UF UNIVERSITY of FLORIDA
IFAS Extension

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Design and Implementation of Edible Plant Demonstration Gardens:
A Case Study of the Putnam County Extension Edible Garden[1]

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DEMONSTRATION GARDENS ARE a collection of plants assembled and organized in a manner that allows garden visitors to access and study them. Most gardens are designed with a particular focus and include plants that support the purpose and educational theme of the garden. Examples of demonstration gardens include gardens that feature a type of plant, such as trees or wildflowers, or gardens that highlight plant uses, such as for medicine or food. A garden can also demonstrate an entire functional landscape, such as a Florida-Friendly landscape or a firewise landscape, through the arrangement and use of particular plants.

Purpose of Demonstration Gardens

Demonstration gardens, sometimes referred to as learning landscapes, are natural settings for environmental education and horticulture programs. Gardens and landscapes provide contact with nature—an essential element to the core mission of environmental education, which is to modify environmental behavior by increasing ecological knowledge. Attitudes about the environment are linked to ecological knowledge, and behavior and attitudes that are formed through direct experience with nature are believed to be better predictors of behavior (Pooley and O'Conner 2000). Experts in environmental education also stress the need for adult education to modify people's values and bring about the behaviors needed to realize global environmental change. Public demonstration/learning gardens have been shown to be an important component of adult environmental education because the availability and experiences in the garden are among the primary means by which adults learn about environmental concepts and transform their perspective of the environment (Bush-Gibson and Rinfret 2010). Several studies also provide evidence that learning in pleasant natural environments improves creative problem solving, creativity, and information recall (White and Stoecklin 1998). Modifying values and attitudes requires a more intimate relationship with the environment, one which allows individuals to gain the skills and knowledge that lead to a commitment to protect the environment. Linking education and direct experience in the environment has been shown to facilitate those relationships.

The Design Process

The design process includes predesign planning and conceptual and final design plans. This case study features an edible plant demonstration garden that was designed and installed in Hastings, Florida, on the Extension office grounds. The UF/IFAS program and the Partnership for Water, Agriculture, and Community Sustainability (FPWACS) designed and implemented the demonstration garden using a step-by-step process that is discussed in this publication. The effort was a collaboration among faculty and graduate students from the UF Environmental Horticulture department, Extension faculty from the Putnam County Extension office, and Master Gardener program volunteers from the Putnam Extension office. The two-phase process to conceive and design the garden begins with predesign planning to determine the goals and objectives for the garden, the educational message, and the educational program. Predesign planning is followed by conceptual and final design production, which is phase II of the process.

Phase I - Predesign Planning

The predesign planning phase begins the entire process of planning, designing, and installing a demonstration landscape. This phase typically involves three steps:

1. **Develop a purpose or mission statement and overall goals and objectives.** The mission statement explains why the landscape is being proposed, and the goals and objectives are defined to provide the context for garden design and development.

2. **Develop the educational message and themes around which the landscape will be designed.** The educational theme dictates the type of plants and growing systems to include in the garden as well as the content of the educational material and signage.

3. **Develop the program based on visitor needs, site resources, and desired activities.** Consider the visitor and the site to determine possible activities, necessary infrastructure, and available resources to carry out the program.

Purpose Statement

Demonstration gardens are a unique learning experience for the visitor, so a good starting point for developing the purpose statement and overall goals and objectives is to consider the desired visitor experience, which generally includes 1) learning (What do you want the visitor to learn?), 2) behavioral (What do you want the visitor to do?), and 3) emotional (What do you want the visitor to feel?). The visitor experience is typically expressed in one or two sentences that address each of the visitor experience concepts.

THE HASTINGS GARDEN PURPOSE STATEMENT

Purpose: The goals of the Hasting garden are to

1. Demonstrate that edible landscaping is affordable, attainable, and can actually reduce a typical grocery bill;

2. Increase awareness of sustainability issues in the home landscape; and

3. Demonstrate to stakeholders that attractive landscapes can be created using edible crops.

Objective: To create an effective display of how to create affordable, attractive, productive, and sustainable edible landscapes that will provide the following visitor experience:

1. The visitor will learn about edible landscaping using Florida-Friendly landscape principles.

2. The visitor will tour the garden and observe a variety of space-saving ideas that demonstrate growing and maintenance practices for fruits and vegetables on a small scale.

3. The visitor will be motivated to adopt an edible landscape in their yard and feel that they have gained the knowledge to create a successful garden.

Educational Message and Themes

Purpose statements typically provide the focus for the educational message. Developing the educational message is a process that links topics and possible stories from the goals and objectives of the purpose statement to visitor needs and available resources. Visitor education falls into two categories: selecting topics and developing stories and selecting appropriate methodologies to convey the stories. Message development should link the stories and methods. Guidelines for developing educational messages (Anderson, Lime, and Wang 1998) include the following:

1. Message content - The content (themes and stories) should reflect the purpose statement's goals and be relevant to visitors.

2. Message presentation - The message should be positive and written in a clear, concise, and professional manner.

3. Message targeting - The message should target specific audiences, including different age groups and learning capabilities.

4. Message timing - Timing is linked to the learning sequence. Some messages are appropriate before or shortly after entering the site, while others are linked to activities or displays throughout the garden.

5. Message effectiveness - Effectiveness is influenced by the content, delivery mechanism (such as signage), source credibility, and timing of the message, as well as the attitude and receptiveness of the visitor.

THE HASTINGS GARDEN EDUCATIONAL MESSAGE AND THEMES

Message: A typical homeowner can create an attractive and productive small-scale edible garden in their yard.

Themes and stories: The themes and stories reflect the message with a series of displays, features, or signs that demonstrate ideas for a productive, attractive small-scale garden:

Space-saving displays
- Vertical hydroponics (both commercially available and homemade)

- Square-foot gardening techniques

- Trellises to make more use of vertical space. Vertical space is often overlooked by gardeners and can be

utilized not only to save space but to allow for companion plantings, thus saving more space and increasing productivity.

- Container gardening is also incorporated throughout the edible landscape to fill void spaces and to further make use of all available space. Vegetables and flowers in containers also add interest and color.

Water use and water–saving displays

- Floating hydroponics increase productivity of leafy vegetables such as spinach, lettuce, radicchio, and others. In the time it takes to grow such crops in traditional ways, two or more rotations can be produced in floating hydroponic gardens. In addition, for those with the limited space or poor soils common in gated communities and newer homes, this technique shows how they, too, can grow at least a portion of their vegetables at home.

- Aggregate culture (another form of hydroponic culture) can be used to grow root crops like carrots, onions, and potatoes. This is yet another way to demonstrate to stakeholders that they can grow edible crops despite having poor soil, limited space, or community association restrictions.

- Low-volume irrigation is used exclusively throughout the edible landscape. This serves multiple objectives in creating edible, Florida-Friendly landscapes. Low-volume irrigation reduces water use dramatically, and since low-volume irrigation is exempt from day-of-week water restrictions, it allows for the landscape to be watered whenever there is a need. Low-volume irrigation also helps to decrease the amount of time that foliage is wet, reducing disease incidence. Additionally, since only the individual plants or plots are being watered and not the spaces between them, weeds and herbicide use are greatly reduced if not eliminated. The garden also includes a 1000-gallon cistern system that provides a large portion of the water needed for irrigation.

Soil amendment ideas

- Soil amendments are usually necessary in Florida vegetable gardening since sandy soils in this state usually average less than 2% organic matter. As a cost-saving measure, we were able to obtain truckloads of horse manure from a nearby stable for $10.00 per load. Stables are resources for affordable soil amendments that are necessary when creating edible landscapes. However, it is important to compost manure prior to planting. The heat and decomposition (as long as it reaches 130°F–160°F) will kill most seeds, including weed seeds, that survive the horses' digestive tracts. For more on this topic, see *Composting Horse Manure* (http://mysrf.org/pdf/pdf_horse/h3.pdf)(Johnson and Nordstedt 2000).

Mulch and sustainable product displays

- Pine bark nuggets are used as mulch. Pine bark is sustainable by-product mulch from the lumber and paper industries.

Fertilizer use

- Synthetic and organic fertilizers are used in the garden. What is used and when is determined by what crop is grown and in what growing system, the time of year, and visual observations.

Gardening for all ages and abilities

- Square-foot gardening and various hydroponic growing systems are especially suited for children since they are more productive per square foot and take up less space. They are also easier to care for and to harvest.

Composting displays

- The compost bin is in the center of the garden and is surrounded by various crops throughout the year. Essentially, this creates additional highly productive growing space that surrounds and camouflages the compost bin. Located in the center of the garden, the compost is easily accessible. When crops are harvested, it is easy to place the waste in the bin. When compost is ready, it is also easy to harvest and transport to any part of the garden that needs additional organic matter.

Pesticide use

- Pesticide use is minimal because the garden incorporates many different growing systems and crop rotation is practiced. When insects are found, they are treated only with insecticidal soaps and horticultural oils.

Cost of growing edibles

- Research from the University of Florida (Dr. Sydney Park-Brown) suggests that a typical household with a 600-square-foot garden can save $500 per year on produce, assuming vegetables are valued at $2 per pound. During its first year, from March 2011 to March 2012, the edible landscape at FPWACS produced over 1200 pounds of fruits and vegetables valued at $2400. The estimated cost to construct the garden so far is $3000. This includes the cost of the Vertigro® vertical growing system (retail price: $439).

Program Development

The program brings together all the information needed to design the site. Program development should consider the visitor and the site when determining the activity, infrastructure, and resources needed for the garden. Specific steps in program development include the following:

1. Determine the target audience (the visitor) and their needs, including mobility and accessibility

2. Develop the learning sequence

3. Analyze the site for potential activities and displays

4. Determine specific learning activities

5. Determine the structures and infrastructure needed to support activities

6. Determine costs and resources, including budget, maintenance, and labor resources

Visitor Profile

Demonstration gardens are designed and built with specific objectives for the visitor in mind. A visitor profile is helpful when determining the amenities needed to carry out the garden's mission and purpose. General profiles should consider various characteristics of probable or desired visitors, such as the following:

1. Age and education level. Message delivery needs to be suitable for the education level of the visitor. For the general public, the text and graphics of signage and displays should be written in a simple, straightforward style that is easy to comprehend.

2. Mobility. The layout of the garden elements, particularly pathways, needs to accommodate people of all mobility levels so that all visitors have access to most areas of the garden.

3. Group and individual visitors. Large groups will have different spatial and amenity needs than the individual visitor. Plan for both if you desire to have groups use the garden.

4. Education focus and methods. Individuals, typically adults, are often seeking specific information, while a general approach is more effective for children and school groups.

The visitor profile can also include other demographics, such as gender, occupation, and group affiliations. This information can help to describe particular interests (e.g., growing vegetables for canning or for a farmers market, or developing landscape codes that include edible gardens).

THE HASTINGS GARDEN VISITOR PROFILE

1. All age groups and education levels will be included. The assumption is that young children and school groups will be accompanied by adults who can relay the message in an appropriate manner for the age and education of the children.

2. Homeowners will need informational displays that share how the garden can be replicated in their yard by a person with average do-it-yourself skills and knowledge.

3. Teachers and educators will need information and materials that can translate to classroom projects.

4. Plant professionals such as Master Gardeners and landscape architects will need specific and advanced information about growing and using plants.

5. Organizations, such as St. Johns County Slow Foods Group, and HOA and condominium association members will need information about promoting and using edible gardens as acceptable landscape gardens.

6. IFAS Extension personnel and FPWACS will need information about demonstration garden planning, program development, design, and implementation.

7. Urban farmers will need information about growing edibles for profit, including selling their crops at farmers markets.

Learning Sequence

Concepts or components embedded in the educational message sometimes have a logical order for learning and determine the order in which the planting displays and exhibits should be viewed. For example, the message may require a progression of displays that express time, such as seasons, while others may need a series of events to illustrate cause-and-effect concepts. The learning sequence determines the spatial layout of exhibits and circulation paths. If there is no particular learning sequence, the garden is typically laid out to facilitate pedestrian movement, allow access to displays, and enhance aesthetic appeal. One example would be organizing unique support structures with a variety of heights for more visual interest as the visitor progresses through the garden. In the Hastings garden, small, covered kiosks with educational signs throughout the displays make the garden more user friendly and self-interpretative.

THE HASTINGS GARDEN LEARNING SEQUENCE:

The concept of the Hastings garden was to demonstrate space-saving ideas that visitors could use to grow herbs and vegetables. Although there was no particular learning sequence, the design intent was to create interest and draw visitors into the garden with a number of unique structures arranged for easy access and viewing. Some structures were designed to pass under, others to provide seating, and some to serve as a fence, but all structures support plant material to increase growing space.

Site Inventory and Analysis

A site inventory is a record of all the features that currently exist on the site. Typical features to note on the inventory include sun and shade patterns, existing vegetation, drainage patterns, and soil conditions. In addition to a general site inventory, other features to note for an edible demonstration garden include the following:

1. Soil composition in several locations—different soil amendments may be needed for a variety of edible plant materials.

2. Circulation opportunities, including access to the site and facilities needed for harvest, handling, and crop storage.

3. Spatial organization—note possible areas for plant displays, pathways, and signage based on logical circulation.

The inventory information is analyzed to determine the site's opportunities and constraints. An opportunity is a site feature that creates a favorable condition to establish a garden, and a constraint is any feature that might impede implementation. The analysis essentially conveys what can or cannot be done on the site. See *Landscape Design: Analyzing Site Conditions* (http://edis.ifas.ufl.edu/ep426) for more information about site inventory and analysis. Figure 1 shows the site inventory for the Hastings garden.
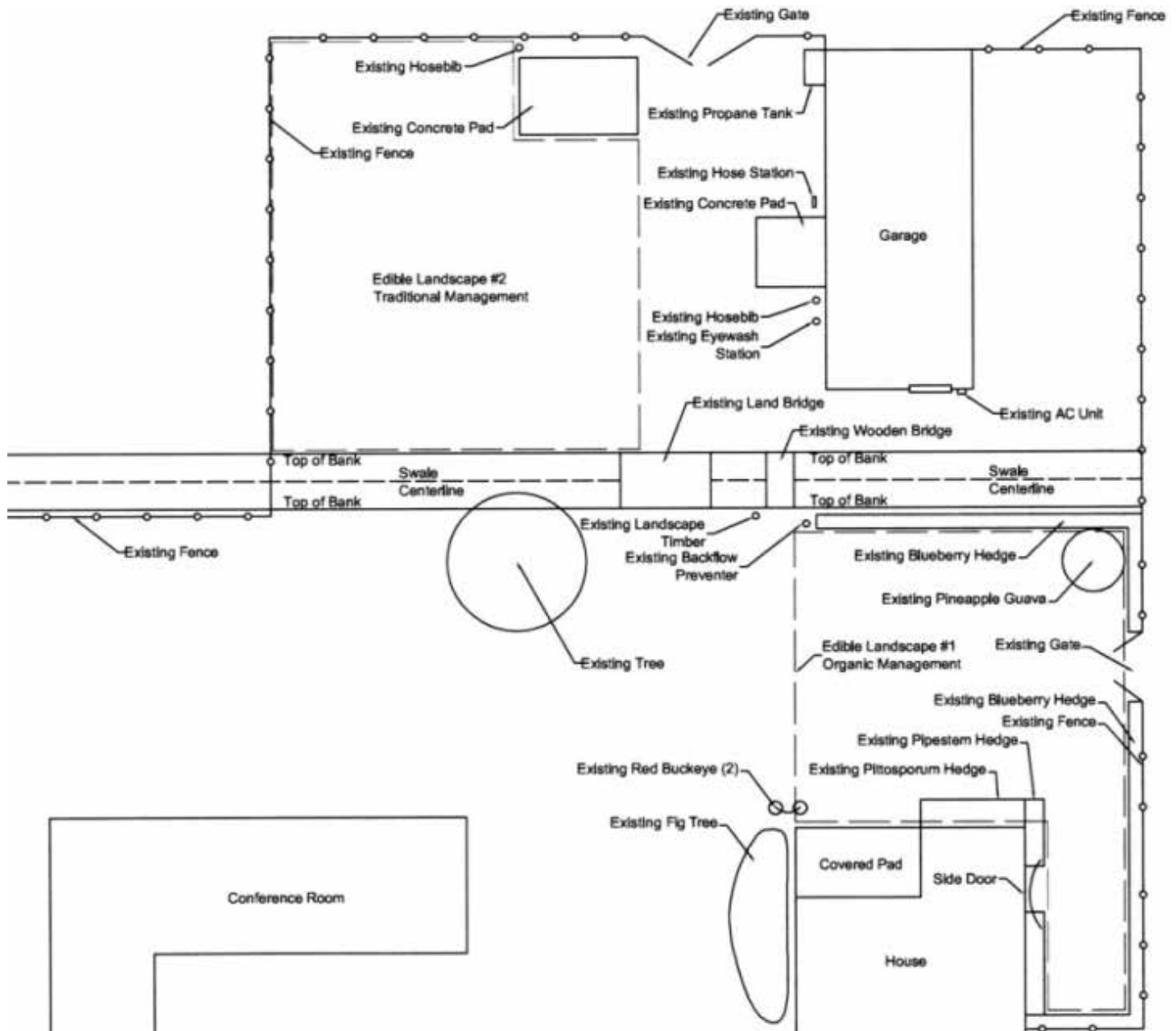

FIGURE 1. Hastings garden site inventory (Credits: Rebecca Almeida and Andrew Dunn)

FIGURE 2. Site conditions before installation of the demonstration garden (Credit: Joe Sewards)

THE HASTINGS GARDEN SITE INVENTORY AND ANALYSIS

The Hastings site was well suited for an edible garden and had few constraints. Figure 1 shows the spatial configuration of existing structures and possible open areas for the first garden. Positive features that provide opportunities include a well-defined open area with few trees or other vegetation to compete for light and water, large areas that would be in sun most of the day, structures that could support garden activities, and a sizeable space to organize planting displays and pathways. A drainage swale directs excess water from the site, and the existing groundcover allows for easy clearing and soil improvement. A feature that may be considered a constraint is the location of the drainage swale, which splits the site and restrains the display areas. Also, an existing concrete slab and the current location of the gates may present some layout constraints. Figure 2 shows pre-installment site conditions.

Learning Activities

Learning activities can be developed for individuals and groups of all ages and education levels. Activities should have a strong focus and an identifiable purpose. Traditional environmental education activities include observation, identification, measurement, and analysis in a structured format, such as a game or experiment. A key consideration when developing learning activities is how you will use the activity to support your program. Considerations for learning activities include the following:

1. Linking to the goals and objectives of the purpose statement and the program

2. Matching activity types to visitor profiles

3. Supporting the educational message and learning sequence

4. Using the opportunities discovered in the site analysis

THE HASTINGS GARDEN PROPOSED LEARNING ACTIVITIES

1. Self-guided tours of the garden with guide maps and information

2. Guided tours for groups with master gardeners

3. Instruction on how to build and use the various growing systems in the garden

4. Harvesting for food banks, senior centers, and charitable organizations

5. Workshops on starting community gardens, school gardens, and condominium and homeowner association gardens

Garden Structures and Infrastructure

Private edible plant gardens can be a variety of sizes, from small backdoor gardens to several acres. A demonstration garden, however, should always be large enough to accommodate several displays and at least a few visitors. Structures should be designed to support the garden's purpose and educational theme. The size of the area, types of learning activities, and budget ultimately determine the size, type, and the need for garden structures, which could include all or a few of the following:

1. Greenhouse/shade house or other protective structures for plants

2. Support structures and planters for plant display

3. Large group facilities for visitors, such as a covered pavilion

4. Seating and rest areas

5. Small gathering areas throughout the garden for group teaching on tours

6. Facilities for instruction or research, such as a laboratory or cold storage

Structures in the garden should be Americans with Disabilities Act (ADA) accessible, particularly those that are primary to the function of the garden. Accessibility considerations should be part of the predesign planning and program development, during which site constraints and visitors' needs are determined. Structures can be designed for individuals or group participation.

Infrastructure includes the systems needed to keep the structures and garden operational, including plumbing for restrooms and irrigation, electricity for irrigation and lighting, fencing for security, pathways and signage for circulation, and facilities for maintenance, such as equipment and product storage.

THE HASTINGS GARDEN EXISTING AND PROPOSED STRUCTURES

Existing large structures on the site included a house with a covered concrete pad and side door and a garage with a concrete pad, air conditioning unit, and propane tank. Other minor structures included fencing around the proposed garden area with a large stand-alone concrete pad in one of the proposed garden areas. The existing structures are used for storage. The site replicates a home with a typical small backyard (about 2000 square feet) New structures that were added to the Phase I garden included the following:

1. Pathways to accommodate foot traffic and accessibility

2. A variety of support structures for growing plants

3. Planters for container gardening

4. Benches for seating

5. Vertical and floating hydroponic structures

Structures for Phase II include:

1. Grow bags

2. Aggregate culture (grow troughs for perlite)

3. A large grape arbor

4. Small covered kiosks with educational signs

Costs and Resources

The planning process must include a cost and resource analysis for installation and a budget for ongoing maintenance. Resources include any existing facilities and structures on the site that can be adapted for use with the proposed garden, any available labor from volunteers or an existing paid position, and any existing budget for installation plus a monthly amount that can be dedicated to maintenance. Different funding sources and strategies to consider include grants, donations, Extension programs, and volunteer groups, such as Master Gardeners or horticulture program students.

THE HASTINGS GARDEN COSTS AND RESOURCES

Funding for the Hastings garden came from a variety of sources. Because the garden is associated with a University of Florida Extension program, the planners were able to access a variety of funds that are available from the university and various university programs. Phase I funding came from the FPWACS, Putnam County Extension office, and from Master Gardener and corporate donations.

Funding for Phase II was provided by the UF/IFAS Horticultural Sciences Department and the UF/IFAS St. Johns County Extension director. Ongoing maintenance is provided by the Putnam County Master Gardener volunteers.

Phase II - Conceptual and Final Design

Once the predesign planning is complete, the conceptual and final design phase can begin. In phase II the design is conceived and the final plan is drawn on paper, which is the document that will go to the installer. The program guides the organization of the garden and the choice of displays. The first step of the conceptual design is to determine the type of displays and activity areas and the space needed for each. The conceptual plan is then

developed to show the proposed location or spatial layout of each of the displays and the location of the pathway to move visitors through the displays. The key is to optimize the space for visitor circulation and the best viewing of the displays. The physical design of the garden can also communicate through visual cues rather than written or spoken communication. Displays and learning areas should be planned with repetition and pattern in mind. Visitors will seek to orient themselves within the garden and make decisions about where to go and what to see. Displays along the pathway in a particular pattern help visitors feel more comfortable and allow them to pay more attention to the displays. Visitors typically want to know what the garden is about, what it has to offer, and where they are in relation to the whole. Most people slow down at the entrance and search for orientation cues, such as signs, a pathway, structures, or other people (Linscott 2001). It is important to remember that conceptual designs are done to explore various layout possibilities, and the final design will most likely be a composite of several conceptual ideas.

Layout and Spatial Organization

Each concept in the learning sequence is used to determine the activity areas and related displays necessary to deliver the information and reach the educational goals. Developing the spatial layout requires consideration of the following:

1. Refer to the learning sequence developed in predesign planning to determine the number of displays or activity areas needed to convey the concept.

2. Determine the display or natural feature needed to demonstrate the learning concept. For example, will an arbor be needed to demonstrate the use of vining plants?

3. Review the site inventory and analysis and locate displays that require particular natural conditions at appropriate areas on the site (e.g., an open area with 6 hours of sun for vegetables).

4. Identify the size of space needed for the displays and locate them so that the order of viewing follows the determined sequence.

5. Connect the demonstration areas with a pedestrian circulation route. The pathways should accommodate all visitors and educational activities, including the solo visitor and groups of people. The learning sequence will determine if the path is linear and one directional (e.g., a one-way loop), or circular and nondirectional (e.g., a loop that can be traveled in either direction).

To accommodate groups, the garden should be designed to facilitate talking and listening by incorporating "pull-offs" along the path for groups to gather at points of interest.
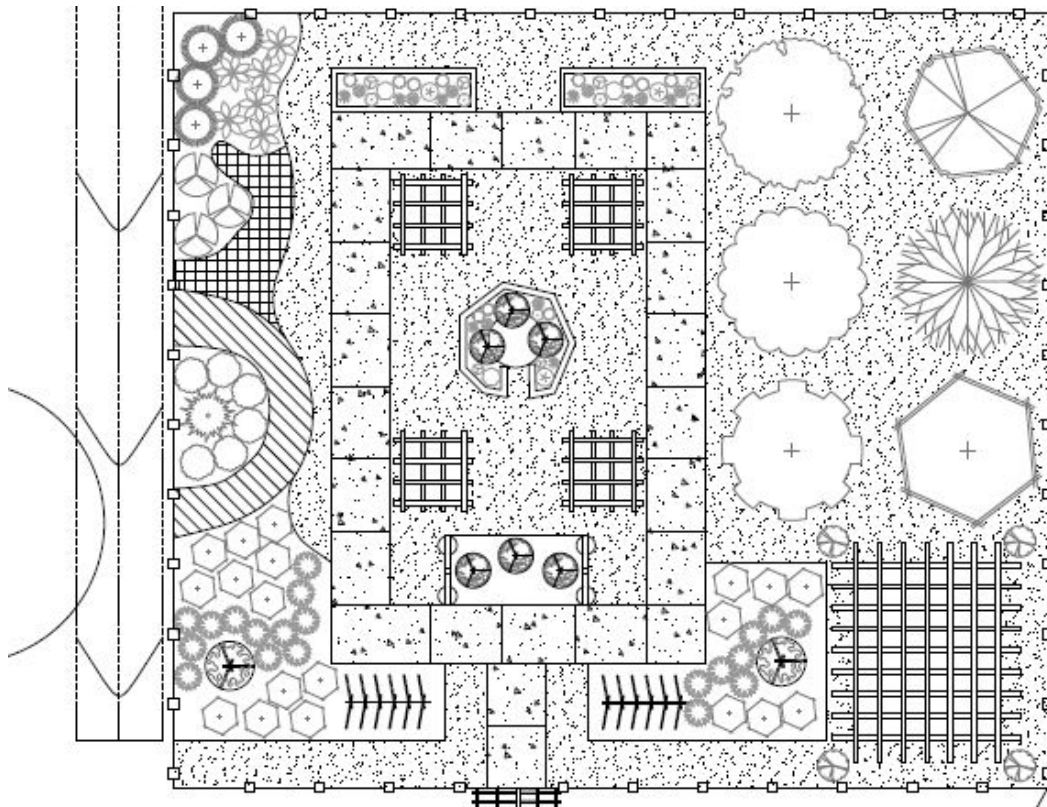

FIGURE 3. Conceptual design showing layout of pathways and plant displays in Edible Landscape Area #1 – Traditional Management (Credits: Rebecca Almeida and Andrew Dunn)

Display areas should be spaced so groups have enough distance between them to prevent speaker overlap. Figures 3 and 7 show the proposed layout of displays and pathways for the Hastings garden.

The pathway in Figure 3 is a loop designed to travel either direction. The entrance arbor is designed for vining plants, such as kiwis that can be observed and harvested by walking under the arbor. The fence sections on either side of the arbor are designed to function as a trellis to support vining plants, and other sections of the fence around the garden are constructed to form espaliers with branching plants. Support structures and teepees on either side of the entrance display vining and climbing plants, such as tomatoes (Figure 4).

Turning to the right on the path leads to an overhead arbor located above an existing concrete slab (Figure 5). The arbor provides shade to a small seating area with a vining plant that can be harvested overhead, such as grapes. The display to the right of the path is a small grove of fruit trees. Continuing around the path leads to enabling gardens that include raised wheelchair accessible planters and a short wall with saddlebag planters, which are accessible to both children and wheelchairs (Figure 6).

FIGURE 4. Artist's conceptual drawing of the entrance arbor and teepees (Credit: Andrew Dunn)

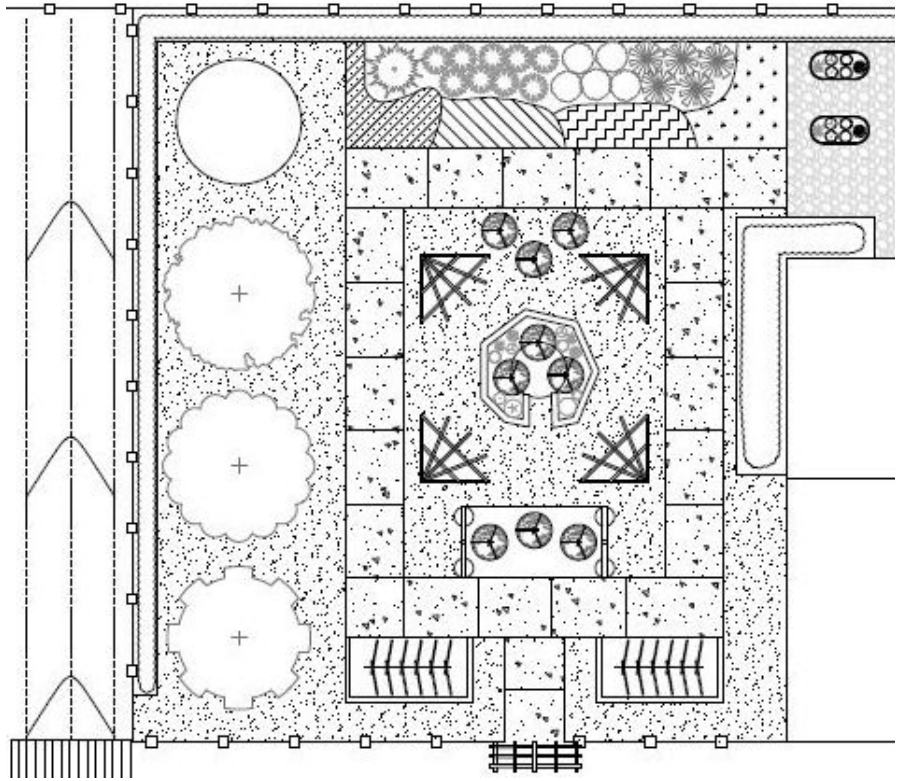**FIGURE 5.** Arbor built over an existing concrete slab (Credit: Joe Sewards)

FIGURE 6. Artist's conceptual drawing showing design of wheelchair-accessible planters (Credit: Andrew Dunn)

Completing the loop leads to a display that demonstrates how edible plants that are normally found in row crops can be integrated into a plant bed that would be found in a typical residential landscape. The displays in the interior of the loop include a raised compost system that seeps into a small planted area around the compost unit as well as four structures for climbing plants that shade the path (Figure 7). The displays are used to demonstrate various structures that can be incorporated in a residential garden and to maximize the crop yield in the garden.

The pathway in area #2 (Figure 8) is also a loop path designed to travel either direction. The entry is flanked on both sides by climbing structures. Directly ahead, the interior of the loop contains various structures for growing tomatoes. The interior also contains another compost garden and four structures for climbing plants with a small seating bench integrated in the structure. The narrow side garden is a series of planters made from galvanized watering troughs on a white rock base to reflect the sun's heat away from the planters. A mixed-plant bed at the top of the loop is intended to show plants that can grow against a wall or fence, and more fruit trees grow on the side of the path. The structures, planters, and plant beds are designed to showcase a variety of edibles, such as row crops, vines, shrubs, trees, and herbs, as they could be used

FIGURE 9. Artist's depiction of different structures for the garden (Credit: Andrew Dunn)

FIGURE 10. Arbor and hanging baskets in area #1 of the Hastings garden (Credit: Joe Sewards)

FIGURE 11. Lattice and hanging baskets in area #2 of the Hastings garden (Credit: Joe Sewards)

in a residential setting. The location of the structures allows for crop rotation and seasonal planting without having large bare areas in the garden. The visual appearance of the garden is considered by including plants for year-round variation.

Plant Support Structures

Edible plant gardens require a variety of structures to support different plant species and encourage a higher yield at harvest by producing more plants in a small space. They also display the plants for easier viewing and harvesting. Some structures support vining plants, others are used to keep thin-stalked plants upright, and some are used to espalier plants. Structures are also used to support hanging pots and stacked pots.

Structures can be used to add vertical interest to the garden and serve as organizational elements to guide visitors around the garden. Placement can lead visitors through the garden, but care should be taken to avoid blocking views in all directions. Figures 9 and 10 show how tall arbor structures were clustered in the center with shorter teepees and racks around the perimeter in the Hastings garden.

Figure 11 shows the structures that were built in area #2 of the Hastings garden. Lattice on the sides of the structures provide more climbing surface for the plants and also help to stabilize the framework of the structure. The horizontal trellis at the top helps plants grow over the benches and shade the seating areas. The hanging baskets can also be seen on the T-bar that can be raised and lowered for maintenance and harvesting.

FIGURE 12. Fruit trees surrounded by trough planters (Credit: Joe Sewards)

FIGURE 13. Onions growing in perlite in plastic trough planter (Credit: Joe Sewards)

Other structures in the garden are used to contain a planted area or raise the plants for easy maintenance. Figure 12 shows the proposed layout of plastic watering troughs that work well to protect small plants such as herbs from accidental trampling. The raised surface also provides easy access to plants that are trimmed or snipped on a daily basis for maximum freshness. Onions are growing in perlite in the raised plastic troughs in Figure 13.

Educational Garden Features

Educational interpretation programs are useful to garden management and maintenance. The management goals can be achieved by linking to the interpretation program to educate and inspire the visitor to use the garden in a way that protects and conserves resources. The most common method of information delivery is signage with illustrations and text relevant to the display or area in which it is located. The most important aspect of signage is to develop graphics and text that attract the viewer's attention and provide information in a short, understandable, and memorable format.

Signage

Communication is a vital part of an educational landscape. There are three basic communication methods: personal, signage, and design. Personal communication is used primarily in a demonstration garden that hosts groups. Staff members are often responsible for leading groups on tours and speaking about the educational displays, so the garden should be designed to facilitate speaking and listening. Signage is more important for solitary visitors or self-guided tours. Three key elements of signage are as follows:

1. Information – Identify what visitors need or want to know and create a brief and concise message. Limit signs with rules and regulations—too many signs will lead to sign fatigue and visitors will begin to ignore them.

2. Visibility – It is important to make the sign attractive and place it where people might expect it or in a sight line where it is easy to find. The same sign design should be used on all signs, and the signs should be placed strategically throughout the garden.

3. Readability – The text and wording of the sign should be clear, explicit, and large enough to read to allow at least two readers at the same time.

Signs should be designed to attract visitors' attention and hold it long enough to convey the information. A few rules for sign design include the following:

1. Text should be 5/8–2 inches high with sans serif typeface, such as Helvetica. Contrasting colors for the text and background are easiest to read, and light on dark is preferred. Braille should be located on the left side of the text.

2. Consistency with the font style, symbols, materials, and graphics thematically ties the message together. When necessary, use internationally recognized symbols.

3. Signs should be located close to the display and about 30–44 inches above the ground with a 30-degree inclination toward the viewer. The sign should be visible to all visitors, including children and those who are wheelchair bound.

4. Photos, images, diagrams, and metaphors make the message understandable and interesting for adults and children.

5. Remember the learning ability of all ages—most text should be at the 8th grade level.

6. The sign material should reduce glare and reflection but be durable and weather resistant (Linscott 2001).

Pathways

Pathways are used for access to the garden areas and to provide structure to the garden. A pathway in a demonstration garden should link the demonstration areas, seating and rest areas, restrooms and pavilions, and amenities such as drinking fountains. They can be used to separate the garden into different planted areas and guide visitors through the educational experience. There are a few design rules for laying out pathways in a teaching garden. The most important is to take into consideration the learning journey of the visitor by leading the visitor to all displays in the garden.

A loop design with one entry/exit point is preferred to a linear pathway; the loop reduces the number of people on the pathway at one time because visitors don't have to backtrack. Sight lines to important or appealing views can also be used as a guide for locating straight or curved pathways. Use sight lines to frame the views and corners to provide glimpses of areas ahead that will entice visitors to continue their journey. It is also important to route the path close to the educational areas for easy viewing and different sensory experiences. Provide turnouts for visitors who want to read the messages at display areas. Always start the pathway at a logical entrance and make it very inviting to draw visitors into the garden. People tend to move to the right, so design the loop to reinforce this tendency. Once the visitor enters the garden, it is important to provide glimpses of the garden without exposing the entire garden.

Gardens that feature edible plants are typically laid out to group plants by type or growing requirements. For example, some gardens may locate row crops in one area, vining plants that require structures in another, and shrubs or trees in another area. The route of the pathway can be used to emphasize the different areas by season, plant type, or plant structure.

Use off-site views to extend the boundaries of the teaching garden. Incorporate the views if they fit in the theme and/or are aesthetically pleasing, and find ways to hide the views if they present a distraction to the learning activities that take place in the garden, or if they take away from the garden's aesthetic value. Adjacent properties can also provide opportunities for extending the educational component of the garden. Activities on an adjacent site can inspire educational lessons, particularly if they affect the garden's ecology or plant material.

Pathway dimensions can vary depending on the anticipated number of visitors, but most of the pathways in a public garden should be accessible according to standards set by the ADA, particularly for wheelchairs. The ADA does not require modifications that would fundamentally alter the nature of the services provided by the facility, and only a specified number of elements must be made accessible in order for a facility to be "readily accessible" (Americans with Disabilities Act 2008). This means it is not necessary to make every pathway wheelchair accessible, but the experience should be the same from both accessible and noncompliant pathways. For example, in a small garden, a perimeter pathway can provide the same experience without the wheelchair participant entering the interior of the garden. Pathway widths and slopes are as follows:

- Minimum width for ADA accessibility: 4 feet

- Recommended width for small groups: 4–6 feet

- Recommended width for large gardens and large groups: 6–8 feet

Horizontal slope:

- Zero to 3% is the preferred slope for walking.

- Five percent is the maximum slope for walkers.

- Five to 8% is the maximum slope for wheelchair ramps.

Cross slope for drainage:

- A minimum of a 1% slope is needed to drain water.

- The ideal slope is 2% for sidewalk surfaces.

- The maximum slope is 3% to avoid a noticeable slope when walking.

Visitor Safety and Comfort

Visitor safety takes two forms: injury prevention and crime prevention. The most important considerations are preventing falls while walking. Surface material of pathways should be well maintained and easy to walk without tripping or slipping. Compacted materials with an even, slightly textured surface, such as asphalt and concrete, are appropriate for the main walkways, and compacted sand, mulch, or turf can be used for more informal walkways. If possible, use porous paving systems in place of asphalt and concrete. ADA accessibility requires a relatively smooth surface appropriate for wheelchair access—typically concrete, asphalt, pavers, wood decking, or compacted gravel. Plant material that could injure visitors with thorns, stickers, or sharp edges should be planted outside of the primary walking and activity areas. Safety from crime is a concern in large demonstration gardens or landscapes where the ability to see and be seen is important. Crime prevention through environmental design is the concept of modifying the environment to make crime more difficult. The key concepts that apply for gardens or any park-like environment focus on improving surveillance—being able to see into the surroundings, particularly along pathways, and minimizing opportunities for criminals to hide. Keeping the midstory of the vegetation open and a relatively open canopy along pathways improves the perception of safety. It is also important not to create hiding spaces on the perimeter behind structures such as storage sheds or perimeter fences (Forsyth and Musacchio 2005).

Visitor comfort is primarily concerned with providing rest areas and creating microclimates that provide protection from temperature extremes. In the summer, shade provides a welcome area for rest and education spots. In the winter, sunny areas encourage people to stay. Try to provide a wide range of sun and shade options. In an edible plant garden, the space will need to be primarily sunny for good plant growth, which means that shady tree canopies are not practical. However, spots of concentrated shade can be created with small shade structures. Pavilions are useful for large gatherings in larger demonstration gardens, such as arboretums. Provide benches for seating throughout the garden to meet needs, including rest, seating for lectures and discussions, and observing plants.

Design Psychology to Reduce Impact to Resources

There are several design tactics that help channel use and reduce the impact visitors have on resources, which also reduces maintenance time and cost. The psychological impact influences visitor behavior in ways that protect resources. Design elements include 1) using curvilinear walkways, which tend to keep people on the designated path; 2) designing to avoid confusion, which eliminates tendencies to create shortcut paths to various locations; and 3) designing to human scale, which makes visitors feel more psychologically comfortable and less likely to damage resources to change the environment. Strategically placed vegetation is often used as an indirect management design tactic. Plants can function as a barrier without taking away from the aesthetics by blending with the other plants in the garden. Well-maintained plants show signs of human care, a design cue that tends to make visitors also care more about the plants and take better care of the garden.

The most common design element to control visitor behavior is the use of physical barriers. Barriers protect resources and ensure visitor safety by keeping visitors on designated pathways. Direct physical barriers, such as a fence, can obstruct movement; other barriers are indirect and encourage visitors to make a decision to comply with the management intentions to protect the resources. Barriers are effective if they convey a behavioral message, even if they don't physically obstruct movement.

Littering is a visitor activity that is highly influenced by the sight of litter. If visitors see litter lying around, they are much more likely to litter and less likely if they see it properly disposed of. It is important to provide enough trash containers to reduce the impact to resources and psychologically influence visitors to use the cans to prevent further impacts. The presence of trash cans coupled with visitor education is the best tactic to reduce littering (Anderson, Lime, and Wang 1998).

Regulations

Regulations are used to control visitor use. However, visitors tend to see them as intrusive and choice limiting unless the visitor personally believes the regulation is appropriate and necessary. Guidelines for implementing the use of regulations are as follows:

1. Use effective nonregulatory alternatives first, such as design and education.

2. Explain necessary regulations to improve compliance.

3. Regulate at the lowest level to solve the problem.

4. Regulate at the entry before visitors enter the site.

5. Monitor the problems to determine if the regulation is effective.

The most common regulatory activities typically restrict access to specific locations, restrict behavior or activities, prohibit certain modes of traffic, or limit the length of stay

or size of groups to protect the resources. An example is to close trails on an alternate schedule to allow resource recovery of a trail while the hiking activity is allowed to continue on other trails (Anderson, Lime, and Wang 1998).

Maintenance

Maintenance is an integral part of a garden and can be facilitated by a good education program that encourages visitors to care for the resources through their actions. The maintenance plans should be tailored to the type of demonstration garden. An edible plant garden requires much different maintenance practices than a teaching arboretum; however, there are general practices that apply to all gardens. It's important to focus maintenance on key problems, such as soil and plant health. One example is managing for the long-term health of trees, which are typically the most valuable plants in the landscape. A maintenance manual allows for continued management practices when garden management responsibilities change. In an edible plant garden, soil health is a key maintenance issue.

THE HASTINGS GARDEN MAINTENANCE PLAN

Ongoing maintenance is performed primarily by UF/IFAS Putnam County Master Gardener volunteers. In 2011, Master Gardeners donated over 1000 hours of labor to the first edible landscape, including labor to construct the various structures and to plant and maintain the various gardens within the landscape. It is important to asses and minimize ongoing maintenance needs when relying on volunteer help. To that end, mulch was used extensively to help conserve soil moisture and minimize weeds. Mulch is also important to help build organic matter content in the soil. This also helps to reduce ongoing fertilizer needs.

Low-volume irrigation not only reduces water use, it helps to avoid diseases common in vegetable gardens that are watered via overhead irrigation. Low-volume irrigation also limits the amount of square footage of land that is irrigated, thereby minimizing weed populations. The irrigation system is completely automated, which provides a steady, consistent amount of water to the edible landscape on a daily basis.

Incorporating copious amounts of organic matter in the form of compost—which is recycled from the landscape, horse manure, and pine bark—enriches the soil and increases the water- and nutrient-holding capacity of otherwise sandy soil.

Integrated pest management practices are used to reduce the need for pesticide applications. When pesticides are used, insecticidal soaps, horticultural oils, mechanical controls, and biorationals are used exclusively. This is a must for public gardens to reduce potential liabilities associated with chemical pesticides to both the applicator(s) and visitors. It also maintains the "organic" status of the edible landscape.

Summary

Learning landscapes are natural settings useful for demonstrating plant material and environmental concepts. Planning a demonstration garden includes developing a mission or purpose statement, an educational theme, and a site program. The mission statement includes the goals and objectives to guide the design of the garden, while the educational theme provides content for the plant types and educational material. The program brings together all the information needed to design the site. Program development should consider the visitor and the site to determine the learning sequence, activities, infrastructure, and resources needed for the garden. Developing a site program can also help determine if a learning landscape is appropriate for your educational program.

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