The Western Kentucky University Horticultural Gardens: A Design & Implementation Plan

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1990
THE WESTERN KENTUCKY UNIVERSITY HORTICULTURAL GARDENS:
A DESIGN AND IMPLEMENTATION PLAN

A Thesis
Presented to
the Faculty of the Department of Agriculture
Western Kentucky University
Bowling Green, Kentucky

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
Catharine Owens Schriver

December 1990
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THE WESTERN KENTUCKY UNIVERSITY HORTICULTURAL GARDENS:
A DESIGN AND IMPLEMENTATION PLAN

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The purpose of this thesis was to design a master landscape plan and serve as a preliminary planning tool for the development of Horticulture Gardens at Western Kentucky University. The planning process involved the development of a mission statement and goals for the gardens, analysis of the site, and design of a landscape plan for the proposed six acre Horticultural Gardens located at the WKU farm. Other areas related to the Garden's development explored in the thesis include: an outline of course learning objectives that could be achieved through learning activities conducted at the Horticultural Gardens, an examination of ways to develop a mutually beneficial relationship with the horticulture industry in Kentucky, and an estimate of the costs and possible funding sources for such an endeavor.

The development of the Horticultural Gardens can provide a means for the Agriculture Department and the university to forge additional linkages with horticulturally related industries as well as the local community. It can also complement the classroom learning experience and broaden the educational resources of the university while creating an aesthetically pleasing environment to be enjoyed by students, faculty and staff, and the general public.
INTRODUCTION

A botanical garden is composed of living plant collections whose members are selected for their educational and research value. The plants are correctly identified and labeled, and accurate documentation of their source is maintained (28). Botanical gardens are affiliated with a variety of institutions or governmental units such as cities, states, non-profit foundations and institutions of higher education. A botanical garden may serve a number of purposes including environmental aesthetics, information and education, research, conservation and preservation, and public service and community pride (26). These purposes are consistent with those of contemporary comprehensive higher education institutions.

The purpose of this thesis is to study some of the benefits and challenges provided by university botanical gardens and to serve as the beginning of the planning process for the Horticultural Gardens at Western Kentucky University. Specifically, the goals are:

1. To develop a mission statement for the Horticultural Gardens at WKU.

2. To develop objectives for the Horticultural Gardens that are based on the mission statement.

3. To design a master landscape plan for the Horticultural Gardens located at the university farm.
4. To outline how these gardens can be used to help meet the learning objectives for a number of courses taught in the Agriculture Department.

5. To examine ways to develop a mutually beneficial relationship with the Kentucky horticulture industry.

6. To outline monetary resources needed to implement such a plan and explore possible resources for external funding.

It is proposed that the development of the Horticultural Gardens at the WKU farm serve as the first step in a comprehensive long-term development plan. Succeeding development would expand the gardens to other areas of the campus.

Interest in the development of a botanical garden at Western is not new. In 1979 a committee which included Agriculture Department faculty developed a proposal for a botanic garden at WKU but the proposal has not been implemented (7, 8).
History of University Botanic Gardens

Botanical gardens and universities have had a long history of association beginning with the establishment of the first university botanical garden at the University of Padua, Italy, in 1545. The purposes of the early gardens were twofold. During this time of worldwide exploration, exotic plants from around the world were brought to these gardens where they were grown, classified and studied to determine possible uses as food and medicine. Also many gardens were associated with medical schools and students studied the plants that were the basis of many of the medical treatments of that time (28). Following the establishment of the Padua garden, other universities throughout Europe followed suit and botanic gardens were established at Bologna, Italy, in 1567, Leiden in the Netherlands in 1587, at Heidelberg, Germany, and Montpelier, France, in 1593, and at the Oxford Physic Garden in England in 1621. By 1700 there were over twenty such botanical gardens throughout Europe. Although some of those early gardens have disappeared, many are still in existence. These early gardens were often named physic gardens due to their relationship with medical training (17).
The garden at Oxford University linked together botany, medicine, and practical gardening for systematic study. When Charles Daubeney was appointed professor in 1834 the name of the garden was changed from physic garden to botanic garden and the focus of the garden was broadened from medicinal plants to experimental gardening. A portion of the garden was devoted to research in areas such as "the effects of soils or of chemical agents on vegetation and for other researches of similar description" (5).

By the 18th and 19th centuries the gardens also developed a public education function. They were open to the public and plants were labeled with the current Latin name, common name, and country of origin. The gardens were popular destinations for families on Sundays and Holy Days and student gardeners often conducted tours and provided information on the plants and their uses (17).

The first university botanic garden in the United States was established at Harvard University in 1805 on a plot of seven acres of land. The garden served as a classroom for students and also distributed new and unusual plants. Although this original garden no longer exists, the Arnold Arboretum was started by Harvard University in 1872 when 250 acres of land was deeded to the school (30). The Arboretum is well known today as a teaching and research facility. The establishment of university botanical gardens is continuing. Examples include the North Carolina State
University Arboretum established in 1977 as well as the University of Nebraska-Lincoln which designated their entire campus as a botanical garden in 1989 (10, 24).

Benefits Provided by University Gardens

Today many types of higher education institutions ranging in size from small private colleges to large universities are involved in some type of planned grounds development or garden development. The four hundred year history of association between universities and gardens continues to thrive because of the benefits a botanical garden can provide for a college or university.

A garden is useful in helping a school fulfill its mission. For example, the mission of Western Kentucky University is education, research and public service. There are a number of ways that the Horticultural Gardens could aid the university in these three areas.

An educational garden complements the classroom learning experience and serves as an outdoor living laboratory where students in disciplines such as horticulture, agriculture, and botany/biology can actually work with many of the plants they have learned about in class. Horticulture students can also gain valuable work experience in a university garden. Non-science disciplines could make use of such a garden. The Art Department could utilize a garden for drawing and photography courses and it could serve as a resource
for nature education for the teacher education program (12, 28).

The Horticultural Gardens could aid in fulfilling the research mission by providing an increased and diverse plant collection that could be used for faculty and student research (28). It could also play a role in fulfilling the university's public service mission by enhancing the surrounding community and expanding the educational impact of the university to citizens of the larger community (12, 28).

A university garden or well-maintained grounds that are part of a comprehensive plan may also benefit student recruitment. In 1984 the Carnegie Foundation for the Advancement of Teaching did a study to learn more about how students choose a college. Campus visits by parents and students were ranked as the most important source of information used in deciding on a college. Furthermore, 62% reported that the appearance of the grounds and buildings influenced them the most during their campus visit. It appears that an attractive well-maintained landscape may pay dividends for a school in the form of increased enrollment (9).

Finally, a botanical garden or well-maintained grounds can provide aesthetic benefits by increasing the beauty of the university campus. By doing so it may improve the quality of life in the educational and work environment as well as serve as a source of passive recreation for students, faculty and staff, and the general community (12).
Factors Which Play a Role in Shaping University Gardens

All botanical gardens develop their own unique identity. Like other botanical gardens, university gardens are guided by the general purposes outlined by Shannon Smith (environmental aesthetics, information and education, research, conservation and preservation, and public service and community pride). In addition to these general purposes, factors that are associated with their educational setting play a role in the shaping of university gardens.

The administrative auspices of university gardens differ from campus to campus and may influence the direction taken by a garden. A number of forms of administrative control are possible. Affiliation may be with an academic department as occurs at the University of Minnesota Landscape Arboretum which is associated with the Horticulture Department (21). The Connecticut College Arboretum is administered by the Botany Department (12). A garden may also be administered by a non-academic department. At the University of Nebraska-Lincoln, the botanical garden is administered by the Grounds Department (10). A different arrangement is found at Smith College where the botanic garden director is considered a 'major administrator' and reports to the Treasurer who in turn is directly responsible to the President (18).

In her presentation at an American Association of Botanical Gardens and Arboreta (AABGA) Conference in Lincoln, Nebraska, Barbara Eggers reported that when a
garden is affiliated with an academic unit, research and teaching goals are often emphasized; while gardens affiliated with physical plant departments appear to emphasize beautification (13). Regardless of the administrative affiliation of the garden, it appears that one of the major tasks facing botanical garden staff is educating the campus community about the educational value of the garden to the university (12, 18).

The location of a university botanical garden also plays a role in the development of its mission and long term plans. Three general sites for university gardens are: on campus, some distance from campus, and adjacent to campus. Each location category has advantages and disadvantages.

The advantages of an on-campus location include increased visibility which promotes support for the garden. The botanical garden is accessible for teaching and research needs. The expense of the gardens is justified based on the benefits to university recruiting cited by the Carnegie study. Character may be added to the garden if the campus has historic significance and existing plantings may be incorporated into the garden.

One of the disadvantages of an on-campus location is the disruption from building construction. Damage to plantings due to the high volume of pedestrian traffic is also a negative result of on-campus locations. Research areas are not easily contained. Community outreach is more difficult
due congested campus parking. Finally, the provenance of existing campus plantings may be unknown.

A garden located at a site distant from the campus can more easily provide community outreach and raise the visibility of the university in a different area of the community. Research areas can be easily controlled.

Disadvantages of an off-campus location tend to be the opposite of on-campus advantages. It is more difficult to create awareness of the garden back on campus; this may make university support harder to solicit. The commute may make teaching more difficult and university resources and equipment may be less accessible.

A garden which is located adjacent to the campus may provide the best of both worlds. It is convenient so teaching and research can be done without the constraints of transportation and time needed for commuting to a distant site. The garden is perceived as part of the university, yet has its own identity. University resources and equipment are more accessible. And finally, parts of the garden can be made secure for research.

A disadvantage may occur if at a future time the administration determines the adjacent site is needed for university expansion. There may also be increased crime potential at an adjacent site since it would be a popular destination for students and may not be well lighted at night (13).

By locating the first phase of garden development at the university farm, it is unlikely that our proposed site
will be disturbed by future building construction. On the other hand, long-term plans for expansion to the campus with the redevelopment of discrete landscape sites will increase the visibility of the gardens and expand the benefits to campus without tying up a large amount of land in an area where space is at a premium and building and land use plans are continually evolving.

As previously noted, a university garden can aid a school in fulfilling its mission. Consequently the mission and goals of the garden may be shaped by the mission of the university. By relating a garden's mission to the mission of its parent institution, a garden experiences greater success in being considered integral to the institution (19). Barbara Eggers showed the relationship between university and garden missions and garden programming on three campuses she surveyed (Table 1) (13).
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METHODS

The Horticultural Garden's Mission

The three previous examples illustrate how an institution's mission can shape the services and programming of a garden. The development of the mission statement for the garden is the first step in the planning process. It creates a vision for the garden that guides all future planning (25). *Factors in Arboretum Development* provided guidelines for the development of the mission and goals (6). The mission of the WKU Horticultural Gardens is related to the university mission and also highlights interests in plants suitable for home landscapes in our region and in conservation.

Mission Statement

The purpose of the Western Kentucky University Horticultural Gardens is to develop, maintain and display a collection of woody and herbaceous plant species for teaching, research, public service/education and enjoyment. The Horticultural Gardens will enhance the natural beauty of the university as well as provide an outdoor living laboratory where students will obtain first hand experience with planning, production, installation and maintenance practices.
The Western Kentucky University Horticultural Gardens shall be dedicated to the culture and use of native and introduced plants which are particularly suited to the environment of south central Kentucky. It shall be a place for the study of herbaceous and woody plant species in the natural environment and shall give primary focus to their use in the urban and residential landscape. The Western Kentucky University Horticultural Gardens will be concerned with the enhancement, protection and conservation of native flora in all of its activities.

Goals of the Horticultural Gardens

With the basic philosophy or purpose of the garden outlined in the mission, planning for the garden can move to the second step which is the development of goals. The goals provide the framework for how the garden can fulfill its broad mission. The goals for the Horticultural Gardens are divided into five general areas: education, research, public service, aesthetics, and conservation and preservation.

Education

To enhance instruction through improved availability of living plant collections.

To provide an outdoor living laboratory to complement the classroom learning experience.

To maintain and display plant materials labeled with scientific and common names for study by students, faculty and visitors.
To provide opportunities for job related work experience for students.

Research

To enhance the opportunity for research through an increased and diverse plant collection.

To utilize field trials to generate information that would be of assistance to the horticulture industry in Kentucky.

To introduce new plant materials into this area.

Public Service

To provide increased opportunities for the public to enjoy the university campus.

To provide increased public exposure to desirable landscape plant materials, landscape design, and appropriate cultural and maintenance techniques.

To serve as a source of passive recreation for the university as well as the larger community.

To provide opportunities for public involvement in the planning and ongoing activities of the Horticultural Gardens.

Aesthetics

To increase the beauty of the campus.

To use plantings to form special areas on campus.

To develop an ongoing maintenance program which results in healthy plants, displayed in an attractive setting and minimizes the use of labor intensive practices.

Conservation and Preservation

To propagate and use native plant materials.

To preserve the natural forested areas of the university as whole units.

To use plant materials to conserve the 'character' of the campus.
Site Analysis

The third step in planning for the garden is analysis of the proposed site at the university farm. A thorough understanding of the land, existing vegetation and microclimates will enhance the creation of a design that 'fits' the area (20).

The proposed site is roughly six acres and extends from the Agriculture Exposition Center (AEC) on the north; southward to Elrod Road. The east and west boundaries are the horse pasture and the AEC entrance drive. Accurate measurements were taken of the site to correctly place permanent existing features such as buildings, roads and utility lines as well as to later draw an accurate scale design.

Inventory of Existing Plantings

An inventory of existing plants was performed. The area around the Expo Center contains a number of *Quercus palustris* (pin oaks) in the lawn which are a positive feature. Some of the plantings such as the magnolias near the entrance have overgrown their site. The hedge of *Berberis x mentorensis* (mentor barberry) along the entrance walkway is a high maintenance planting and restricts use of the lawn area for special events.

The portion of the garden site that contains the pond and woods has most of the mature trees that are found on the site. The woods are composed primarily of *Quercus imbricaria* (shingle oak) with other species scattered
throughout. A few of the trees are in poor health and will need corrective treatment or removal.

The old nursery which surrounds the greenhouse primarily contains shrubs. There is a short row of mature Acer rubrum (red maple) and Quercus palustris (pin oak) along the fence which are an asset. The shrubs in the nursery are located in rows and there are approximately seventy-six Euonymus alatus (winged euonymus) and fifty-one Taxus spp. as well as other species. Many of these are mature specimens and it would be possible to incorporate them into the garden design by moving them.

**Soil Types**

The type of soil on the garden site was determined using the *Soil Survey of Warren County, Kentucky*. The soil maps show most of the area contains Pembroke silt loam with a 2-6% slope. The high natural fertility, deep root zone and moderate organic matter content make it a good soil for horticultural use. The soil map also shows an area of Pembroke silty clay loam with a 6-12% slope. This occurs in the portion of the site with the pond and woods. The terrain is more rolling in this area and there is a steep depression or sink hole at the south end of the woods. The slopes are within manageable limits and add interest to the site. In certain areas, ground covers will be used on the steeper slopes to reduce erosion and simplify mowing. This soil has a lower natural fertility and is generally more
acid than the Pembroke silt loam and these factors will need to be considered in making management plans. Soil tests in all areas will need to be performed prior to planting (27).

Environmental Factors

Environmental factors and microclimates were also considered. There are no areas of dense shade on the site. The shade in the woods is a filtered shade provided by mature deciduous trees and will provide sufficient sun and shade for a variety of shade tolerant and woodland plants. The remainder of the garden area is quite sunny and, in fact, trees for additional shade will be needed in some areas.

Perceptual Factors

Also considered were perceptual factors such as good views which should be enhanced and poor views that will require screening. An example of an area to enhance is located between the pond and large specimen Quercus imbricaria (shingle oak). It affords a fine view of the pasture and horses as well as the pond and existing display beds. The view of the Weyerhauser factory warrants screening.

Miscellaneous Factors

Finally, with Dr. Martin's assistance, we attempted to determine if there were other plans for the site, such as parking, that would play a role in the final design. After
speaking with a number of people in the Agriculture Department and Claude Threlkeld of the Physical Plant it appears that there are no definite parking plans at the present time. The design allows for a twenty-five foot set back from the road to accommodate possible future needs in this area.
RESULTS

Description of Design Plans for the Garden

The Horticultural Gardens will be composed of several smaller gardens or display areas that will demonstrate a variety of garden styles and incorporate a broad variety of plant materials. Because of the lay-out of discrete display areas, it will be possible to develop the gardens in stages over time (Landscape plans and a plant listing are found in the Appendix).

An entrance and orientation sign would be placed near the present entrance drive to the greenhouse. The sign would contain a map to orient visitors to the location of different displays and could provide a spot where visitors could pick up a simple map of the garden. This centralized location would allow the visitor to enter the garden at one of several areas depending on the displays they are interested in.

The visitor may enter the garden next to a small greenhouse parking lot which is screened by shrubs. The first display area is the vegetable garden which will be used to demonstrate edible and ornamental vegetables. This area also contains a trial bed for annuals which is visible from the road and will provide summer color. From the vegetable garden, the visitor will pass through a small orchard.
planted with fruit trees that are suitable for the home garden.

Next the visitor may choose to enter the herb garden which is surrounded on three sides by a formally trimmed hedge. The garden is laid out in a formal design with a central parterre planting. Some of the beds will be raised to allow the visitor to readily experience a variety of scented herbs. A perennial border on the inside of the hedge will provide a succession of color in the area.

The visitor may then proceed southward to an open lawn area that contains a conifer display bed and a variety of desirable ornamental and landscape sized trees. This area will also contain a daylily border planted with cultivars that will provide a colorful display throughout most of the summer.

Two home landscape demonstrations on the south end of the garden are screened from view by shrub borders. These demonstration areas will each contain a seating area such as that found in a home landscape.

One of the demonstrations will contain a flagstone patio and a small water feature with a recirculating pump that would be usable in a home landscape. This area would display a variety of shrubs that are tolerant of acid soil conditions as well as small trees, herbaceous plants and ground covers.

The second demonstration landscape would contain a wood deck oriented around an existing Quercus palustris (pin
oak). Plantings would include a variety of trees, shrubs, ornamental grasses and herbaceous plants.

The visitor would again pass through the area containing landscape trees before entering the ornamental vine and ground cover display. This section of the garden is separated from the tree display by an informal wall constructed from stone that is on the site. This wall as well as trellises and the fence between the garden and the pasture provide a means of highlighting a number of desirable vines. In addition to a selection of ground covers, a trial bed for perennials will be located in this area and planting beds for shade tolerant annuals and hostas will be located under mature trees near the fence.

A container plant production area and storage facility next to the greenhouse will be screened from view by a mixed hedge of viburnums. A small compost operation will be located behind the greenhouse and will be accessible to visitors via a gate.

A display of drought tolerant plants is located near the ornamental vines. This portion of the garden will contain trees, shrubs, ornamental grasses and herbaceous plant species that have low water requirements. Once established, the display will not receive supplemental irrigation. It will serve as a transition into the meadow.

The meadow is placed to take advantage of a flat open and sunny location near the fence that is the boundary with the horse pasture. It will give the feeling of being part
of the larger pasture and will contain meadow wildflowers and native grasses. The meadow will be a relatively low maintenance area once established.

From the meadow the visitor may enter the woodland area. This portion of the garden will be informal with paths meandering through so visitors can enter and leave at several different points. One section will be devoted to native plants. The woodland will also contain an ericaceous shrub border, plantings of native understory trees such as *Cornus florida* (dogwood), *Cercis canadensis* (redbud) and *Amalanchier laevis* (serviceberry), as well as shrubs and herbaceous plantings that will be consistent with the natural woods atmosphere of this area.

Leaving the woodland by a pathway at the north end, a visitor will reach the amphitheater. The topography of this spot is a sloped bowl with a semicircle of trees surrounding it. It provides the ideal setting for the construction of a simple amphitheater whose seating conforms to the contours of the land. A small platform, accented by shrubs and ornamental grasses, would provide firm footing for speakers. This would provide a setting where classes could meet at the garden.

The display beds that are maintained by the horticulture program are located next to the amphitheater. The annual and perennial plants provide summer color and will tie the other areas of the garden with the pond and also the Expo Center located across the road.
The pond has potential for development into an attractive water feature containing aquatic plants. A short pier extending into the pond would allow a closer view of the aquatic plants. The area between the pond and a large specimen *Quercus imbricaria* (shingle oak) has, possibly, the prettiest view on the site with the horses in the pasture and the display beds and pond in the other direction. The construction of a seating area on this spot would create a focal point to take advantage of the vistas.

Finally, the area near the Expo Center entrance has been redesigned to highlight the entrance and complement the building. The existing barberry hedge will be removed from along the entrance walkway and replaced with a planting bed on the right side of the walk that resembles and complements the existing bed on the left. The large magnolias in the present bed will be replaced with smaller trees and shrubs that will provide year around interest and are more in scale with the size of the beds. Annual bedding plants will continue to be used to provide summer color. Small ornamental trees will be planted among the *Quercus palustris* (pin oaks) that are currently in the lawn surrounding the building. The use of similar types of shrubs around the building's foundation and in the circle area near the flagpole will tie the two areas together.

Because the plan for the garden is composed of individual small gardens, it is possible to gradually develop the garden according to designated priorities. In order to take
advantage of the existing display beds, early priority should be given to revitalizing this area with the clean-up and reworking of the existing perennial beds and clean-up of the pond. Development of the woodland area which is near the display beds would provide another garden style; and since these two areas are in close proximity they would provide an early backbone for the garden. Another early priority should be the clean-up and development of the production area surrounding the greenhouse so the garden will quickly have the capability for container plant production to help meet its future needs. Next priority would be given to the redesign of the area surrounding the Expo Center and finally longer range plans would include the development of the old nursery on the south end of the site.

With the development of the Horticultural Gardens the Agriculture Department will have a facility to highlight the skills of WKU horticulture students and provide a setting that will visually enhance the Agricultural Exposition Center as well as fulfilling educational, research and public service goals.

Educational Role of the Horticultural Gardens

The educational function of the Horticultural Gardens will be of primary importance. Student involvement in the gardens will be the key to the garden’s success in this area. Student participation in virtually all aspects of the garden from planning to plant production, installation and
maintenance will provide valuable learning experiences. This involvement may take a number of forms including learning activities in labs, through work study, and through the involvement of the Horticulture Club.

In order to illustrate how the garden can be used to complement the classroom, I have briefly outlined how learning objectives and activities for a number of courses can be accomplished via the Horticultural Gardens. Courses that are highlighted * are horticulture requirements and those highlighted # are required by the golf course management program.

Landscape Plants I, Hort 301*# and Landscape Plants II, Hort 402* & 402G

1. Provide additional opportunities for students to study a diverse collection of landscape plants throughout the growing season.

2. Gain experience with plants maintained in a manner consistent with their growth habits and cultural needs.

3. The gardens will be a resource for plant specimens used for identification quizzes.

Landscape Maintenance, Hort 304 *#

1. Students may observe and also gain first hand experience in landscape maintenance techniques such as:
   a. Site assessment and preparation
   b. Planting techniques for trees, shrubs, and herbaceous plants
   c. Pruning techniques for trees and shrubs
   d. Developing and implementing fertilization programs
   e. Irrigation practices
   f. Weed control methods for the landscape
   g. Integrated Pest Management practices
Greenhouse Production, Hort 316*

1. The farm greenhouse will be a model to illustrate structural style, heating, cooling and irrigation equipment.

2. Greenhouse production of annual bedding plants will provide first hand experience in scheduling and production tasks such as:
   a. Seed sowing
   b. Irrigation methods
   c. Fertilization practices
   d. Disease and pest management
   e. Transplanting techniques

Landscape Design and Construction, Hort 403 & 403G

1. Provide a facility where students can observe a variety of garden styles, design principles and different plant uses and combinations.

2. Provide a setting for landscape design exercises.

3. Serve as a facility where students can gain first hand experience at design implementation and construction.

Nursery/Landscape Management, Hort 405* & 405G

1. Provide a facility where students can observe container nursery production techniques such as:
   a. Propagation methods
   b. Container spacing systems
   c. Fertilization practices
   d. Irrigation methods
   e. Pest management practices

Plant Propagation, Hort 413* & 413G

1. Serve as an outdoor laboratory where students will gain experience in propagation techniques such as:
   a. Budding and grafting
   b. Propagation by specialized stems such as rhizomes, corms, tubers, and tuberous roots
   c. Layering of woody plants
2. Serve as a resource for plant materials that are used in sexual and asexual propagation methods performed in the lab or greenhouse.

Turf Equipment Management & Operation, Ag Mech 277#

1. Provide an additional facility where students can obtain first hand experience in operating a variety of turf equipment for management tasks such as:
   a. Mowing and edging
   b. Fertilization
   c. Application of chemicals for weed and disease management

Turf Irrigation, Ag Mech 376#

1. Provide an additional facility where students can observe different types of irrigation equipment used in a variety of landscape situations.

2. Provide the opportunity for students to gain experience in planning and installation of irrigation equipment.

Other courses such as Introduction to Horticulture# or Turfgrass Management# may utilize the Horticultural Gardens as a site for field trips to allow students to observe plant specimens or management practices discussed in class. The gardens will also be a resource for undergraduate and graduate students who wish to do more in-depth study in an area through a Special Problem.

It has been said that learning through doing is an excellent teacher. In an applied science such as agriculture or horticulture, students who have mastered knowledge through actual experience are able to enter the job market with an increased degree of self confidence in their skills. Using the Horticultural Gardens to supplement the classroom
provides our students with an additional means of obtaining that type of well-rounded learning experience.

**Relationship with the Kentucky Horticulture Industry**

One of the goals of the Horticultural Gardens is to develop a positive and mutually beneficial relationship with members of the horticulture industry in Kentucky. There are a number of ways that the gardens could generate useful information and assistance.

The trial beds located at the gardens can be used to test the performance of new cultivars under the growing conditions of our region. The results of these trials could be provided to industry members.

Consumers are expressing concern regarding pesticide use and the process of chemical re-registration through the EPA may remove from the market some of the minor use chemicals presently used by horticulturalists. As a result, research and information about options for integrated pest management strategies may be of interest to Kentucky growers. For example, biological pest control mechanisms are becoming increasingly available. Growers may be interested in trials of biological pest control mechanisms such as *Amblyseius californicus* a predatory mite to control spider mites on ornamentals or a beneficial bacterium that can aid in the management of fungus gnats.

The North Carolina State University Arboretum appears to have a strong relationship with the green industry in
that state. Some of their activities may be adaptable to our gardens. For example, to encourage the adoption of desirable new species by the nursery industry, the arboretum allows nurseries to take cuttings from their plant collection. When the arboretum identifies a desirable species through their trials, they distribute gift packs containing propagules of the plant and propagation information through a booth at nursery trade shows. The arboretum in association with the North Carolina Association of Nurserymen has also started designating an annual "Plant of Promise" to promote a new plant with good characteristics for their region. The arboretum sponsors workshops on topics such as propagation techniques and provides other continuing education opportunities in coordination with trade associations. For example, the arboretum and the state landscape contractors association jointly sponsor an annual one day workshop where a project in the arboretum is constructed by workshop participants (16).

Finally, it would be important for our garden personnel to develop an ongoing dialogue and relationship with the Kentucky Nurserymen's Association and its members to learn directly from them what types of assistance the garden may provide.

Costs and Resources for Funding the Gardens

An area of importance to the Horticultural Gardens is the expense of establishing and maintaining the gardens.
The development at this time of the Golf Course Management Program within the Agriculture Department makes it possible for a cooperative relationship to develop between these two areas so that expertise, personnel and equipment may be utilized for the benefit of both.

In order to obtain background information on how another university approached the challenge of establishing such an educational facility, Dr. J.C. Raulston, Director of the North Carolina State University (NCSU) Arboretum in Raleigh, North Carolina, was contacted about their experience. The NCSU Arboretum is a small facility, such as ours would be, that has been extremely successful in developing a quality program that involves student participation, has a strong relationship with the horticulture industry in the state and has grown steadily. The arboretum is affiliated with the Horticultural Science Department. Dr. Raulston reports it was established in 1977 with a research mission and was funded by the university with $4,000 which was Dr. Raulston’s research allocation. The arboretum had one full-time paid staff person, a research technician who oversaw arboretum operations. The arboretum is located at the university’s Method Research Farm. The total size of the arboretum is eight acres with six to seven acres planted. Dr. Raulston reports most of the work at the arboretum is performed by students and volunteers.

In 1981 the arboretum started a membership program, Friends of the Arboretum, and began publishing a newsletter
about their activities. Membership categories range from $10 per year for students to $5,000 for corporations. Most memberships are in the $25-$50 range. By 1988 the arboretum had raised $40,000 from memberships.

The arboretum continued to have only one paid staff person until 1989 when a development officer was hired for fund raising. This position isn't funded by the university and funds for it must be generated by the fund raising efforts of the development officer. In July 1990 a third staff member was hired to coordinate the Friends program and computerize their system. This position is also funded via contributions.

The day to day operations of the arboretum continue to be performed primarily by students and volunteer staff. Dr. Raulston reports that maintenance in the summer is managed by part-time student employees whose hours equal that of 1-1/2 full-time staff. The arboretum also relies heavily on volunteer assistance. Seven volunteer curators are responsible for the management of areas that require intensive attention such as the rose garden and perennial border. Volunteers also perform other activities such as conducting tours. (24).

The NCSU experience shows that it is possible to develop an arboretum or garden using creative methods to obtain the necessary staffing, materials and funds. Factors that appear to have contributed to making their project successful include the support of the university by providing
one staff person and a minimal amount of funds, their success in involving students and volunteers, and the strong relationship with the green industry which has been a source of contributions of funds and materials.

Horticultural Garden Expenses

The expenses involved with the Horticultural Gardens fall into six broad categories: plant materials, equipment, site preparation and planting, maintenance, and staffing.

Plant Materials

Plants for the gardens can be obtained in three ways: through our own propagation efforts, purchase, and by donation. The horticulture program currently produces annual bedding plants from seed each spring for sale and for our own use. Each year we have a surplus of plants that either aren't sold or we don't have room to use. Because of this, the eventual increase in the number of areas where these annuals can be utilized will be possible without a substantial increase in the funds already allocated for this project. Our propagation efforts could also be a source of some of the herbaceous perennials in the garden.

The purchase of plants is another, more costly, alternative. Following is an estimate of the cost to purchase the woody plants that are used in the landscape plan for the garden. Three categories of plants were designated: large landscape trees, small ornamental trees, and shrubs. Prices were obtained from catalogs of the Ammon Wholesale Nursery,
Burlington, Kentucky, for as many of the species in the plan as this nursery stocked (2, 3). A mean cost was then figured for each of the three groups and multiplied by the number of plants in that group used in the landscape plan (Table 2).

Table 2. Estimated costs for woody ornamental plants

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>SHRUBS</strong></td>
<td></td>
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<tr>
<td>Number of Shrubs</td>
<td>483</td>
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</tr>
<tr>
<td>Mean Cost Per Shrub</td>
<td>$8.98</td>
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</tr>
<tr>
<td>Estimated Total Shrub Cost</td>
<td>$4337.34</td>
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</tbody>
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| **SMALL ORNAMENTAL TREES**|               |     |
| Number of trees           | 64            |     |
| Mean Cost Per Tree        | $83.55        |     |
| Estimated Total Tree Cost | $5347.20      |     |

| **LARGE LANDSCAPE TREES** |               |     |
| Number of trees           | 19            |     |
| Mean Cost Per Tree        | $109.00       |     |
| Estimated Total Tree Cost | $2071.00      |     |

The figure for total estimated costs for woody plants for the entire garden is $11,755.54. One mechanism to reduce this expense is to seek donations of plants from nurseries.
Equipment

A number of types of equipment will be needed at the gardens for plant labeling, installation and maintenance. While the horticulture program currently has a limited amount of equipment it is not adequate to meet the increased needs of the garden. The cooperative use of equipment between the Horticultural Gardens and the Golf Course Management Program will help fulfill these increased needs. The Golf Course Management Program is obtaining sophisticated mowing and turf maintenance equipment on loan. Also, through grant funds available to the Ag Mech Program a wide variety of equipment that will be useful to both programs ranging from wheelbarrows to hand tools is being requested.

Site Preparation and Planting

Activities in these areas will be performed by students as part of learning activities in labs and through work study duties. In certain instances the short-term donation of equipment and operators may be sought for large tasks such as moving existing plants on the site.

Maintenance

As the garden is developed there will be a larger area that will require maintenance. The horticultural program currently has three work study students that are allocated forty-five total hours per week during the school year and sixty hours per week in the summer. In addition, Pete Dotson of the Golf Course Management Program has indicated
that students in the Turf Equipment Management and Operation course will be spending eight hours per week mowing areas at the farm including the garden. He also anticipates that two students will perform turf maintenance tasks in the summer.

**Staffing**

The Horticultural Gardens will need a staff person who will be responsible for the overall implementation of the plan. This will include duties such as assisting with the development of relationships with outside industry and organizations that will allow the gardens to receive important support from these organizations in return. The coordination of a production program will allow the garden to be able to meet some its own needs for plant materials. And finally to utilize student workers and volunteers to the fullest extent, the activities of these individuals will need to be organized, coordinated and supervised.

As mentioned, the horticulture program currently has three work study students allocated. This is presently sufficient but additional hours may be needed in the future as the garden develops. The creative use of volunteers such as has been done at NCSU is an idea that we could also adapt to meet our staffing needs.

Because the garden will be gradually developed in stages over time, not all expenses will be incurred at once. This will allow time to develop outside relationships and seek outside funding sources for many of the projects.
Resources for Garden Funding

As discussed previously, because of the educational focus of the Horticultural Gardens many tasks at the garden will be performed by students who will gain valuable hands-on experience. This will reduce costs but there will, of course, be items/services needed that will require an expenditure of funds. Due to the tight financial situation in education today, outside funding for many projects will be needed in order for the garden to be feasible. Possible resources for funding in addition to funds from the university are reviewed.

Contributions for the Horticultural Gardens could be solicited from individuals, businesses and organizations such as garden clubs that are interested in horticulture. Not only would the garden benefit from the contribution of funds but materials and services would be extremely helpful. For example, the donation of plant materials from nurseries or organizations such as the Kentucky Nurserymen's Association would help defray the expenses in this area. For example, the hardwood bark mulch donated to the Agriculture Department last year can be used to construct paths in the woodland area. The garden would also benefit from the contribution of services. There are trees and shrubs located in the nursery area that are usable if transplanted to other areas on the site. The donation of digging equipment and operator for a day or two would make this possible as well as provide a learning experience for students.
Another area to explore is enlisting the assistance of volunteer organizations such as Garden Clubs with a designated area or project in the garden. At Cheekwood Botanical Garden in Nashville the Howe Wildflower Garden is a special project of the Garden Club of Nashville. This club provides funding and volunteer support for this area of the botanical garden (4).

A source of a limited amount of funds but important community contacts might be the development of a membership organization for the Horticultural Gardens. The eight acre North Carolina State Arboretum boasts approximately 1700 members. The arboretum rewards their members' support with an annual plant give-away and picnic (16).

Private philanthropic foundations are another possible resource for funds in response to a specific grant application. On a national scale, the Stanley Smith Horticultural Trust provides grants to organizations for horticultural programs including education and research. The trust has allocated funds for building funds, operating budgets, special projects and research (22).

There are also foundations in Kentucky who channel their assistance to organizations within the state. Three such foundations emphasize aid to higher education. The James Graham Brown Foundation provides grants for endowment funds, equipment, and building funds. The Gheens Foundation has funded special projects, building funds and equipment.
And the George W. Norton Foundation has funded grants for operating budgets (22).

Funding for specific research projects may be available through grants from the USDA, depending upon what that agency's area of research emphasis is at the time. The American Association of Museums offers assistance to museums, including botanical gardens and arboreta. MAP I (Museum Assistance Program) provides a grant to fund a one day site visit from a professional consultant to address overall operations and programs. The institution may receive recommendations regarding areas of concern such as long-range planning, finance/fund raising, programs, purpose, public relations, and marketing. The Association also offers a MAP II program which funds a consultant's assistance with issues regarding collections management. Programs such as these could be a resource for guidance in these less tangible areas once the garden is established (1).

The Institute of Museum Services, an independent agency within the Executive branch of the federal government, offers competitive grants for general operating support to established museums, botanical gardens and arboreta. The grant amount may be up to 10% of the organization's non-federal operating income and can be used in part for expenses such as salaries and fringe benefits, maintenance and repair, materials and supplies, and official travel (15). The Institute of Museum Services also offers competitive
grants for conservation projects through its Conservation Project Support Program. A current funding priority of this program is a general survey of collections and environmental and site conditions as well as the development of long range conservation plans (14).

The last three programs would not be of benefit to the gardens at the present time but are presented to provide an idea of possible future areas of assistance for the garden once it is established with its own identity and purpose and is in a position to 'fine-tune' its operations and services.
SUMMARY AND CONCLUSIONS

This thesis has attempted to explore a number of areas regarding university gardens and relate them to the development of Horticultural Gardens at Western Kentucky University. The document is intended to serve as a planning tool for the horticulture program and the Agriculture Department in a number of ways. It may be used to articulate plans and serve as a resource to be used to solicit support for the concept. The mission statement and goals create a beginning purpose for the garden and together with the landscape plan act as a guide for initial development. Expenses involved in the project and possible resources for funding are explored. Ways the gardens would be useful for a number of courses were also outlined.

The development of the gardens is particularly timely. Curriculum changes in the horticulture program have shifted the emphasis to preparing the student for a career in the nursery and landscape fields. The Horticultural Gardens will be an important resource for hands-on laboratory experience to replace that which students previously obtained in the greenhouse production courses through lab exercises in the greenhouse.
The development of the Horticultural Gardens at the university farm will not only provide a valuable educational resource but will create an attractive setting to complement the L.D. Brown Agricultural Exposition Center. If this development proves successful, expansion to other areas of the university could be considered.

The second stage of development could occur at the nature area also located at the university farm. The refinement of this area would provide a larger example of a woodland environment. The educational value of the area would be enhanced with additional labeling of plants and a site analysis might reveal additional features of value.

The third phase of development would expand the gardens to the university campus with the redevelopment of discrete landscaped areas on the campus. Examples of potential sites include the Italian garden, the small wildflower garden near the Kentucky Museum, and a terraced area near the campus entrance sign which has potential for use. Expansion to the campus would make the benefits of the gardens more readily available to a larger population. It would also support the university's long-term plans, mentioned in the Western XXI draft, to preserve and enhance the beauty of the campus.

In conclusion, the Horticultural Gardens can provide a means for the Agriculture Department and the university to forge additional linkages with horticulturally related industries as well as the local community. It can also broaden the educational resources of the university while at
the same time creating an aesthetically pleasing environment to be enjoyed by students, faculty and staff, and the general public.
APPENDIX
HORTICULTURAL GARDENS PLANT LIST

Design #1, Ag Expo Center

Expo Entrance and Foundation

C.F. - *Cornus florida*, Flowering Dogwood
H.S. - *Helictotrichon sempervivens*, Blue Oat Grass
K.J. - *Kerria japonica 'Picta*', Japanese Kerria
M.G. - *Magnolia grandiflora*, Southern Magnolia
M. - *Malus spp. 'Adirondack' or 'Autumn Glory*', Flowering Crabapple
M.S.M. - *Miscanthus sinensis 'Morning Light*', Eulalia Grass
N.D. - *Nandina domestica, 'Harbor Dwarf*', Nandina
P.V. - *Panicum virgatum 'Rehbraun*', Red Switch Grass
P.A.H. - *Pennisetum alopecuroides 'Hamelin*', Dwarf Fountain Grass

Expo Lawn Area

C.F.R. - *Cornus florida 'Redcloud*', Flowering Dogwood
C.K. - *C. kousa, Kousa Dogwood*
F.I. - *Forsythia x intermedia, Forsythia*
F.S. - *Prunus serrulata 'Kwanzan', Kwanzan Japanese Flowering Cherry*
F.S.P. - *P. subhirtella var. pendula, Weeping Higan Cherry*
P.C. - *Pyrus calleryana 'Aristocrat', Aristocrat Pear*
Q.P. - *Quercus palustris, Pin Oak*
V.P. - *Viburnum plicatum tomentosum, Doublefile Viburnum*

Lawn Surrounding the Flagpole

K.J. - *Kerria japonica, 'Picta', Japanese Kerria*
P.T.A. - *Potentilla fruticosa, 'Abbotswood', Bush Cinquefoil*
P.T.B. - *P. fruticosa, 'Beesii', Bush Cinquefoil*
P.F.P. - *P. fruticosa, 'Pink Pearl', Bush Cinquefoil*
P.F.W. - *P. fruticosa, 'Woodridge Gold', Bush Cinquefoil*
Q.P. - *Quercus palustris, Pin Oak*
T. - *Taxus x media, Anglo-Jap Yew*

Selected annuals around the flagpole
Design #2, Pond, Woodland, and Nearby Areas

Pond Area

C.S. - Cotoneaster salicifolius, Willowleaf Cotoneaster
G.T. - Gleditsia triacanthos, Common Honeylocust
I.C. - Ilex crenata, Japanese Holly
I.S. - Iris ensata, Japanese Iris
M.V. - Magnolia virginiana, Sweetbay Magnolia
M.S.G. - Miscanthus sinensis, 'Gracillimus', Maiden Grass
N.D. - Nandina domestica, 'Harbor Dwarf', Nandina
P.A. - Pennisetum alopecuroides, Fountain Grass
P.P. - Prunus pensylvanica, Wild Red Cherry
Q.I. - Quercus imbricaria, Shingle Oak
Q.F. - Q. falcata, Southern Red Oak

Selected Annuals and Bulbs

Amphitheater and Display Bed Area

A.S. - Acer saccharum, Sugar Maple
C.O. - Celtis occidentalis, Common Hackberry
C.C.A. - Cercis canadensis, 'Alba', Redbud
C.C.F. - C. canadensis, 'Forest Pansy', Redbud
C.R.O. - Cercis reniformis, 'Oklahoma', Redbud
C.D. - Cotoneaster dammeri, Bearberry Cotoneaster
I.G. - Ilex glabra, Inkberry Holly
I.V. - I. verticillata 'Nana', Winterberry Holly
P.A. - Phalaris arundinacea 'Picta', Ribbon Grass
P.P. - Prunus pensylvanica, Wild Red Cherry
Q.I. - Quercus imbricaria, Shingle Oak
Q.F. - Q. falcata, Southern Red Oak

Selected annuals and perennials in the display beds.

Woodland

A.S. - Acer saccharum, Sugar Maple
A.P. - Aesculus parviflora, Bottlebrush Buckeye
A.L. - Amalanchier laevis, Allegheny Serviceberry
A.F. - Athyrium filix-femina, Lady Fern
C.M. - Carex muskingumensis, Palm Sedge
C.O. - Celtis occidentalis, Common Hackberry
C.C. - Cercis canadensis, Redbud
C.A. - Clethra alnifolia, Summersweet
C.O. - Cornus canadensis, Bunchberry
C.F. - C. florida, Flowering Dogwood
D.E. - Dryopteris erythrosora, Japanese Shield Fern
Ericaceous Shrub Border:
- Enkianthus campanulatis, Redvein Enkianthus
- Fothergilla major, Large Fothergilla
- Leucothoe fontanesiana, Drooping Leucothoe
- Rhododendron mucronulatum, Korean Rhododendron
- Rhododendron spp., Rhododendron and Azalea cultivars

- F.S. - Fagus sylvatica, European Beech cultivar
- F.G. - Fothergilla gardenii, Dwarf Fothergilla
- F.M. - F. major, Large Fothergilla
- F.A. - Fraxinus americana, White Ash*
- H.Q. - Hydrangea quercifolia, Oakleaf Hydrangea
- K.L. - Kalmia latifolia, Mountain Laurel
- M.P. - Maclura pomifera, Osage Orange*
- M.S.V. - Miscanthus sinensis variegatus, Striped Eulalia Grass

- N.S. - Nyssa sylvatica, Black Gum
- O.A. - Oxydendrum arboreum, Sourwood
- P.F. - Pieris floribunda, Mountain Pieris
- P.A. - Polystichum acrostichoides, Christmas Fern
- P.P. - Prunus pensylvanica, Wild Red Cherry*
- Q.I. - Quercus imbricaria, Shingle Oak*
- Q.M. - Q. macrophylla, Burr Oak*
- Q.P. - Q. palustris, Pin Oak*
- Q.F. - Q. falcata, Southern Red Oak*
- S.A. - Sassafras albidum, Common Sassafras
- U.A. - Ulmus alata, Winged Elm*

Selected shade tolerant annuals and perennials

Wildflower Meadow

Possible Wildflower Selections:
- Achillea millefolium, Yarrow
- Asclepias tuberosa, Butterfly Weed
- Coreopsis lanceolata, Tickseed
- Daucus carota, Queen Anne's Lace
- Echinacea purpurea, Purple Coneflower
- Hemerocallis spp., Daylily
- Liatris spicata, Blazing Star
- Linum perenne, Perennial Flax
- Rudbeckia hirta, Blackeyed Susan

Possible Native Grass Selections:
- Andropogon gerardi, Big Bluestem
- A. scoparius, Little Bluestem
- Panicum varigatum, Switch Grass
- Sorghastrum nutans, Indian Grass
- Sporobolus heterolepis, Prairie Dropseed

B.D. - Buddleia davidii, Butterfly Bush
Design #3, Gardens Surrounding Greenhouse

Greenhouse Driveway Entrance

F.M. - *Fothergilla major*, Large Fothergilla
I.V. - *Ilex verticillata 'Nana*', Winterberry Holly
M. - *Malus spp.*, Flowering Crabapple
M.S.A. - *Miscanthus sinensis 'Autumn Light'*
M.S.G. - *M. sinensis 'Gracillimus*', Maiden Grass
P.A. - *Pennisetum alopecuroides*, Fountain Grass
P.F. - *Pieris floribunda*, Mountain Pieris
P.M. - *Pinus mugo mugo*, Mugo Pine
T.. - *Taxus x media*, Anglo-Jap Yew
Also selected annuals and bulbs

Herb Garden

B.S. - *Buxus sempervivens*, Boxwood
M. - *Malus spp.*, Flowering Crabapple
V.J. - *Viburnum x juddii*, Judd Viburnum
V.O. - *V. opulus*, European Cranberry Bush Viburnum
V.P. - *V. plicatum tomentosum*, Doublefile Viburnum
V.T. - *V. trilobum*, American Cranberry Bush Viburnum
Selected herbs and perennials

Conifer Display Bed

A.C. - *Abies concolor*, White Fir
C.O.G. - *Chamaecyparis obtusa 'Gracilis*', Hinoki Falsecypress
C.O.N. - *C. obtusa 'Nana*', Hinoki Falsecypress
C.P.B. - *Chamaecyparis pisifera 'Boulevard*', Sewara Falsecypress
C.P.P. - *C. pisifera 'Plumosa aurea*', Sewara Falsecypress
J.C. - *Juniperis conferta*, Shore Juniper
P.O.G. - *Picea orientalis 'Gracilis*', Oriental Spruce
P.P.G. - *P. pungens glauca globosa*, Globe Blue Spruce

Home Landscape Demonstration #1

C.F. - *Cornus florida*, Flowering Dogwood*
C.K. - *C. kousa*, Kousa Dogwood
C.M. - *C. mas*, Corneliancherry Dogwood
E.C. - *Enkianthus campanulatus*, Redvein Enkianthus
F.G. - *Fothergilla gardenii*, Dwarf Fothergilla
F.A. - *Franklinia alatamaha*, Franklinia Tree
I.M. - *Ilex x meservaeae*, Meserve Holly
L.F. - *Leucothoe fontanesiana*, Drooping Leucothoe
M.A. - *Mahonia aquifolium*, Oregon Grapeholly
M.P. - *Myrica pensylvanica*, Northern Bayberry
O.A. - *Oxydendron arboreum*, Sourwood
P.J. - *Pieris japonica*, Japanese Pieris
P.B. - *Pinus bungeana*, Lacebark Pine  
P.K. - *P. koraiensis*, Korean Pine  
R. - *Rhododendron* spp., Azalea cultivar  
V.P. - *Viburnum x pragense*, Prague Viburnum

**Home Landscape Demonstration #2**

A.P. - *Aesculus parviflora*, Bottlebrush Buckeye  
B.N. - *Betula nigra 'Heritage*', River Birch  
C.M. - *Carex morrowii variegata*, Japanese Silver Sedge  
C.R.O. - *Cercis reniformis*, 'Oklahoma', Redbud  
C.L. - *Cladrastis lutea*, American Yellowwood  
C.A. - *Clethra alnifolia*, Summersweet  
C.K. - *Cornus kousa*, Kousa Dogwood  
C.C. - *Cotinus coggygrina 'Daydream*', Smoke Tree  
F.O. - *Festuca ovina 'Solling*', Solling Fescue  
H.Q. - *Hydrangea quercifolia*, Oakleaf Hydrangea  
H.F. - *Hypericum frondosum 'Sunburst*', Golden St. Johnswort  
I.C. - *Ilex crenata 'Green Luster'* in the shrub border, 'Black Beauty' near the deck  
Im.C. - *Imperata cylindrica 'Red Baron*', Japanese Blood Grass  
M.S.G. - *Miscanthus sinensis 'Gracillimus*', Maiden Grass  
M.S.P. - *M. sinensis 'Pupurescens*', Flame Grass  
Mo.C. - *Molina cacrulea 'Variegata*', Variegated Purple Moor Grass  
M.C. - *Myrica pensylvanica*, Northern Bayberry  
P.V. - *Panicum variegatum 'Rotstrahlbusch*', Red Switch Grass  
P.A. - *Pennisetum alopecuroides*, Fountain Grass  
P.S. - *Pinus strobus*, Eastern White Pine*  
Q.F. - *Quercus palustris*, Pin Oak*  
S.O. - *Symphoricarpos orbiculatus*, Indiancurrant Coralberry  
V.T. - *Viburnum trilobum 'Alfredo*', American Cranberry Bush Viburnum

Selected annuals and perennials

**Ornamental and Landscape Trees**

A.B. - *Acer burgeranum*, Trident Maple  
A.C. - *A. campestre*, Hedge Maple  
A.Gi. - *A. ginnula*, Amur Maple  
A.Gr. - *A. griseum*, Paperbark Maple  
A.P. - *A. palmatum*, Japanese Maple  
A.R. - *A. rubrum 'Autumn Flame*', Red Maple  
C.J. - *Cercidiphyllum japonicum*, Katsuratree  
C.V. - *Crataegus viridis 'Winter King*', Winter King Hawthorn  
F.I. - *Forsythia x intermedia 'Fairyland*', Forsythia  
K.J. - *Kerria japonica 'Picta*', Kerria Japonica
O.V. - Ostrya virginiana, American Hophornbeam
P.P. - Parrotia persica, Persian Parrotia
P.A. - Phellodendron amurense, Amur Corktree
Q.R. - Quercus robur 'Fastigiata', Upright English Oak
S.P. - Stewartia pseudocamellia, Japanese Stewartia
T.C. - Tilia cordata, Littleleaf Linden
U.P. - Ulmus parvifolia, Chinese Elm
Z.S. - Zelkova serrata 'Village Green', Japanese Zelkova

Selected daylily cultivars

Ornamental Vine and Ground Cover Area

A.R. - Acer rubrum, Red Maple*
A.Q. - Akebia quinata, Fiveleaf Akebia
A.B. - Ampelopsis brevipedunculata 'Elegans', Procelain Ampelopsis
C.R. - Campsis radicans 'Flava', Trumpet Vine
C.C. - Carex conica marginata, Sedge
C. - Clematis cultivars
C.D. - Cotoneaster dammeri, Bearberry Cotoneaster
H.A. - Hydrangea anomala var. petiolaris, Climbing Hydrangea
L.H. - Lonicera x heckrottii 'Goldflame', Goldflame Honeysuckle
Q.P. - Quercus palustris, Pin Oak*
V.B. - Viburnum x burkwoodii 'Mohawk', Burkwood Viburnum
V.L. - V. lantena 'Mohican', Wayfaringtree Viburnum
V.O. - V. opulus, European Cranberry Bush Viburnum
V.P. - V. plicatum tomentosum, Doublefile Viburnum

Selected ground covers, Hosta cultivars and shade tolerant annuals

Drought Tolerant Area

C.A. - Calamagrostis acutifolia, Feather Reed Grass
C.S. - Cotoneaster salicifolius, Willowleaf Cotoneaster
F.A. - Festuca amethystina 'Superba', Superba Fescue
H.S. - Helictotrichon sempervivens, Blue Oat Grass
J.H. - Juniperus horizontalis, Creeping Juniper
K.P. - Koelreuteria panniculata, 'September', Golden Raintree
M.S.P. - Miscanthus sinensis 'Pupurescens', Flame Grass
M.S.S. - M. sinensis strictus, Porcupine Grass
M.S.V. - M. sinensis variegatus, Eulalia Grass
P.A. - Pennisetum alopecuroides, Fountain Grass
R.T. - Rhus typhina 'Lancinista', Staghorn Sumac
S.H. - Sporobolus heterolepis, Prairie Drop Seed

Selected drought tolerant annuals and perennials
Perimeter Plantings

C.A. - *Cornus alba*, Tatarian Dogwood
C.V. - *Crataegus viridis*, 'Winter King', Winter King Hawthorn
E.A. - *Euonymus alatus*, Winged Euonymus*
T. - *Taxus spp.*, Yew*

* Indicates plants on the site, although additional plants may be added.
SOURCES CONSULTED


3. Ammon Wholesale Nursery, Inc. '89 -'90 Fall and Spring Catalog. Burlington, Ky.


24. Raulston, J.C. Personal telephone communication by author with J.C. Raulston, Director of NCSU Arboretum, November 1990


