorber for light stability. This is molded at 150 p.s.i. pressure at 230° F. The entire process is done for LASCA by a private manufacturer. The average cost per label in 1977 was $1.19. After seventeen years of use, they report that their only major problem is theft.

Messages may be applied to metal with pencil, with an etching ink, by stamping, embossing, or through a photographic process. Some institutions use one label for both record purposes and for public identification. Some recommend a very inexpensive combination.

A Number 2 lead pencil may be used to inscribe information on a zinc strip. According to Leonard Sweetman at the Jenkins Arboretum near Philadelaphia, the carbon from the pencil reacts electrolytically with the zinc etching the label more deeply as time passes. An ink composed of one-half hydrochloric acid and one-half Antimony (III) chloride is used to etch information in zinc plates at the Stanley M. Rowe Arboretum.[24]

Embossed metals, such as aluminum, zinc, and steel are used as display labels by several gardens. Although they don't usually have the high visibility of other materials, they are durable, and easy to make. Strips of metal cut from long rolls, or individual plates are used. A Graphotype machine that has a keyboard stamps metal strips as does the hand-operated Roovers-Lotsh machine. An addressograph machine embosses addressograph plates. Morris Arboretum and now the Arnold Arboretum are using an orange colored addressograph plate. They are easily seen, but they may be too bright for some people's taste.

The final method of production is a newer one, photosensitive aluminum plates, but it is well tested. The U. S. National Arboretum has been using the system for at least thirteen years, and the U. S. Navy had a much longer experience with them. The Navy uses them to identify equipment and to produce equipment panels with instructions for ship-board use. Subjected to salt spray, extremes in temperature, humidity, harsh sunlight, chemicals, and even fire, they have remained legible for thirty years.

Institutions with a dark room have most of the equipment required to produce labels of photosensitive anodized aluminum. Very simple or very sophisticated equipment may be used to carry out each step in the process. Besides the durability of the product, the process provides for exceptional flexibility in usage. Name tags, labels of any size, signs up to 24" x 40" can be made. Simple lettering or fine art work can be reproduced in durable aluminum. The following steps define the process: producing the type of artwork, putting it on film, exposing and processing the aluminum plate, and fabricating the metal plate. The Botanical Garden of the University of British Columbia uses a typewriter to produce print for 0.25" x 4" accession labels. Some places use Press Type(R). Many places use a "Headliner" that produces type on film at the touch of a key. Ingenuity has reduced the time involved in producing the film or negative for labels. The U. S. National Arboretum has blocked off a clear acetate sheet into sixteen 3" x 5" rectangles. They lay this sheet over graph paper and then they easily, rapidly and neatly tape the letters to the acetate sheet with clear tape. Several sheets may be prepared to be taken to the photography room. If a fine image is needed, a clear sharp negative equal in size to the final desired positive should be produced. Lacking a special camera, an institution can have a professional photographer produce the negative. A dark-room isn't needed for processing. A General Electric gold fluroescent lamp (F 40 GO) or equivalent may be used as a safe-light and produces illumination for easy working conditions. The photography room requires table space and a contact printer, that will take a 12" x 20" sheet. The contact printer should

have a vacuum pump to obtain firm contact between the acetate sheet or other negative, especially when fine art work is reproduced. Unlike many photographic processes, exposure time of the photosensitive plate isn't especially critical, and it can be easily determined for average subjects after one or two trial exposures. A Quartz light, 650-watt, or Photoflood, 500-watt, lamp lit for 15 - 30 seconds will produce the image. The plate must then be developed in a chemical bath, in a tray or in a "Zip-Processor." The latter is slightly faster (10 seconds vs. 3 minutes), conserves chemicals but costs $500.00 more than trays. After developing, the plate is rinsed, and the image must be sealed by emersing the plate in a heated chemical bath for 20 - 30 minutes, and then rinsing it again in clear water. Distilled water is used for the rinse process.[15] The fabrication step is last. The large plate is cut into 3" x 5" pieces with a shear; a hand operated one may be used, but one with a foot pedal is needed for sheets greater than 0.063" in thickness. Holes must be punched, and the corners may be rounded.

The process when explained in detail may seem elaborate, but it is quite simple, and for someone with dark-room experience and the desire to experiment, the materials may provide exciting opportunities and flexibility for reproducing art work, long interpretive labels, large signs, and even accession labels.

Label Holders and Attachments

a. Introduction

For labels that require some sort of holder or attachment, its

selection is equally important as the label itself. The form of attachment is probably the most important factor affecting the rate of vandalism. Labels stuck directly in the soil outdoors or among conservatory plants, are most subject to theft. Labels attached to heavy stanchions in the ground are also subject to removal and if placed on the lawn are a hindrance to mowing. Some labels are attached directly to trees with nails, with screws, or with a wire. Some labels are thin metal or plastic (to conserve costs), and need a solid backing or support.

One of the major problems with attachments is the incompatability between the attachment and the plant. Copper wire is phytotoxic, and any wire loop poses the problem of girdling. Plants will overgrow permanently attached labels. The use of springs behind the label delays girdling, but it doesn't eliminate it. Although girdling is a hazard, some systems provide the opportunity for growth measurement.

Besides a conflict between attachment and plant, there may be an incompatability between the metals used for the label and the attachment. A galvanic reaction may occur increasing the deterioration of the two. Copper wire and zinc labels corrode because of a chemical reaction, as do copper wire and aluminum labels. Plastic coated copper wire will prevent a reaction until the coating wears away. Copper wires and brass labels are unreactive, and stainless steel wire is non-corrosive.

Although there is some information available about label production time, little is published about the manufacture of various holders and how this affects the overall cost of a labeling system. There is

also some disagreement as to label placement. Installation is usually simple, and the most time consuming aspect is likely to be walking the grounds to reach the plant requiring a label. The growth of trees and shrubs produces a maintenance requirement. Nails and screws must be backed out, springs replaced, new wires added, and labels reattached. All this requires a scheduled maintenance program to prevent the labels and attachments from damaging the plant.

J. R. Schramm[25] while at the Morris Arboretum in Philadelphia wrote on the subject of plant growth and labeling. He discussed labels for thick barked trees, thin barked trees, and shrubs, as well as, labels on standards. On thick barked trees, screws were inserted no deeper than the bark, usually less than 1/4". When these labels were checked eight years later, most were in place, because the labels were firmly attached to the cork which was pushed out by the tissues formed by the cambium and cork cambium. His work was convincing, but I'm afraid that the vandalism problem of today negates the solution.

b. Attachments by Plant Size or Growth Habit

There are several alternatives that one may select for attaching a label to a tree. It may be attached to the trunk or a major horizontal limb. A height of 7' - 10' on the trunk is suggested to reduce the possibility of vandalism. Many gardens place them on one compass face of the tree, usually the north side, because the lower light levels slow the fading of susceptible label materials. Consistency is helpful when possible, but sometimes for easy reading display labels should be

placed on the side of a tree that faces a path. Record labels should be placed on the side away from the path. Often it is impossible to attach a label to the trunk of very dense evergreen trees and thorny trees. Labels should then be hung from horizontal branches at about a height of 7' - 10' feet. Consistency again applies.

Labels may be attached to large trees by several methods, either directly or on a holder. The label is held in place with nails or screws. Springs are placed between the outer face of the label and the nail head or screw head. This arrangement is likely to cause less damage to the bark. Aluminum or stainless steel screws, nails, and springs are recommended. Aluminum objects imbedded in a tree would be less damaging to a saw than stainless steel objects. At the Brooklyn Botanic Garden, a section of old garden hose is used between the label backing and the tree to absorb the growth by the living tree.

Some label materials require a backing for support, either metal, wood, or heavy plastic. At some gardens the label and backing are held in place with a lag bolt. To avoid nail holes which would provide access fungi on palms, The Fairchild Tropical Garden uses a coiled stainless steel wire to encircle the trunk and hold the label. A sliding band of metal was once used at Morris Arboretum[25] to offset the growth problem. It worked well, but was abandoned because of cost. A loop of wire, either bare or coated, may be used to secure a label to a branch. Aluminum, copper, zinc-aluminum, or stainless steel wire are available. The problem of girdling is the same as that discussed in the section about accession

labels. The phytotoxicity of copper wire is also a concern here. Labels attached to stakes should not be used around trees because they are easily removed and they are an impediment to easy mowing.

The only reason a holder is used for a label is to increase the strength of the label, helping to reduce breakage by vandals. An inexpensive backing material is chosen rather than increasing the thickness of the more expensive label material. However, the use of a backing material may add several additional steps to the manufacturing process. The holder must be made or purchased, and the label must be secured to the backing.

Labels are often attached to a backing to produce increased rigidity. Several methods are used to accomplish this. For example, at Hidden Lake Gardens[8] and the campus of Michigan State University, a three-inch lag screw, with head removed is welded to the center of a 3/4" x 5" x 3/16" piece of steel. One-quarter inch marine plywood cut to the same dimension, but 1/4" thick, is attached with rivets at either end. The plywood is treated with wood preservative and painted before assembly. The top of the lag screw is bent about 10°, which cants the label downward when the label is screwed into a tree. A screw at each corner of the label holds it against the plywood. At some gardens, glue is used to hold the label against the backing.

Labels cannot be nailed or screwed into small trees and shrubs. A loop of wire is one method of attaching a label to a small tree or shrub. Stakes (standards) are more useful for small trees and shrubs,

especially if they are in beds separated from the mowed areas. Vandals easily remove stakes from the ground unless they are anchored with a cross-piece or concrete. Elaborate anchoring systems are labor intensive, so that some gardens do not use them. Therefore, the cheapest but strongest standard should be chosen, because someone is likely to remove it before it deteriorates. The stronger stakes are L - shaped, T - shaped and U - shaped in cross-section rather than rectangular.

Wood, polyvinylchloride and plexiglass plastic, aluminum, iron, galvanized metal, stainless steel, and cement are used as standards. The material itself, its thickness and its length, determine its price. Standards may be simply a stake or a stake and label holder combined. Table III shows some material costs and fabrication times for wood, plastic, and metal standards.

By computing labor costs from the fabrication times, and by adding the material cost, a garden can determine its own approximate cost for production of a standard. The formula (0.016 hour/minutes x ab) where " a " equals the fabrication time in minutes and " b " equals the hourly pay of the operator gives the labor cost for an item. This should then be compared to a manufacturer's price. A garden should evaluate any fabrication process by making a few items before it begins large scale production to determine if in-house production is more desirable than purchase from a manufacturer.

Labels cannot be attached to most herbaceous plants, but must be attached to a standard of a height appropriate to the size of the plants.

Each different plant or each group of plants may be identified with a label. Such a scheme also applies to collections of some woody plants like dwarf conifers. When a single label is used for each cultivar in a mixed bed, the bed looks like a graveyard. A group label like those used in the Gotelli Dwarf Conifer Collection[6] of the U. S. National Arboretum reduces the total number of labels required. Brochures with plot plans may be an equally effective solution, however, some visitors are confused by them.

c. Cost of Materials

Holders, such as metal sleeves, rigid backings for labels, and combination stands-label holders, add costs in materials and handling time to a system. In 1977, material ranged from $0.09 to $0.75 per unit.

The range in cost for direct attachments is also quite variable. Number 10-D galvanized common nails cost $0.01 a piece; and $0.035 for stainless steel. Aluminum nails are also used but they bend more easily than steel nails. Most hardware stores sell galvanized nails but few sell stainless steel nails. Three inch, 10 gauge, round headed zinc-chromate steel nails list for $0.12 each, and steel compression springs sell for $0.21 - $0.35 each. Stakes and standards ranged widely in price, from $0.10 - $1.90. There is so much variability in length and thickness of stands used that it is difficult to compare costs for wood versus plastic or metal versus plastic. A garden should determine what height stand is needed, then determine the thickness requirements for a specific material and compare the price of one stand versus another.

TABLE III

PRODUCTION OF LABEL STAKES

Material		Material Cost	Fabrication Time
Wood	Cedar 1" x 2", 33" long	$0.25	10.0 minutes
	Fir 2" x 4", 32" long, pressure treated	.98	*----
Plastic	Plexiglass bar 3/4" x 1", 18" long	* ----	2.0
	Polyvinylchloride T - stake, 8" long, holder 2½" x 2½"	0.10	*----
Metal			
	Aluminum bar 1/8" x 1", 12" long	* ----	2.0
	Aluminum bar 1/8" x 3/4", 30" long	* ----	4.5
	Aluminum bar 12" long, zinc holder 9 ga.	* ----	6.0
	Aluminum angle 1/8" x 1" x 1", 30" long	0.26	*----
	Aluminum channel 1/8" x 5/8" x 5/8", 30" long	0.79	15.0
	Galvanized wire 18 - 20 ga., 33" long	0.14	2.6
	Galvanized wire 8 ga., 26" long, holder 26 ga.	0.21	*----
	Galvanized rod 1/4", 26" long, holder 1/8"	0.50	8.5
	Galvanized stake 20" long, aluminum holder	0.95	*----
	Galvanized T - iron 1/8" x 1" x 1", 30" long	1.90	48.0

*---- Data lacking

d. Production

In-house production of stanchions in not necessarily a bargain. Actual material costs are not cheaper than some of the fabricated costs. Additionally, production time must be added to the material cost for in-house manufacturing. The average time to produce holders for trees, shrubs, and herbaceous plants is 6.5 minutes. Table IV lists some recorded production or fabrication times for various attachments. At an hourly rate of $3.30 it costs $0.79 to fabricate an aluminum channel stake. Produced in quantity label holders become an expensive item, in time and money. However, many gardens are thankful to have this type of work available for the off-season and for days of inclement weather. The making of elaborate attachments produces some questions that are relevant to most problems. Does the garden need it? Can the garden make it efficiently and cheaply? Can the garden afford the time to make it?

e. Methods of Production

Stakes used at Los Angeles State and County Arboretum[14] fit the following specifications: aluminum-channel-extruded-hard-tempered-Alcoa die No. 2715 - alloy No. 6325 in 16' lengths, 3/8" x 3/4" x 1/8". Twenty-one inch lengths are cut on a machine-band saw. An arbor press and jig are used to produce a forty-five degree angle at one end, and a drill-jig is needed for drilling holes in both the label and stake with a No. 30 drill. The labels are attached to the stakes with Cherry Blind Rivets - Aluminum alloy - Pull Through Hollow - Modified Brazier Head - Stell Stem. A hand operated Cherry Rivet Gun is used to press the rivets into place.

In the past at Boerner Botanical Gardens,[31] a label holder of galvanized steel, 4" x 2 5/16", was mounted on a metal standard pointed at the bottom. The standard was twenty to thirty-six inches long, and it was made of hot rolled rod of hot-dipped galvanized steel. The top of the standard was bent at a 30° angle. A spot-weld or rivet was used to fasten the holder to the standard.

At Brookgreen Gardens, embossed aluminum tape is secured to a label-holder of steel 3" x 1¼" x 1/8".[28] The top 3/8" of the embossed label is bent backward 90°. The label is then held against the holder, and the bottom of the label is bent around the bottom of the holder. The top of the label is then crimped over the top of the holder in a vise. A ¼" rod, either galvanized iron or stainless steel is welded at an angle to the back of the holder.

At the Botanic Garden of Smith College, No. 9 sheet zinc was used as holders for their embossed labels.[3] The top and bottom was turned over one-eighth inch to form a sleeve. The holders were made in different widths and lengths for their needs. A galvanized, No. 22 gauge, sheet metal bracket with holes at top and bottom, was soldered on the back of the label holders. Galvanized lag bolts, 1½" or 2", were used for mounting on trees. A loop of 12 or 14 gauge wire was used for mounting on shrubs. The same holders with a 18 or 20 gauge wire soldered to the back of the zinc holders were used in the perennial gardens. A slight kink was bent in the standard below the soil line to prevent the stakes from turning with the wind.

TABLE IV

FABRICATION OF LABEL

ATTACHMENTS

Galvanized label holder for tree, riveted	2.0 minutes
Aluminum label holder	2.0
Galvanized stake	2.0
Iron stake	2.0
Plexiglass stake	2.0
Wire	2.6
Bell Wire	3.5
Aluminum standard and zinc holder	6.0
Steel plate on steel stand	7.0
Wood backing for tree label	7.6
Aluminum standard	8.3
Cedar stake	10.0
Aluminum channel stake	15.0
Galvanized stake	30.0
T - iron stake	48.0

The Brooklyn Botanic Garden screws an engraved plastic label to a wood backing on a "T" iron stake, and inserts this into the ground for young trees, and in beds which contain perennial herbaceous plants.[12] Sometimes the stake is set in cement. The wood is white pine 2½" x 5½" x 1/2" with 13/64" holes drilled and countersunk. Two coats of exterior paint are applied to the wood.

The "T" iron 1" x 1" x 1/8" is cut into thirty-inch lengths, and the top three corners are smoothed on a grinding wheel. The stake is heated in a forge, and the top is bent. Two 7/32" holes are drilled in the "T" iron flange to correspond with the holes in the wood backing. Three inches from the bottom another hole is drilled through the rib of the "T" iron. The stakes are then sent to a company to be galvanized. When they return they are washed with vinegar and water. After drying they are painted with one coat of dark green enamel.

After the paint drys, a galvanized nail is driven half-way through the hole in the mid-rib of the "T" iron. Two 3/4" long, flat head, 10/24 brass machine bolts inserted through the wood backing and the "T" iron hold the backing in place. The plastic engraved labels have 7/64" drill hole in each corner, and a No. 3 round head, brass wood screw, 3/8" long holds the label on the backing.

At Longwood Gardens where polyvinylchloride plastic labels are used, they attach some labels to PVC stakes. The stake is U - shaped in cross-section for rigidity, but the top two inches of the stake are flat and angled backwards. Labels are attached with a PVC solvent.

For some conservatory plants, more permanent labels than plastic or wooden markers may be desired. Clarence Nead of Longwood Gardens designed a pot clip[10] about 1957 which is still used. It fits tightly over the lip of clay pots, and it is difficult for a vandal to remove. Stainless steel type 304, 16 gauge, 1/2" wide is purchased and cut in lengths 4 1/16". It is bent back upon itself in a jig and a piece of 13 gauge stainless steel wire 1 3/4" long is welded at the bend of the clip. The wire is bent in a loop. The brass identification label is slipped on the loop and the gap is closed with pliers. The clip is slipped over the flower pot rim. On plastic flower pots, the clip may be eliminated and a loop of heavy wire passed through a hole melted into the rim of the pot holds the label.

CONCLUSION

Labeling of a plant collection or a garden can improve its educational value for some members of the visiting public. It can be conducted without destroying the aesthetic qualities of some gardens, but labeling should not be considered as an add-on feature, but rather an integral part of interpreting the garden for the visitor. Therefore labeling should be considered as part of the design process. In fact whole new gardens should be developed primarily for their educational potential as is being done in Germany. How labeling is conducted at an institution reflects its commitment to education and to aesthetic principles. Labels should therefore be chosen with many criteria in mind: visibility, legibility, durability, initial cost, handling problems, maintenance requirements, and compatibility with the garden environment. I think that people have ignored the impact of their labeling systems on the enquiring and aesthetically sensitive public, and therefore the subject deserves careful consideration. I hope that this thesis will serve as a helpful model for a handbook on labeling.

FOOTNOTES

1. Alexander, E. P. 1977. "What is Interpretation?" The Longwood Program Seminars 1977. University of Delaware. Newark. 9: 70 p.

2. American Horticultural Society. Plant Sciences Data Center. Mount Vernon, Virginia 22121.

3. Campbell, W. 1965. "Metal Holders for Roover Embossed Labels." American Association of Botanical Gardens and Arboretums, Quarterly Newsletter Issue No. 63: 13.

4. Castro, N. 1972. "Humanizing Park Signs." Parks & Recreation 7 (9): 39, 74, 76.

5. DeBorhegyi, S. and I. Hanson, eds. 1968. The Museum Visitor . . . Visitor Reaction to Exhibits in the Milwaukee Public Museum. Milwaukee. 187 p.

6. Dorer, R. F. 1976. "Outdoor Communication at the U. S. National Arboretum." The Bulletin, The American Association of Botanic Gardens and Arboreta 10 (3): 67-70.

7. Freeman, F. W., ed. 1965. Quarterly Newsletter American Association of Botanical Gardens and Arboretums. No. 63: 61 p.

8. Freeman, F. W. p. 33-34.

9. Gabianelli, V. J. and E. A. Munyer. 1974. "A Place to Learn." Museum News 53 (4): 28-33.

10. Hodge, W. H. 1959. "A Permanent Label Clip for Potted Plants." The National Horticultural Magazine 38 (3): 181-183.

11. Kaplan, S., R. Kaplan and J. S. Wendt. 1972. "Rated Preference and Complexity for Natural and Urban Visual Material." Perception and Psychoanalysis 12 (4): 354-356.

12. Langenau, M. 1965. "Vandal Resistant 'T' Stake Label." American Association of Botanical Gardens and Arboretums, Quarterly Newsletter Issue No. 63: 29-32.

13. Martel, D. 1965. "Fiberglass Labels in Use at the Los Angeles State and County Arboretum." American Association of Botanical Gardens and Arboretums, Quarterly Newsletter Issue No. 63: 7-10.

FOOTNOTES

14. Martel, D. p. 8.

15. _____, 1976. Metalphoto(R) Technical Manual. Metalphoto Corporation. 18531 South Miles Road. Cleveland, Ohio 44128.

16. McIntosh, P. A. 1976. Chapter 12. "Signs and Labels." In G. W. Sharpe. Interpreting the Environment. John Wile and Sons, Inc. New York. 565 p.

17. McLuhan, M., H. Parker, and J. Barzun. 1969. Exploration of the Ways, Means, and Values of Museum Communication with the Viewing Public. Museum of the City of New York. New York. 82 p.

18. Melton, A. W. 1972. "Visitor Behavior in Museums: Some Early Research in Environmental Design." Human Factors 14 (5): 393-403.

19. _____, 1972. Sign System Specifications, National Park Service. U. S. Department of the Interior. Jan. NPS 871: 181 p.

20. Oakes, G. W. 1971. Turn Right at the Fountain. Third Edition. A Signet Book. Holt, Rinehart, and Winston. New York. 304 p.

21. Pierotti, R. 1973. "Be . . .See . . .Touch . . .Respond." Museum News 52 (4): 48.

22. Pierotti, R. p. 48.

23. Rabb, G. B. 1969. "The Unicorn Experiment." Curator 12 (4): 257.

24. Rowe, S. M. (Mrs.). 1976. "How to Handle a Private Arboretum." The Avant Gardener 8 (6): 47.

25. Schramm, J. R. 1954. "A Reexamination of Plant Label Problems with Some New Designs." Morris Arboretum Bulletin 5 (3-4): 36-43.

26. Schroeder, F. 1976. "Designing Your Exhibits, Seven Ways to Look at an Artifact." American Association for State and Local History Technical Leaflet 91. History News 31 (11): 8 p.

27. Simon, S. J. 1977. "Using the Living Collection as an Educational Resource - A German View." The Bulletin, American Association of Botanical Gardens and Arboreta 11 (1): 42-45.

FOOTNOTES

28. Tarbox, G. L., Jr. 1965. "Embossed Labels in Use at Brookgreen Gardens." American Association of Botanical Gardens and Arboretums, Quarterly Newsletter Issue No. 63: 11-13.

29. Tilden, F. 1957. Interpreting Our Heritage, Rev. ed. The University of North Carolina Press. Chapel Hill. 120 p.

30. Tilden, F. p. 88.

31. Voight, J. E. 1965. "Vinylite Plastic Coated Flexible Paper Labels - Economical and Practical for Seasonal Usage." American Association of Botanical Gardens and Arboretums, Quarterly Newsletter Issue No. 63: 10-11.

32. Wilson, E. H. 1926. Aristocrats of the Garden. The Stratford Co. Boston. 312 p.

BIBLIOGRAPHY

Bunce, F. H. 1969. "Arboretum - A Place for Trees?" Parks and Recreation IV (9): 71-72.

Bryant, W. L. 1923. "Experiments with Museum Labels." Museum Work VI (4): 115-120.

Castro, N. 1972. "Humanizing Park Signs." Parks and Recreation VII (9): 39, 74, 76.

Chase, R. A. 1975. "Museums as Learning Environments." Museum News 54 (1): 36-43.

Clayton, D. ed. 1977. The Longwood Program Seminars 1977. Newark. University of Delaware. 9: 70 p.

Coleman, L. V. 1927. Manual for Small Museums. New York. G. P. Putman's Sons. 395 p.

Conaway, M. E. 1972. "Exhibit Labeling: Another Alternative." Curator XV (2): 161-166.

DeBorhegyi, S. and I Hanson. eds. 1968. The Museum Visitor . . . Visitor Reaction to Exhibits in the Milwaukee Public Museum. Milwaukee. 187 p.

Dorer, R. F. 1976. "Outdoor Communication at the National Arboretum." The Bulletin American Association of Botanical Gardens and Arboreta 10 (3): 67-70.

Freeman, F. W. ed. 1965. Quarterly Newsletter American Association of Botanical Gardens and Arboretums No. 63: 61 p.

Gabianelli, V. J. and E. A. Munyer. 1974. "A Place to Learn." Museum News 53 (4): 28-33.

Hartman, S. G. 1972. "New Designs for a Systematic Exhibit of Birds." Curator XV (2): 113-120.

Hellman, R. A. and E. J. Drago. 1961. "A New Technique in Nature Trail Signs." Curator IV (2): 181-183.

Hodge, W. H. 1959. "A Permanent Label Clip for Potted Plants." The National Horticultural Magazine 38 (3): 181-183.

BIBLIOGRAPHY

Huttleston, D. 1976. "Labeling at Longwood Gardens." The Bulletin American Association of Botanical Gardens and Arboreta 10 (3): 74-75.

Jefferson, R. M. 1962. "Metalphoto - A Promising New Plant Labeling Method." The American Horticultural Magazine 41 (3): 171-173.

_____, 1976. "Modular Signs Point the Way." Parks and Recreation 11 (6): 33.

Jensen, J. E. N. 1970. "Sign Language of the National Park System." Parks and Recreation V (11): 42, 60.

Kaplan, S., R. Kaplan and J. S. Wendt. 1972. "Rated Preference and Complexity for Natural and Urban Visual Material." Perception and Psychoanalysis 12 (4): 354-356.

Kent, H. W. 1923. "Museum Labels." Museum Work. VI (2): 55-58.

Link, J. 1973. "The Arboretum's Labels: A Valuable Teaching Aid." Arnoldia 33 (4): 239-244.

McLuhan, M., H. Parker, and J. Barzun. 1969. Exploration of the Ways, Means, and Values of Museum Communication with the Viewing Public. New York. Museum of the City of New York. 82 p.

Melton, A. W. 1972. "Visitor Behavior in Museums: Some Early Research in Environmental Design." Human Factors 14 (5): 393-403.

Musgrove, S. W. 1976. "Making Exhibit Labels: A Mechanical Lettering System." History News 31 (10): 1-8.

National Park Service. 1972. Sign System Specifications U. S. Department of the Interior NPS 871: 181 p.

Oakes, G. W. 1971. Turn Right at the Fountain 3rd. ed. New York. A Signet Book. Holt, Rinehart, and Winston 304 p.

Pierotti, R. 1973. "Be...See ....Touch ....Respond." Museum News 52 (4): 43-48.

Rabb, G. B. 1969. "The Unicorn Experiment." Curator XII (4): 257-262.

BIBLIOGRAPHY

Renwick Gallery. 1976. "Signs of Life: Symbols in the American City." Washington. National Collection of Fine Arts. Smithsonian Institution. APERTURE, Inc.

Rowe, S. M. (Mrs.). 1976. "How to Handle a Private Arboretum." The Avant Gardener 8 (6): 47.

Schramm, J. R. 1954. "A Reexamination of Plant Label Problems, with Some New Designs." Morris Arboretum Bulletin 5 (3 and 4): 36-43.

Schroeder, F. 1976. "Designing Your Exhibits, Seven Ways to Look at an Artifact." History News 31 (11): 1-8.

Seibert, R. J. 1953. "Something Different in Tree Labels." Lasca Leaves III (1): 4-5.

Sharpe, G. W. 1976. Interpreting the Environment. New York. John Wiley & Sons, Inc. 565 p.

Shettle, H. H. 1973. "Exhibits: Art Form or Educational Medium?" Museum News 52 (1): 32-41.

Simon, S. J. 1977. "Using the Living Collection as an Educational Resource - A German View." The Bulletin American Association of Botanical Gardens and Arboreta 11 (1): 42-45.

Sohl, S. 1969. "Effective Exhibits." The Museologist Northeast Regional Museums Conference No. 112: 17-26.

Thompson, P. A. 1972. "The Role of the Botanic Garden." Taxon 21 (1): 115-119.

Tilden, F. 1957. Interpreting Our Heritage Rev. ed. Chapel Hill. University of the North Carolina Press. 120 p.

U. S. Department of Agriculture. 1970. "Plant Labeling." Conservation Guide Sheet No. 21. Soil Conservation Service. 6 p.

Voight, J. E. 1965. "Vinylite Plastic Coated Flexible Paper Labels - Economical and Practical for Seasonal Usage." American Association of Botanical Gardens and Arboretums, Quarterly Newsletter No. 63: 10-11.

BIBLIOGRAPHY

Watts, M. T. 1948. "Adventures in Nature Education at the Morton Arboretum." Morton Arboretum Bulletin of Popular Information 23 (1 and 2): 1-8.

Williams, L. A. 1960. "Labels: Writing, Design, and Preparation." Curator III (1): 26-42.

Wilson, D. W. and D. Medina. 1972. "Exhibit Labels: A Consideration of Content." History News 27 (4): 1-8.

Wilson, E. H. 1926. Aristocrats of the Garden. Boston. The Stratford Co. 312 p.

Wyman, D. 1954. The Arnold Arboretum Garden Book. New York. D. Van Nostrand Co., Inc. 354 p.

Wyman, D. 1971. Wyman's Gardening Encyclopedia. New York. The MacMillan Co. 1222 p.