Attributes of a Successful Ethnobotanical Garden

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Abstract: *A successful ethnobotanical garden tells a compelling story about the relationship between people, plants, and the natural world in a particular place at a particular time, within a broader cultural or environmental context. We propose a framework for programming and design based on five attributes of a successful ethnobotanical garden. The proposed framework can help landscape architects answer six basic questions when programming and designing an ethnobotanical garden: What people are being interpreted? What aspects of their culture? How did they use this place? What plants did they use? How did they use them? What did they make with them? More importantly, the framework provides a tool for expanding our collective vision of what an ethnobotanical garden can be. By sharing this framework, we encourage landscape architects to approach ethnobotanical gardens from the broader context of a people's relationship to the Earth. In this way, we can improve the quality of ethnobotanical garden design and interpretation, and increase these gardens' effectiveness in changing visitors' perceptions of, attitudes towards, and behavior on the land.*

Ethnobotanical gardens are increasingly important components of botanical gardens and interpretive facilities. These gardens should tell a compelling story about the relationship between people and plants: plants used or grown by traditional or indigenous peoples, as well as plants used or grown by technologically advanced cultures. An ethnobotanical garden may interpret people, plants, cultures, and gardens of the past or the present. It may speculate about future relationships or examine the diverse ways that people interact with the plant world, ecosystems, and the land. The best ethnobotanical gardens reach beyond mere description of plants to provoke thought and to precipitate change in visitors' perceptions of, attitudes towards, and behavior on the land (Hoversten and Jones 2002). Plants become the springboard to effect this change, as each garden interprets a specific people and their relationships with the natural world, in a particular place at a particular time, within a broader cultural or environmental context.

Over the years we have observed a wide range of approaches to incorporating ethnobotany into public gardens and other interpretive facilities. Size, design quality, and educational messages varied dramatically between different institutions and even within a single institution. However, ethnobotanical gardens have not been addressed in the published literature on public garden or interpretive facility design. As a result, we conducted a pilot study to identify the attributes of a successful ethnobotanical garden and create a framework for ethnobotanical garden programming and design. By sharing this framework, we encourage designers to approach ethnobotanical gardens from the broader context of a people's relationship to the Earth. The complete framework correlates attributes and issues to the design process and products as shown in Figure 1. Travel logistics, time, and funding constraints limited this study to nine botanical gardens and interpretive facilities in Southern Nevada and Arizona that could be studied within approximately six months. However, the literature review encompassed studies from around the world to expand the geographic scope and applicability of the results.

The study specifically examines the interdependent roles of ethnobotany, interpretive design, garden management, and landscape architecture in ethnobotanical garden design. Each discipline brings a distinct expertise, experience, and frame of reference to the programming and design of botanical gardens. Ethnobotanists bring their

understanding of people, plants, processes, and products of a particular culture at a particular time and place. Interpretive planners and exhibit designers understand visitor learning preferences and cultural differences, and have the story-telling skills to choreograph a memorable visitor experience. Managers and staff of botanical gardens supply the organizational vision, horticultural expertise, and intimate knowledge of the institutional resources. Landscape architects combine three-dimensional design skills and abilities in cultural landscape and visual resource analysis with an overarching sensitivity to site and environment.

We synthesize theory, research, and practice in these disciplines with botanical garden management issues to propose five attributes of a successful ethnobotanical garden as the basis of a practical framework for programming and design. By translating these attributes into the design language of landscape architecture, the typical design process expands into a potential management tool for facilitating dialog, reducing miscommunication, and integrating different perspectives among members of a multi-disciplinary garden design team.

Research Methods
The study systematizes existing information derived from the literature and original information developed from site visits, interviews, and case studies. The study combines the case study method for landscape architecture proposed by Francis (1999) with the architectural programming method of Duerk (1993).

Literature Review. The literature review identified typical issues, problem-solving approaches, and expertise from fields as diverse as cultural landscape preservation (Alanen and Melnick 2000, Birnbaum 1994); museum exhibit and label design (Belcher 1991, Eberbach 1997, Goulding 1999, Hall 1987, Luke 1997, Royal Ontario Museum 1999, Serrell 1996); and heritage tourism development (Francaviglia 2000, Hardesty 2000,

Shackley 1999); as well as ethno-botany (Balick 1991, Balick and Cox 1996, Cotton 1998, Nabhan 1985); interpretive planning (Jones-Roe 1986, Knudson, Cable and Beck 1995, Parnan 1999, Vandiver 1991); botanical garden design (Greenhouse 1997, Greenhouse and McGinn 2000, Roberts 1990, Skye 1996, Skye 1997); and landscape architecture (Byrd 1989, Kaplan, Kaplan and Ryan 1998, McHarg 1992, Steiner 1999).

During the literature review, plant-use classifications from nineteen ethnobotanical studies were compared to identify the spectrum of people-plant relationships that should be considered by design teams during the programming phase. The studies originally were published between 1900 and 1995 and are summarized in Appendix A. Fourteen studies addressed native cultures of North America, including eight studies describing ethnobotany within the desert southwest, and six studies representing cultures from the Pacific Northwest and central plains. One study examined ethnobotany in Hawaii; the remaining four documented cultures in Africa

and South America. The studies introduced historic, geographic, and cultural diversity into the pilot study that could not be achieved due to logistical constraints. From our analysis, we prepared tables that grouped plant uses into three categories: plant use related to food (Table 1); plant use related to medicine, ceremony, and ritual (Table 2); and plant use related to construction, arts, and crafts (Table 3).

We also examined general works of ethnobotany as a means of defining the appropriate role of ethnobotanical gardens within the broader perspective of interpretive facilities such as zoos, museums, and botanical gardens. Our literature review also helped identify potential programming and design issues, clarify roles and interrelationships among design team disciplines, and define measures of success.

Site Visits. During the site visits, we examined relationships among storylines, the designed environment, and visitor experience. Visits focused on design characteristics that must be experienced firsthand, such as visual appeal, ease of way-

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Table 1. Plant Use Related to Food (Adapted from Jones 2001).

Food Plants	Wild plants, cultivated plants Primary food sources, secondary food sources One plant group (e.g., fungi or grains) All plant groups
Plant parts	Roots, tubers, bulbs Stems, leaves, tree bark, inflorescence, flowers Fruits, seeds, nuts, berries Whole plants
Related uses	Beverages, chewing, smoking Saps, gums, oils Spices, condiments, seasonings, herbs Poisons, plants avoided
Gathering, preparing, and storing food	Plant-gathering and harvesting tools and implements Hunting and fishing tools and implements Milling tools and storage facilities or utensils Cooking and eating utensils Fuel and charcoal
Agriculture	Farming tools and fencing Food for livestock Pest control

Table 2. Plant Use Related to Medicine, Ceremony, and Ritual (Adapted from Jones 2001).

Medicinal uses	Remedies for people and for livestock
	Medicine containers
Ceremonial and ritual uses	Dances and dance implements
	Ritual baths
	Clothing, adornments
	Tools, utensils, implements
	Food and drinks
	Structures, buildings, shrines, temples
	Sacred groves and images
	Ritual objects, religious artifacts, incense
	Plants avoided
	Myths, legends, and magic

finding, visitor experience and comfort levels, and the interactive learning experience. Between August 2000 and February 2001 we evaluated nine botanical gardens, museums, and interpretive centers in Arizona and Nevada, including facilities with and without ethnobotanical gardens. These facilities display a common cultural background that enabled us to isolate ethnobotanical garden design and interpre-

tation issues from culturally imposed differences. Limited resources and a short timeframe also precluded more extensive field research. Four key facilities in Arizona received special attention because they exhibited especially clear expressions of design and interpretation: (1) the Arizona-Sonora Desert Museum, Tucson, (2) the Desert Botanical Garden, Phoenix, (3) the Tucson Botanical Garden, and (4) Tohono Chul Park, Tucson. Other Arizona facilities included the Boyce Thompson Southwestern Arboretum, Superior, and the Pueblo Grande Museum and Archaeological Park, Phoenix. Facilities in Clark County, Nevada, included the Old Las Vegas Mormon Fort State Historic Park, the Nevada State Museum, and the Red Rock Canyon National Conservation Area. We visited each facility at least twice, except the Boyce Thompson Southwestern Arboretum (one visit).

Checklists prepared prior to each site visit guided our data-gathering related to previously identified issues and attributes (Table 4). Site visits verified whether preliminary issues and attributes derived from the literature and early observations were appropriate to ethnobotanical gardens and measured success in the built environment. Our preliminary issues and attributes addressed the following:

- Mission, history, and background of the overall facility, as well as the specific ethnobotanical gardens or exhibits
- People or culture being interpreted and their relation to the site
- Interpretive themes and storytelling
- Landscape architectural components of the design related to visitor learning styles, physical comfort, psychological comfort, and way-finding

We drew additional practices and examples from previous visits to other botanical gardens and interpretive facilities.

Case Studies. Case studies of the four key facilities, based on the method

Table 3. Plant Use Related to Construction, Arts, and Crafts (from Jones 2001).

Construction	Shelter, flooring, framing
	Doors and windows
	Walls and roofing
	Furniture for seating, sleeping, eating
	Storage
	Construction tools
Transportation	Land conveyances
	Boats and rafts
	Air transport
Fibercraft	Clothing, textiles, weaving, sewing
	Cordage (rope, string)
	Matting
	Sewing and weaving implements
Basketry	Basket materials
	Tools and implements
Personal use	Adornment, jewelry, headdresses
	Perfume, cosmetics,
	Soaps and oils
	Other hygiene products
Leathercraft	Tanning tools and agents
	Saddlery and harness
	Footwear
Utilitarian uses	Dyes, coloring agents
	Gums and glues,
	Resins, latex, waterproofing, caulking
	Pottery glazing
Other uses	Toys, games, sports
	Musical instruments
	Warfare, armor, weapons

Table 4. Ethnobotanical Garden Site Visit Checklist.

NAME OF INSTITUTION:
NAME OF ETHNOBOTANICAL GARDEN COMPONENT:
DATE AND TIME VISITED:
ACCOMPANIED BY:

Mission (why ethnobotany is being interpreted)
- Mission of the parent institution:
- Mission of the ethnobotanical component:
- Who defined the ethnobotanical garden mission?

Ethnobotany (who and what are interpreted)
- What people/culture is being interpreted?
- What was their relationship to this place/this site/this area?
- What processes are interpreted?
- What products are interpreted?

Interpretation (how ethnobotany is interpreted)

The Big Ideas
- Who designed the exhibits?
- What are the overarching interpretive themes?
- Who is the target audience?
- How have plants been used as a springboard to broader contemporary societal issues?

Cultural Landscapes
- Is the site classified as a cultural landscape? ____yes ____no If yes:
- What is its significance?
- What is its integrity?
- How has it been treated? Describe preservation, rehabilitation, restoration, and reconstruction efforts, including ways in which new construction is distinguished from original.

Exhibit(s)
- What is the focal point of each exhibit?
- How big is each exhibit?
- What are the general layout and components of the exhibit?
- What media are used to deliver the ideas?

Learning environment
- Are there places to stand and read/listen to educational materials? ____yes ____no   Describe.
- Are there places to sit and read/listen to educational materials? ____yes ____no   Describe.
- Are there learning stations for groups? ____yes ____no   Describe.
- Are paths wide enough to accommodate groups? ____yes ____no   Describe.
- Are transitions to and from exhibits clear? ____yes ____no   Describe.
- Are they well defined physically? ____yes ____no   Describe.
- Are the educational contents clearly related? ____yes ____no   Describe.

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proposed by Francis (1999), evaluated select design and interpretive practices for more general applicability to the design of ethnobotanical gardens. Each case study examines the history of the facility related to ethnobotanical interpretation, particularly mission statements, storylines, and exhibits. We analyzed the designed environment in terms of proximity, access, way-finding, and comfort for impacts on visitor experience. Facility staffs were interviewed whenever possible for information related to the design,

management, and effectiveness of the gardens and exhibits.

Synthesis of Results. We synthesized results from the literature search, site visits, interviews, and case studies into five generalized attributes of successful ethnobotanical gardens. By correlating the attributes to the typical landscape architectural design process, we provided a conceptual framework for pro-

gramming and design of ethnobotanical gardens. After establishing the basic framework, we adapted the issue-based approach to architectural programming proposed by Duerk (1993) to define issues that should be addressed at each phase of programming and design. According to Duerk, *issues* are those matters, concerns, questions, topics, propositions, or situations that demand a design response in order for a project to be successful. Issues then become the categories for gathering in-

Table 4. Ethnobotanical Garden Site Visit Checklist. (*Continued*)

Landscape Architecture (how physical design features contribute to mission)

General information
- Who designed the ethnobotanical garden?
- What is the overall size of the ethnobotanical garden? ___ft × ___ft or _____acres

Congruency
- Are there sights, sounds, smells, etc. that detract from the featured areas and create an incongruent experience?
Is the entrance/ethnobotanical garden inviting and welcoming? _____yes _____no
High quality of materials is apparent _____yes _____no
High quality of workmanship is apparent _____yes _____no
Garden appears well-maintained _____yes _____no
- Is there anything about the exhibit design that deters people from entering? What is it and why does it deter people?
- Do all features of the ethnobotanical garden contribute to a sense of immersion in the specified place and time? _____yes _____no Explain.
Material/form/line/color/texture are consistent with theme _____yes _____no
Material/form/line/color/texture used consistently within the garden _____yes _____no
Labels and signage are consistent with theme _____yes _____no

Proximity
- Are visitors physically separated from the exhibit components? _____yes _____no
How and why are they separated?
How are visitors protected from the resources?
How are resources protected from visitors?
- Do exhibit materials help people feel closer to the subject? _____yes _____no
Why or why not?

Access and Way-finding
- Is the ethnobotanical garden featured in the institution's advertising? _____yes _____no
Are visitors explicitly directed to it? _____yes _____no
- Is the ethnobotanical garden easy to find? Why or why not? _____yes _____no
Are the entrance and exit clearly marked? _____yes _____no How?
Is there a clear beginning and end to the ethnobotanical garden? _____yes _____no
- Is there a defined sequence/path that visitors are expected to follow? _____yes _____no
How is the sequence marked?
Is it obvious and easy to follow? _____yes _____no
- Are primary and secondary paths easy to see and follow? _____yes _____no   Why or why not?

Visitor Comfort
- What type of protection from the elements is provided, e.g., shade, windbreaks?
- How often is drinking water available? How is it delivered?
- What other beverage/food services are available?
- What kind of seating is available?
Is it appropriate for the space and the visitors? _____yes _____no

formation, stating goals, doing research, developing performance requirements, making programming and design decisions, preparing reports, and communicating with the client. Building on Duerk's definitions, we believe that a successful programming and design framework for ethnobotanical gardens must foster insightful programming questions, organize the resulting answers in a manner useful to a design team throughout the design process, and define criteria for measuring the

effectiveness of the gardens as learning environments.

Discussion of the Five Attributes
Five attributes emerged as indicators of successful ethnobotanical garden design (Figure 1). A successful ethnobotanical garden (1) adheres to a clearly defined mission; (2) focuses on its visitors and capitalizes on the resources of its site

and institution; (3) tells a compelling story; (4) provides an environment conducive to learning; and (5) adapts through time. After discussing the five attributes, we provide examples of successful ethnobotanical garden designs drawn from the four case studies.

Attribute #1. A successful ethnobotanical garden adheres to a clearly defined mission. If programming is the first critical step in garden design, then defining a mission is the first critical step in programming. Why

Figure 1. Systematic application of the programming and design framework for ethnobotanical gardens can expand opportunities for interpreting the wide range of people-plant relationships.

Attributes of a successful ethnobotanical garden	1. Adheres to a clearly defined mission	2. Focuses on its visitors while capitalizing on the resources of its site	3. Tells a compelling story	4. Provides an environment conducive to learning	5. Adapts through time
Steps in the design process	Define the mission	Conduct a site analysis and resource inventory	Develop interpretive themes and choreograph visitor experience	Complete the design	Complete construction and evaluate the garden
Issues to be addressed during programming and design	Reason for the project Measures of success Set of values	Visitors Institutional resources Cultural landscapes Ethnobotany Geophysical systems	Storylines Interpretive methods and media Iconic status of the garden Cultural diversity Choreography of visitor experience	Congruency, immersion, proximity and access Visitor amenities Visitor and resource protection Exhibits Spatial organization Materials palette Construction technology	Congruency Visitor experience Educational effectiveness
Products	Mission statement	Site analysis Resource inventory Opportunities and constraints	Interpretive master plan Programming document	Conceptual and schematic design Design development Construction documents	Post-occupancy and summative evaluations

is the garden being designed? What message is it trying to convey? Ideally the answers to these questions are found in a clearly defined mission statement specifically prepared for the ethnobotanical garden.

A good mission statement captures the reason why the institution has undertaken the project. It suggests measures of success and articulates or implies a set of values that will be communicated through the interpretive program and physical design of the garden. The mission statement becomes the basis for identifying design issues, setting project goals and performance requirements, and making design decisions (Duerk 1993). The statement states a brief and concise written answer to the question "Why do we need to do this project?"

The mission statements of successful ethnobotanical gardens reflect a broad concept of ethnobotany that encourages creative thinking with respect to garden design and interpretation. Traditionally, ethnobotanists inventoried and classified plants used by indigenous groups and recorded their utilization; wrote detailed monographs on the plants and their observed uses; and added specimens to the living and herbarium collections of their sponsoring institutions. Ethnobotanists focused most of their attention on how so-called primitive, pre-industrial, or indigenous societies used plants (Balick and Cox 1996). In the late twentieth century,

however, ethnobotany evolved into a multidisciplinary science incorporating perspectives from many different fields, such as anthropology, archaeology, ecology, economics, pharmacology, and nutrition (Balick 1991). Ethnobotany has evolved beyond material aspects of culture to encompass a broader perspective of the relationship between people and plants.

Botanical gardens also evolve. The linkage of natural resource management, cultural and biologic conservation, and ethnobotany to botanical gardens has renewed public, as well as academic interest in both ethnobotany and botanical gardens. Popular interest in ethnobotany also reflects rising popular interest in conservation, cultural preservation, and heritage tourism. As a result, priorities at botanical gardens have begun to shift away from purely scientific endeavors towards more visitor-oriented programs (Byrd 1989). Newer ethnobotanical gardens often unite past, present, and future plant uses by interpreting traditional knowledge within the context of contemporary concerns (Skye 1997). These gardens examine the bond between people, plants, and civilization in many cultures at many stages of development. Furthermore, newer gardens tend to be issue-oriented advocates for changing the way humanity relates to the earth (Hoversten and Jones 2002).

A selection of viewpoints included here illustrates the range of possibilities for mission statements that will give deeper meaning to interpreting people-plant relationships. In addition, Tables 1 through 3 reflect an entire spectrum of people-plant relationships for consideration during development of a mission statement.

A working definition based on Cotton's concept of *traditional botanic knowledge* could serve as the starting point for discussion of the reason to design an ethnobotanical garden (Cotton 1998). According to Cotton, ethnobotany is the total botanical knowledge held by any community that "incorporates all utilitarian, ecological, and cognitive aspects of both plant use and vegetation management . . . encompasses all types of knowledge . . . including that concerned with the identification, processing, and management of plants used in subsistence, material culture, and medicine . . . and [considers] this knowledge within its original spiritual and sociological context." (60)

Ethnobotanist Gary Paul Nabhan (1985) offers a cultural perspective on ethnobotany that suggests potential mission statements. An ethnobotanical garden could be designed to gain a perspective on the dynamics of a culture's use of plants for food and other purposes as they have shifted through time. The garden could attempt to uncover the diversity of historic responses that individuals and cultures have had to the set of potential plant resources in a region, or describe the symbolic and ecological relationships between a culture and plants. The mission of an ethnobotanical garden should include saving the folk botany or traditional scientific knowledge of plants as part of the heritage of a culture, as well as evaluating native plants as potential economic resources.

Archaeologist David Hurst Thomas (2000) writes about the preservation of great archaeological sites, but his reasoning can be applied to ethnobotanical gardens. Ethnobotanical gardens could be important links to the past that preserve the cumulative identity of a nation, a region, a state, a community, or a world. Research, educational programs, and exhibits that interpret the relevance of the past could teach tolerance and respect for other cultures and awaken a sense of social responsibility towards the earth.

Botanical garden curator and botany professor Frank Telewski (1999) speaks to the importance of heirloom plants. From this perspective, the role of ethnobotanical gardens expands beyond serving as a genetic reserve to evoke a sense of place, a connection with the past, both personal and regional. By demonstrating the valuable contributions made by many cultures and countries to the development of common plants (for example, the apple), ethnobotanical gardens can serve as a showcase for heirloom plants that have almost been lost from our horticultural and botanical heritage, and that have played an important role in a society's agricultural history, arts, literature, or culture.

Ethnobotanists Michael Balick and Paul Cox (1996) state that botanical gardens play an important role in the conservation of biological diversity by maintaining living collections of a diverse range of plant species. They assert that biological and cultural conservation are interrelated and botanical gardens should preserve more than the living plant. Ethnobotanical gardens should focus on preserving the relationship between plants and people. In this way, gardens can assist indigenous communities in documenting their historical land-use rights and plant-gathering areas, and in preserving knowledge concerning plants that are at risk of being lost as cultures become Westernized. Research and educational programming should strive to convey the role of plants in an indigenous culture and the traditional cultural and religious contexts in which plants are used. Conservation programs should preserve the world's legacy of genetic and species diversity in the face of lost ecosystems and increased use of genetically altered and hybridized crop varieties. Perhaps most importantly, Balick and Cox stress that botanical gardens can convey the belief shared by indigenous cultures worldwide that the entire planet is sacred.

Given this broad array of possibilities, a clearly defined mission statement helps lay the foundation for success by focusing and guiding all subsequent design and interpretive decisions. For example, public gardens share one common challenge: visitors want to see something growing year-round. Tohono Chul

Park met this challenge by developing a mission statement that offers flexibility to grow warm and cool season plants. Its ethnobotanical garden "displays plants used today and in the past by native peoples of the Southwest. These plants may be wild, cultivated (purposefully grown), domesticated (adapted to be more useful), or introduced (brought to the New World by Spanish or other European settlers). The emphasis in this garden is on plants cultivated during the late Spanish Colonial period in southern Arizona and Sonora, Mexico" (Tohono Chul Park 2001, 14). This mission defines a time period, geographic area, and plant palette including Old and New World species and varieties. The mission allows curators to rotate crops twice each year, growing mostly native crops in summer and Old World crops in winter. Crop rotation solves the problem of year-round growth and becomes an interpretive opportunity for describing how European plant introductions changed traditional lifestyles of indigenous Hohokam and O'odham tribes.

Attribute #2. A successful ethnobotanical garden focuses on its visitors while capitalizing on the resources of its site and institution. Ethnobotanical gardens challenge designers to create settings for experiential learning opportunities in ethnobotany, history, ecology, and other fields of human knowledge that communicate how closely plants and people are intertwined. Garden managers know that visitors are a botanical garden's most important resource (Greenhouse 1997; Greenhouse and McGinn 2000; Greenhouse and Socolofsky 1997). Their psychological and physical comfort must be assured, so time spent in the garden is a positive aesthetic experience that feeds the spirit as well as the mind (Kaplan et al. 1998). The garden and interpretive displays accommodate multiple learning styles—the different ways that people receive and process information in a learning situation (Serrell 1996). The size and number of exhibits in the ethnobotanical garden are carefully

planned because studies show that most visitors have a limited amount of time to spend in a garden (Shackley 1999).

Site analysis for ethnobotanical gardens differs substantially from site analysis for typical landscape architectural projects. Whereas typical site analyses focus on biotic and abiotic geophysical systems operating at the site (such as climate, geology, physiography, hydrology, soils, vegetation, and wildlife), site analyses for ethnobotanical gardens emphasize cultural landscape features, ethnobotany, and visitors. Successful ethnobotanical gardens also inventory the non-landscape resources of the institution, such as herbarium collections, staff interests and expertise, library holdings, and all other resources available to support interpretive themes and exhibits. A thorough analysis and inventory reveal the strengths and weaknesses of the site and its collections (Parnan 1999, Jones-Roe 1986), and suggest

storylines that reinforce the mission and can be supported by existing resources. After developing interpretive themes, design teams use the analyses to suggest places on site with characteristics that reinforce storylines. Because an ethnobotanical garden serves to interpret these themes, designers must focus on the visitor experience as a design determinant. Later, as exhibit and garden designs mature, the resource inventory forms the basis of collections management policies and helps organize an acquisition program to complete the exhibits and garden.

Attribute #3. A successful ethnobotanical garden tells a compelling story. Interpretive components of the garden go beyond mere recitation of facts to tell a compelling story that increases visitors' sensitivity toward our cumulative cultural and natural heritage, past, present, and future. Many stories can be told within a garden. The most successful ethnobotanical gar-

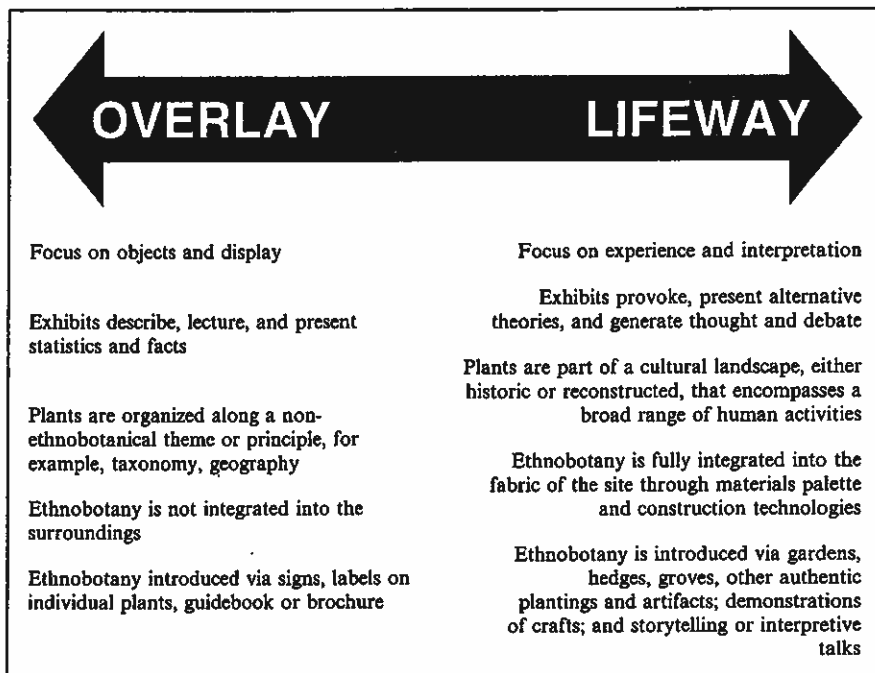| OVERLAY	LIFEWAY
Focus on objects and display	Focus on experience and interpretation
Exhibits describe, lecture, and present statistics and facts	Exhibits provoke, present alternative theories, and generate thought and debate
Plants are organized along a non-ethnobotanical theme or principle, for example, taxonomy, geography	Plants are part of a cultural landscape, either historic or reconstructed, that encompasses a broad range of human activities
Ethnobotany is not integrated into the surroundings	Ethnobotany is fully integrated into the fabric of the site through materials palette and construction technologies
Ethnobotany introduced via signs, labels on individual plants, guidebook or brochure	Ethnobotany is introduced via gardens, hedges, groves, other authentic plantings and artifacts; demonstrations of crafts; and storytelling or interpretive talks

Figure 2. Interpretive facilities fall along a continuum between two basic approaches to ethnobotanical garden and exhibit design—the Overlay and the Lifeway (from Jones 2001).

dens select stories that reinforce their mission, build on their resources, and engage a diverse audience physically, emotionally, and intellectually.

Our site visits revealed that ethnobotany can be introduced into a garden or interpretive facility in different ways. However, the interpretive approach generally falls along a continuum defined by two end members that the authors call the *Overlay* and the *Lifeway*, with most ethnobotanical gardens lying somewhere in the middle (Figure 2). The Overlay focuses on display of objects in descriptive exhibits that present statistics and facts in a lecture-like format. Ethnobotany is not integrated into the surroundings. Rather, it is introduced as an afterthought via signs or labels on individual plants, or through guidebooks and brochures. These gardens skim the surface of ethnobotanical knowledge, tend to ignore non-material aspects of culture, and lack a strong focus or storyline. Plants generally are organized along a nonethnobotanical theme, such as taxonomy or geography. As an example, randomly placed plant labels listing medicinal uses of various species typify the Overlay approach.

In contrast, the most successful ethnobotanical gardens immerse visitors in a culture using the Lifeway approach. Exhibits provoke thought and dialog, often by presenting alternative theories and differing points of view. Lifeway exhibits fully integrate ethnobotany into the fabric of the site, especially when the site consists of authentic or recreated cultural landscapes. Authentic plantings and artifacts, storytelling, or interpretive talks introduce visitors to ethnobotany. The Lifeway creates a more effective garden because it focuses on visitor experience; provides a variety of opportunities that address visitor learning styles; presents a holistic treatment of plants relating to the people of a particular culture (immersing visitors in that culture); and improves proximity to the resources.

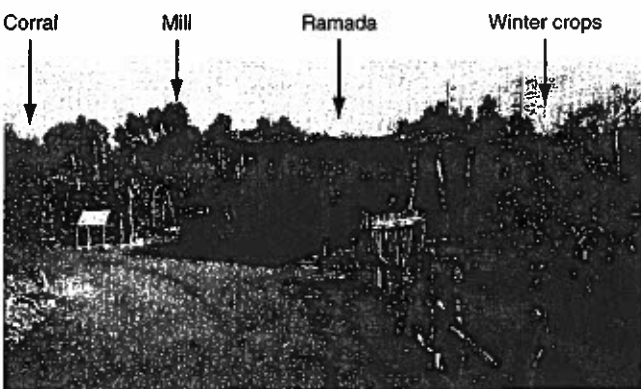For example, the "Plants and People of the Sonoran Desert Trail"

(a)

(b)

(c)

Corral   Mill   Ramada   Winter crops
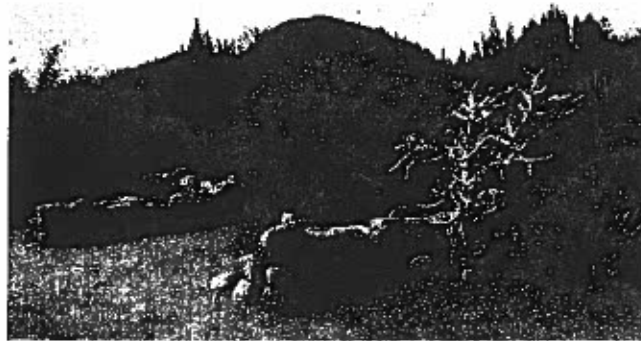
(d)

Figure 3. Some of the exhibits and gardens along the "Plants and People of the Sonoran Desert Trail": (a) an authentic Salado house ruin moved 70 miles and reconstructed on the site; (b) traditional nineteenth-century Pima household with its open-air kitchen on the left and roundhouse to the right; (c) an authentic Apache wickiup; and (d) an Hispanic garden featuring traditional construction materials and plant varieties similar to those introduced by the Spanish nearly 300 years ago.

at the Desert Botanical Garden displays many of the characteristics of the Lifeway interpretive approach as it winds through three acres of desert landscape. Interpretation focuses on the diverse peoples who have inhabited the Phoenix region during the last 5,000 years: Archaic and Hohokam Indians; protohistoric and contemporary O'odham peoples; and Spanish, Mexican, and other Euro-American settlers. The trail shows some of the ways people have used plants in the Sonoran Desert region in order to increase visitors' understanding and appreciation of the richness of this desert land (Desert Botanical Garden 2001). Trailside exhibits immerse visitors in the domestic life of Sonoran Desert cultures through use of traditional materials, structures, artifacts, plants, and activities. Exhibits depict the ruins of a Salado House (Figure 3a), a traditional Pima household (Figure 3b), authentic Apache wickiups (Figure 3c), and an Hispanic garden (Figure 3d). Visitors can grind mesquite-bean flour (Figure 4), make yucca-fiber brushes, and braid agave rope. A hillside *agave* garden demonstrates traditional water-harvesting techniques (Figure 5), while the future resources garden introduces today's visitors to the potential of desert plants as new sources of food, medicine, cosmetics, and industrial products.

Regardless of the interpretive approach chosen, every successful garden conveys a clear storyline, a *Big Idea* that all visitors take home after their visit. Interpretive themes distinguish one ethnobotanical garden from another. Common themes include:

- The ethnobotany of social or ethnic groups, like the Tohono O'odham Path at the Tucson Botanical Gardens
- Geographic regions, like the "Plants and People of the Sonoran Desert Trail" at the Desert Botanical Garden
- Historic sites, like the Old Las Vegas Mormon Fort
- Individual species of plants, such as the Saguaro Harvest

exhibits at the Tucson Botanical Gardens and the Desert Botanical Garden

Interpretive themes can be simple or complex, but the most compelling stories relate what a visitor is experiencing in the garden to his or her everyday life. Compelling stories answer a series of visitors' questions first posed by Francaviglia (2000) for heritage visitor attractions and paraphrased here for ethnobotanical gardens. Why does this ethnobotanical garden appear to be authentic? Did someone discover it and open it to the public? Why does this garden, which appears historic because of its style or design, look so new and well maintained? Was it restored? Does it look the way it did in the past? What does this garden mean? What am I supposed to see or do here?

Knudson et al. (1995) describe at length the way in which a strong interpretive program creates an understanding of the history and significance of events, people, plants, and objects associated with a site. They define interpretation as an educational activity that reveals meanings and relationships through the use of original objects, by firsthand experience, and by illustrative media. At successful ethnobotanical gardens, strong interpretive programs change people, so they touch the earth more softly and with deeper understanding.

Attribute #4. A successful ethnobotanical garden creates an environment conducive to learning. An emphasis on learning differentiates ethnobotanical gardens (and all interpretive facilities) from other recreational landscapes. Research shows that visitor experience in museums is influenced not only by physical surroundings, but also by visitors' prior knowledge, their expectations, and the people attending with them. Visitor experience depends on this interplay of the personal, social, and physical contexts of the visit. The first two contexts are largely beyond the influence of a design team. There-

fore, the primary aim of a design team is to provide a physical environment that encourages visitors to explore, whatever the social or personal context of the visit (Caulton 1999; Kaplan, Kaplan and Ryan 1998).

Successful ethnobotanical gardens provide an atmosphere and a three-dimensional form that are welcoming, inviting, and conducive to learning. Exhibits, visitor amenities, spatial organization, materials palette, visitor and resource protection, and construction methods contribute to the overall quality of the garden experience. Interpretive planners consider six characteristics that describe a well-choreographed, successful visitor experience, symbolized by the acronym ADROIT (J. Coleman, personal communication, 2001). ADROIT stands for:

Arrival—defining the entry to a clearly defined space to signal the start of a new experience;
Decompression—giving visitors an opportunity to relax and rest before beginning the new experience;
Reception—creating a state of mind in which a visitor is ready to receive a new message;
Orientation—preparing the mind so that it can progress from the known to the unknown and providing basic information to maximize the benefits of viewing the exhibit;
Interpretation—provoking thought, offering new knowledge or new ways of looking at previously known information; and
Transformation—effecting a change in behavior, perception, or attitude.

Landscape architects measure success of a physical design from a different perspective. According to Jones and Hoversten (2002), successful ethnobotanical gardens display the following four non-material qualities that contribute to high-quality visitor experience and allow visitors to enter and become part of the scene:
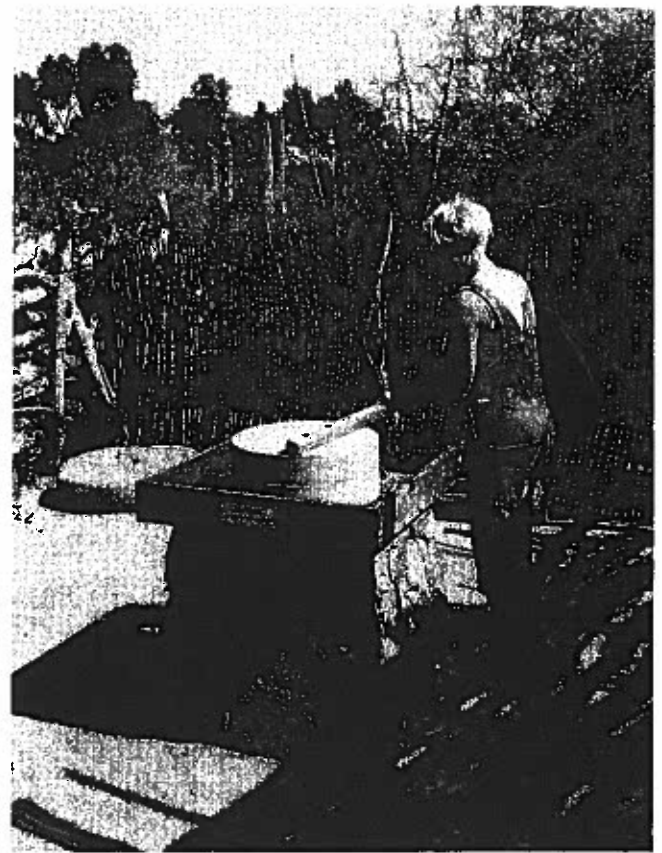
Figure 4. Visitors compare (a) hand-grinding mesquite in the Pima Household Exhibit to (b) grinding with the millstone in the Hispanic Gardens at the Desert Botanical Garden.

- Congruency—the consistency between the spaces encountered by the visitor and the experience expected by that visitor *or* intended by the designer;
- Immersion—the feeling of being deeply involved in, and absorbed by, the character of a place;
- Proximity—the extent to which a visitor is in contact with the biological, cultural, and geological resources of the area; and
- Access—the ease with which a visitor can get to the resources physically and intellectually.

Although exhibits at the Arizona-Sonora Desert Museum focus on habitats of the Sonoran Desert region, not ethnobotany, it nevertheless epitomizes the qualities of congruency, immersion, proximity, and access. Visitors reach the Museum after a lengthy scenic drive through the relatively undeveloped landscape of Saguaro National Park and an equally undeveloped State Park. Materials, forms, lines, colors, and textures drawn from the surrounding desert create a visual harmony among Museum exhibits and structures to achieve an aesthetic compatibility with the landscape that enhances visitor experience (Figures 6 and 7). Designs emphasize philosophical consistency, innovative exhibits, and coherent presentation of interpretive programs to generate a commitment to conservation of the Sonoran Desert region's natural resources (Arizona-Sonora Desert Museum 2000).

As a result of this study, the authors identify six material components that contribute to successful ethnobotanical garden design. First, facilities integrate visitor amenities that provide physical comfort, such as restrooms, food and beverage services, seating, and protection from the weather, into the garden relative to spatial organization of the exhibits, circulation patterns, materials palette, and construction techniques.

Second, visitor and resource protection methods and devices, used to prevent damage to the resources and injury to the visitors, encourage visitors to interact with plants and artifacts with all of their senses whenever possible. However, designers choreograph the degree of interaction and provide signals telling visitors what type of behavior is expected. Signals can be as subtle as a well-defined edge of a path or as direct as fencing. Regardless of the reason for introducing barriers between people and plants, materials contribute to (or at least do not detract from) the ambiance dictated by the interpretive theme.

Third, interpretive exhibits—the collection of plants, artifacts, objects, signs, methods, and media that convey the interpretive theme—involve all of the visitors' senses; guide them to make discoveries; make it clear where to begin and what to do; and provide many opportunities to investigate and make observations (Serrell 1996). Gardens recreate a sense of place, time, and scale appropriate to the plants and people being interpreted. For example, authentic agave roasting pits build up over tens to hundreds of years of use, and can have a diameter of 10 to 15 feet at the top, 20 to 30 feet at the base, and a height of 5 feet or more. Small-scale models do not convey the same sense of time and effort as a real pit or full-scale model. And a full-scale model tells a more compelling story when built where Native Americans historically roasted agave.

Fourth, the spatial organization or physical layout of the ethnobotanical garden reflects opportunities and constraints uncovered during the site analysis and reinforces the storyline. Spatial subdivisions should relate to subdivisions of the subject matter to create manageable perceptual environments and isolate visitors from remote distractions. The variety and sequencing of spaces and experiences reinforce the storyline yet allow visitors some flexibility to move through the garden however

Figure 5. Native Americans cultivated agave and terraced hillsides to collect rainfall for their crops—a technique applicable to today's xeric gardens.

Figure 6. (a) Islands planted with native trees and shrubs blend parking areas into the native landscape, immediately immersing visitors in the landscape as they exit their cars. (b) Bronze sculptures of native wildlife, such as these javelina, and displays of living lizards and tortoises mediate the transition from entry plaza to Museum and introduce design components found throughout the grounds. (c) The arrival sequence ends with scenic overlooks and expansive vistas, signaling the start of a new experience for visitors, providing them with an opportunity to rest and relax and preparing them to receive the Museum's message. (Photograph of scenic overlook courtesy J.W. Zunino and Associates, Las Vegas, Nevada)

they choose. Visitors can easily understand the spatial organization of the garden and the exhibits because designers provide adequate spatial clues and eliminate meaningless decision points. The exit from the garden reflects a clear policy decision about what a visitor is expected to do or feel upon leaving. For example, a splendid view or spectacular specimen plant might be used to end the exhibit, but a dramatic ending is not always appropriate. The interpretive message may require a visitor to exit the garden on a quieter note to promote reflection and further study.

Fifth, the materials palette, including plant, construction, and interpretive materials used to construct the garden and all of its components, strongly reflects the ethnobotany of the culture being interpreted. Belcher (1991) characterizes ethnobotanical gardens as intricate communications systems that depend on a non-verbal, visual, tactile, and olfactory language of plants, objects, and images, aided by the verbal language of interpretive text. A garden communicates its interpretive themes effectively when every detail conveys a clear and consistent message. Furthermore, plants form the core of the garden's interpretive theme and exhibits; they are not treated as decoration. Whenever possible, gardens grow and use the exact plant species and varieties in the same ways as they are grown and

used by the people whose story is being told. Materials used in the exhibits and for visitor amenities are consistent with the materials used by the culture being interpreted (Figure 8). Compromises to authenticity are used sparingly and do not detract from the overall impact of the storyline or design. When in doubt, the design team errs on the side of authenticity, rather than risk creating a false picture or offending the people whose culture is being interpreted.

Finally, *construction technology*—the tools, components, and techniques used to construct the garden and its exhibits—is consistent with the ethnobotany of the culture being interpreted. For example, yucca fiber rope used to strap together a shade structure would contribute to the authenticity and consistency of certain desert exhibits while use of nails or bolts would not.

Attribute #5. A successful ethnobotanical garden adapts through time. Designers evaluate projects so they can repeat successes and avoid mistakes. Designs can be evaluated during the design process (formative evaluations) or after construction is complete (summative, post-construction,

and post-occupancy evaluations). Duerk's (1993) discussion of the architectural evaluation process is adapted here for application to ethnobotanical garden programming and design. Successful ethnobotanical gardens periodically evaluate themselves to test how well programming and design are making progress towards meeting the garden's mission and goals: to test how well a built garden or exhibit implemented its goals, to fine-tune the exhibit or garden performance, and to make corrections for the rest of the garden or exhibit life cycle; to gather information that will be valuable in the programming and design of a new garden or exhibit; to test the validity of the intentions of the program; to test new concepts; to add generalizable information to the knowledge base for ethnobotanical gardens; and to develop entirely new policies or new programming and design processes.

Using the Programming and Design Framework

Briefly, as described above, a successful ethnobotanical garden (1) adheres to a clearly defined mission; (2) focuses on its visitors and capitalizes on the resources of its site and institution; (3) tells a compelling story; (4) provides an environment conducive to learning; and (5) adapts through time. In this section we present our thoughts on how landscape architects might
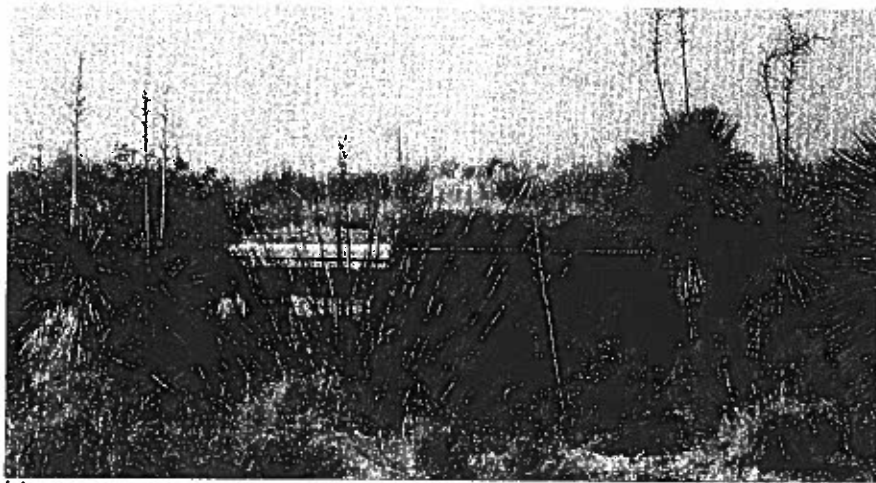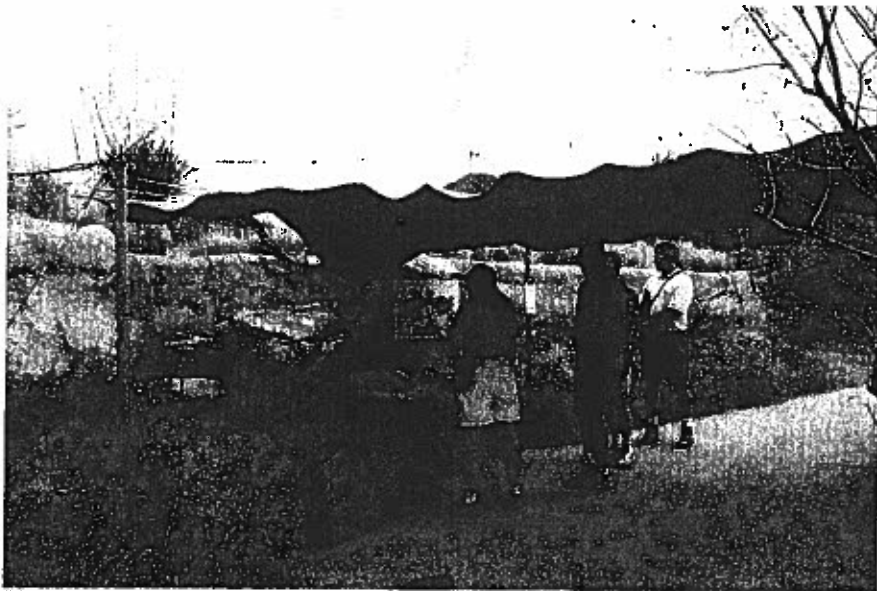
Figure 7. At the Arizona-Sonora Desert Museum, exhibit designers think three-dimensionally, housing exhibits above and below ground in canyons, dry washes, tunnels, underground dens, and simulated caves. Even rooftops support exhibits, host lookout areas, and harvest water. The Desert Grasslands Exhibit, which opened in 1994, exemplifies the newest generation of exhibits. (a) The roof of the building is planted with grass to be nearly invisible in the landscape. The main viewing area is below grade to protect visitors from the elements. (b) A simulated archaeological dig replicates an 11,000 year old mammoth kill site, performing triple duty as a docent demonstration area; and an interpretive exhibit on extinction of the Pleistocene megafauna; and as a permanent shade structure for visitor comfort. (Photograph courtesy J.W. Zunino and Associates, Las Vegas, Nevada)

apply this attribute-based framework to improve the design of ethnobotanical gardens.

The proposed framework can help landscape architects answer six basic questions when programming and designing an ethnobotanical garden. What people are being interpreted? What aspects of the culture should be emphasized? How did they use this place? What plants did they use? How did they use them? What did they make with them?

More importantly, the framework provides a tool for expanding our collective vision of what an ethnobotanical garden can be. The range of possibilities for mission statements and the plant-use tables should stimulate a design team to think beyond one-dimensional expressions of plant-people relationships, to reject oversimplified characterizations of plants as "food" or "medicine," and to incorporate a broader concept of ethnobotany into a garden's mission statement, storylines, and design.

Landscape architects can adopt the framework as a checklist to help them stay focused on the garden's mission throughout programming and design. The framework can help ensure that site analysis includes a detailed study of the culture to be interpreted and a complete inventory of institutional resources. If the design team applies the framework systematically across professional disciplines, it can provide a common programming and design language to facilitate dialog, reduce miscommunication, and integrate different perspectives among members of a multi-disciplinary team. The framework can be used to help select the storytelling approach—Overlay or Lifeway—and to find creative ways of integrating ethnobotany into new or existing gardens. Continual reference to the framework and attributes of success serve as reminders that storylines, cultures, and interpretive approach dictate the physical form and materials palette of the garden, including plant selection. Finally, the framework reminds all of us that successful ethnobotanical garden design considers the total
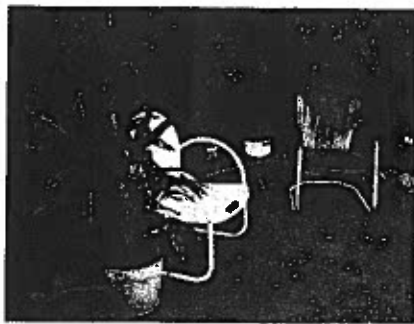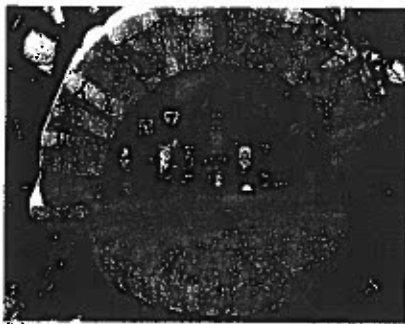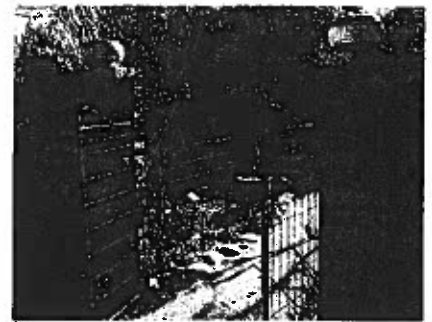
Figure 8. The Tucson Botanical Gardens created Nuestro Jardín ("Our Garden") to honor the city's Mexican-American heritage. Garden staff carefully researched traditional elements and collaborated with local Latino gardeners to present a contemporary neighborhood (barrio) garden. Every design detail in the tiny 1100-square-foot garden conveys the feel of the neighborhood, including such typical elements as (a) these old metal chairs, (b) a shrine to honor La Virgin de Guadalupe, and (c) a recycled iron gate.

social, intellectual, and physical context of a visitor's experience.

Although we have presented the attributes of success and the programming and design framework as guides to development of new ethnobotanical gardens, we believe garden managers can also use them to evaluate and improve existing gardens and exhibits. The framework provides a tool to measure the effectiveness of existing ethnobotanical gardens as learning environments, to develop new compelling stories about people and plants, and to reassess the focus and organization of their collections. Armed with an expanded vision, ethnobotanical gardens can go beyond mere description of plant use to provoke thought and to precipitate changes in visitors' perceptions of, attitudes towards, and behavior on the land.

Appendix A

Tables 1 through 3 were developed strictly as aids for landscape architects who may be unfamiliar with ethnobotany, and are not meant to propose a new classification scheme for ethnobotanical studies. Reference to the tables will help design teams consider the entire spectrum of people-plant relationships before selecting stories to tell in the garden and before beginning conceptual design. Discussions of all possible plant uses will also generate ideas for construction techniques and materials, suggest a plant palette to reinforce the interpretive themes, and create a more immersive visitor experience. The nineteen studies are briefly summarized here for those interested in the origins of the plant-use tables.

In his undergraduate textbook, *Ethnobotany: Principles and Applications*, C. M. Cotton covers the main principles and potential applications of ethnobotany: wild plant resources, domesticated plants and traditional agriculture, plants in material culture, traditional phytochemistry, and paleoethnobotany (1998; Chichester, England: John Wiley & Sons, Inc.).

Studies focused on tribes of the arid southwestern portion of the United States include David Prescott Barrows' *Ethno-botany of the Coahuilla Indians of Southern California* (1900; reprinted by New York: AMS Press, 1978, 35–82); Edward F. Castetter and Ruth M. Underhill's *Ethnobiology of the Papago* (1939; reprinted by AMS Press, 1978, 13–78; covers southern Arizona and adjacent parts of northern Mexico); James W. Cornett's *Indian Uses of Desert Plants* (1995; Palm Springs, California: Palm Springs Desert Museum); William Dunmire and Gail D. Tierney's *Wild Plants and Native Peoples of the Four Corners* (1997; including parts of Colorado, New Mexico, Arizona, and Utah) and *Wild Plants of the Pueblo Province* (1995; covering northern New Mexico; both published by the Museum of New Mexico Press, Santa Fe, New Mexico); Francis H. Elmore's *Ethnobotany of the Navajo* (1943; Albuquerque, New Mexico: University of New Mexico Press, 96–111); Matilda Coxe Stevenson's *The Zuni Indians and Their Uses of Plants* (1993; New York: Dover Publications Inc., 5–66); and Richard W. Stouffle, David B. Halmo, John E. Olmsted, and Michael J. Evan's *Native American Cultural Resources at Yucca Mountain, Nevada* (1990; Ann Arbor, Michigan: Institute for Social Research, University of Michigan).

Sources related to other North American indigenous peoples included Frances Densmore's *How Indians Use Wild Plants for Food, Medicine, and Crafts* (1927; originally titled "Uses of Plants by the Chippewa Indians", who inhabit Minnesota and Wisconsin; reprinted by New York: Dover Publications, Inc., 1974); Melvin R. Gilmore's *Uses of Plants by the Indians of the Missouri River Region* (1919; reprint with new line illustrations; Lincoln, Nebraska: University of Nebraska Press, 1991); Erna Gunther's *Ethnobotany of Western Washington* (1973; Seattle, Washington: University of Washington Press, 13–50; covers eighteen tribes primarily from the Olympic Peninsula); Harriet V. Kuhnlein and Nancy J. Turner's *Traditional Plants Foods of Canadian Indigenous Peoples* (1991; Philadelphia, Pennsylvania: Gordon and Breach Scientific Publishers, 1–23; covers nutritional properties of plants used by peoples of British Columbia, Alberta, Saskatchewan, Manitoba, and the Yukon and Northwest Territories); Paul A. Vestal and Richard Evans Schultes, *Economic Botany of the Kiowa Indians* (1939; reprint AMS Press, 1981, 13–78).

Other references include William Balée's *Footprints of the Forest*, which interprets the culture and the environment of the Ka'apor, a forest-dwelling tribe of Eastern Amazonia in Brazil (1994; New York: Columbia University Press, 310–332); John H. Bodley's 1978 *Preliminary Ethnobotany of the Peruvian Amazon: Reports Investigation No. 55* (Pullman, Washington: Laboratory of Anthropology, Washington State University, 27–33); Beatrice H. Krauss' amply illustrated introduction to farming and fishing cultures titled *Plants in Hawaiian Culture* (1993; Honolulu, Hawaii: University of Hawaii Press, 1–123); Bernard W. Riley and David Brokensha's *The Mbeere in Kenya*, a study of the relationships between a society and its natural resource base at a time of rapid change and expanding population (1988; Lanham, Maryland: University Press of America, Inc., 77–190); and Robert J. Rodin's

Ethnobotany of the Kwanyama Ovambos, a tribe from the northern edge of Namibia (formerly South West Africa; 1985; Monograph in Systematic Botany from the Missouri Botanical Garden, Lawrence, Kansas: Allen Press Inc, 23–43).

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