ASSESSING THE POTENTIAL PLAY VALUE OF VEGETATION IN THE OUTDOOR ENVIRONMENTS OF NAEYC-ACCREDITED PRESCHOOL PROGRAMS IN TUCSON, ARIZONA

By

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DEDICATION

This research is affectionately dedicated to the memory of my mother-in-law, Joan Darnell, who shared her boundless love of life and the desert with everyone, especially her granddaughters.

TABLE OF CONTENTS

TABLE OF CONTENTS – Continued

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Vegetation has the potential to support all domains of early childhood development when carefully selected, yet it is infrequently used as a deliberate learning element in outdoor play environments for young children. The purpose of this study was to measure vegetation value in the context of developmentally appropriate early childhood education by assessing existing vegetation and interviewing educators at thirteen nationally accredited preschools in Tucson, Arizona. Results indicated low vegetation density and diversity compared to presence and quality of built elements, both indoors and out. While potential of existing vegetation was high, many educators reported few values of vegetation and rarely regarded it as a tool in their stated environmental curriculum. Furthermore, the values of structure for climbing and refuge for dramatic play appeared infrequently despite their importance in cited literature.

INTRODUCTION

The significance of and inspiration for this study comes primarily from anecdotal observations and conversations with early childhood educators and young children, including my own. My 4-year-old daughter attends a preschool in Tucson, Arizona whose mission statement includes outdoor play and their play areas are full of a variety of vegetation including many native species. There are large stands of creosote (*Larrea tridentata)* which were saved at the school's inception over 50 years ago and are fondly referred to as "the jungle". One day, I accompanied the director on a tour of the school given to a Master Gardener who was searching for sites for their annual school garden tour. I pointed out the significance of the creosote and its multiple play attributes as a native plant whose scent, especially after a rain, is considered the scent of Tucson and how I had observed children intently collecting its fuzzy "seedballs" in a wheelbarrow. I also mentioned how its size and loose form allows children to hide within it while still being visible to teachers. Later, the director admitted that she had not previously considered the value of the creosote's specific qualities.

In observations at other schools, I have seen first hand the spontaneous and intrinsic attraction to plants by children. At one school, I was visiting after hours, but a child had not been picked up yet and tagged along on the tour. The school's vegetation consisted of 2 trees, one a large African sumac (*Rhus lancea*) growing in a small planting space. The child was very quiet and refused to respond to any of the teacher's questions or urgings to tell me her name and age. But as we approached the African sumac, she

cried out excitedly "Look! There are flowers popping up down here!" Indeed, there were several small "volunteers" at the base of the tree, which the teacher sensitively pointed out were not in fact flowers, but were sprouts of the African sumac. The fact that the only verbal comment made by this child was a spontaneous, almost uncontrollable discovery about a plant is very significant. The "popping up" plant was a surprise, a magical occurrence, worthy of bringing to our attention.

At a separate school, also quite sparsely planted, there was a pyracantha (*Pyracantha sp.*) that was pruned, probably accidentally, to form a perfect, child-scaled hiding place. While I was photographing it, a child rode inside its shade on his scooter, panting from the heat. Another boy followed suit and they proceeded to have an imaginative conversation about hearing a cricket going "crick, crick" and the cricket then turning into a butterfly. The teacher excitedly wrote down their conversation to include in their daily journal. The teachers commented on how much children loved this space, but how it made them uncomfortable because the pyracantha is thorny and too dense for them to see through. In a later visit to that school, I was disappointed to see that it had been pruned so that it no longer had that "refuge-like" form and after a state licensing inspection, it was removed entirely.

Finally, an observation close to home. There is a pomegranate tree in our front yard that also forms a wonderful refuge space for my children. One of my daughter's first writing experiences was a picture of this tree accompanied by the letters "Í L C P E N E N M I P A G R E T T H E A T E Z F T P W F E T B C E T E Z S C T". This sample of "kid spelling" translates to read "I like playing in my pomegranate tree. It is

fun to play with it because it is secret". So much is said in these 2 simple sentences. First, that she "plays in and with it", it is both setting and material. Second, that she has taken possession of the tree ("my tree") and has attributed secret, almost magical characteristics to being inside it, and finally, that it was important enough for her to want to write about.

Study Questions and Hypotheses

The examples above suggest that children have a unique and intrinsic attraction to the natural element of vegetation and that adults, even those who work with young children every day, may not be fully aware of how vegetation can be valuable in their play environments. The purpose of the study was to measure the value of vegetation in the context of play-based, developmentally appropriate early childhood outdoor learning environments. This was accomplished by assessing the potential play value (PPV) of existing vegetation based on characteristics noted in the literature and the perceived vegetation value or "visibility" by lead teachers or directors at 13 study sites. The following questions were addressed in the study:

1) What are the potential play values of vegetation, that is the qualities of vegetation that directly support the development of young children?
2) To what degree is vegetation being provided for young children in their outdoor learning environments?
3) To what degree do early childhood educators "see" or value vegetation in the context of early childhood education.

Data was collected to address these questions and hypotheses were:

1) The density and richness of vegetation in terms of species, growth structure and potential play value diversity will be generally low, even in schools that are considered to be "high quality"
2) Educators from the study sites will not be fully aware of the potential of vegetation in the context of early childhood development.
3) Educators at sites where there is more vegetation will appear to value it more based on interview responses.

In addition, the study revealed other information related to the integration of vegetation into early childhood play environments that might be useful in providing recommendations to educators and designers and suggesting related topics for further research.

Study Scope

The potential benefits offered by vegetation for young children were explored through the existing relevant literature. The literature also served as a theoretical framework for developing a Potential Play Value (PVV) of Vegetation index. This index was used to assess the vegetation in early childhood outdoor environments and determine whether or not it was being provided and what its potential play value was. In addition, directors or lead teachers at evaluated sites were interviewed to gain information about their perceptions of vegetation value to young children and the methods used to teach children about plants, nature and the environment. Indicators for "visibility" of

vegetation were determined through content analysis of interview responses and other aspects of the existing vegetation that suggested it was being valued. The study evaluated other elements of the early childhood outdoor environment, such as the presence or absence of outdoor cultivated gardens, lawn, and other natural and built elements, only in relation to the permanent vegetation. The study did not use focused observation of children in these environments, but spontaneously observed or reported interactions between children and vegetation were noted and included in the site narratives. Evaluated sites consisted only of NAEYC (National Association for the Education of Young Children)-accredited program sites serving children ages 3-5 in Tucson, Arizona. Accreditation is a rigorous process and accredited programs are considered to be of highest quality, have minimum requirements for physical space and are presumed to have a consistent constructivist, play-based educational philosophy in the areas of curriculum and teacher-child interactions. Interviews were conducted with the lead teacher or director of each site only. Site selection relied on voluntary participation.

REVIEW OF THE LITERATURE

Introduction

The value of vegetation to young children is difficult to measure empirically and making the need to provide it is equally difficult to justify. However, recent studies do provide ample evidence of vegetation value to adults, particularly in the area of therapeutic site design, and indicate vegetation as the single-most environmental factor contributing to health and restoration in the design of healing environments (Kirk 2002; Ulrich in Relf (Ed)1992). The unique settings and materials provided by plants persist as the dominating elements in adult memories of nature and childhood (Francis, 1995; Sebba, 1991; Schneekloth, 1989). Research has also indicated that early, direct experiences with nature, and specifically with vegetation appear to contribute to the development of an environmental ethic later in life (Kellert, 2001; Tanner in Chawla, 1998; Harvey, 1989).

Relevant research regarding vegetation value specifically for young children is scant, but one study comparing the play of children ages 18 months to 3 years before and after the implementation of a vegetation-rich design indicated greater variation and locomotion in play behavior (Herrington, 1996). Robin Moore's extensive anecdotal studies of children playing with and in vegetation offer plentiful examples of children's attraction to vegetation (Moore and Wong, 1997). Part of this attraction may be due to evidence that children see vegetation differently than adults (Olwig, 1989; Eberbach in Relf (Ed), 1992).

The positive association between vegetation value and early childhood education is neither random nor new. The first early childhood educators recognized the natural environment and vegetation, both natural and cultivated, as central to the intellectual, physical and moral development of children (Wellhausen, 2002; Herrington, 2001; Rousseau, 1979). Current trends toward developmentally appropriate early childhood education stress both the importance of play and the need for a sensory rich environment in which play involves all domains of development (DeVries, 2002; Olds 2001, Bredekamp and Copple, 1997). Amidst seemingly overwhelming evidence of the potential benefits of vegetation for children, a handful of designers and educators have advocated ways to increase vegetation richness in the play environments of children despite increasing predominance of generic, built structures and non-natural materials (Moore, 2002; Olds 2001, Francis C., 1998, Herrington, 1997; Stine, 1997; Francis M.,1995).

However, thoughtful planting design in outdoor play environments is rarely prioritized in the care and education of young children, a field that frequently suffers from severe lack of resources. Furthermore, a phenomenon described as "the invisibility of vegetation" often pervades adult thinking in which the value of vegetation is not "seen" and it is relegated to the background, regardless of the fact that we could not live without it (Schneekcloth,1989). As a result, vegetation is, at best, randomly selected and placed in these environments of play and learning and at worst, non-existent. This is particularly disturbing given the fact that a child who enters daycare as an infant may spend as many as 12,000 hours in these settings before reaching school age (Isbell and

Exelby, 2001). One way of giving vegetation "foreground" status, making it visible within the context of early childhood education is to quantify its value by isolating vegetation and the physical characteristics that make it valuable in a developmentally appropriate play environment and developing criteria for assessing vegetation in early childhood outdoor environments. This would involve first defining the major goals of a developmentally appropriate early childhood program and showing how vegetation in and of itself can support them. In his excellent plant selection guide, *Plants for Play*, Robin Moore has defined many criteria of plant species that make it particularly valuable for children's play. He recommends starting with these selection criteria to develop regionally appropriate species lists and using them to "evaluate existing plantings in children's outdoor spaces, to select additional species, and to develop new designs that will provide a complete palette of plants to support children's play experiences." (Moore, 2002)

This literature review discusses the researched benefits that vegetation offers to both adults and children, the evolving role of nature and vegetation in early childhood education and some recent trends in the design of outdoor play environments for children that use vegetation as a significant element. Finally, the specific qualities of vegetation that both contribute to early childhood development and limit vegetation use are examined. In essence, the literature review provides justification for a method of assessing the current state of vegetation in existing early childhood outdoor environments so that design and planting recommendations can be thoughtfully made. However, the greatest value of such an assessment may come from merely drawing attention to the

importance of vegetation in early childhood play environments, allowing the adults who ultimately make decisions about these environments to begin to "see" and prioritize it.

The Value of Vegetation to Adults

Before discussing the potential value of vegetation for children, it is useful to look at the body of research that has focused on its value to adults. Plants are obviously significant to humans in numerous ways. They are a food source and a source of life-supporting oxygen. They are featured in our most important rituals, our celebrations and deaths. A National Symposium on The Role of Horticulture in Human Well-Being and Social Development was held in 1990 where speakers such as Stephen and Rachel Kaplan, Roger Ulrich and many other leading authorities presented research findings on the beneficial effects of nature and plants on humans (Relf (Ed.), 1992). Perhaps one of the most highly regarded values that has drawn the attention of the design and medical communities is the potential for passive experiences with plants to assist in the restoration of health, both physical and mental. (Ulrich and Parsons in Relf (Ed), 1992) In a study applying therapeutic design criteria to urban spaces, it was concluded that "the most restorative effect may be an increase in the percentage of plantings and a decrease in hardscape cover" (Kirk, 2002, pp. 72-73).

Another area of research regarding potential vegetation benefits for humans is the study of adult memories of childhood. Rachel Sebba (1991) asked adults to record their positive childhood memories through either writing or sketches. Ninety-seven percent of the sketches and eighty-four percent of the written descriptions contained elements of

nature and many of the favored activities reported involved vegetation, such as peeling tree bark, standing barefoot on leaves and climbing trees. Most significant was the finding that adults, when recalling their childhood, describe it in terms of their perceptual experience, and that these experiences tend to occur between the ages of 3 and 7. Sebba noted several unique qualities of the natural environments that may be responsible for its ability to elicit these memories, such as the "the continual change of stimuli that are spread out over a relatively long range" and the instability, compared to the built environment, "which requires alertness and attention." (Sebba 1991, p. 411)

A similar study of adult memories was conducted by Lynda Schneekcloth (1989) in which she asked educators and design students to draw a picture of an experience, place or activity that was important in forming their relationship with nature. Vegetation was represented in eighty-four percent of the drawings, with seventy-four percent using vegetation as the main focus. Mark Francis (1995) interviewed adults in California and Norway about their childhood memories of gardens in an effort to find common elements that could then be used in the design of good gardens for children. Through content analysis of the stories, Francis discovered that the most important preferred element in people's "ideal garden" was the vegetation and that many people actually remembered specific plants. Plants used as shelters and hiding places, edible plants and playing with plant parts, such as "using flowers as people" were all mentioned frequently. Furthermore, memories of "gardens" were not limited to the cultivated garden but included wild, natural areas and vacant lots. No matter what the setting, plants were always central to the memory of the experience.

Regardless of the powerful written accounts of vegetation value to adults, there exists a phenomenon of "invisibility of vegetation" discussed by Lynda Schneekloth in her article entitled "Where Did You Go? The Forest? What Did You See? Nothing." The topic is initiated during a dinner discussion with adult friends after their trip into a Costa Rican rainforest in which they claimed to see nothing. What they were referring to, of course, was the lack of animal life, which they considered to be "something", but the lush and diverse vegetation was perceived to be "invisible" (Schneekloth 1989). Schneekloth believes that one of the primary reasons for the "invisibility of vegetation " is that we no longer connect it directly to our daily lives. "The role of plants as a basis for the food chain and our ultimate life sustainer is invisible" (Schneekloth 1989, p.15). Vegetation holds a "background" position and the only way to move it to the foreground and make it visible is to make it important and necessary. Furthermore, we have vast scientific knowledge of plants but lack the ability to "incorporate what we *know* into what we *experience*". Increasing anthropocentrism and disconnectedness with the non-human world also plays a role in invisibility. Schneekloth strongly encourages that we overcome this phenomenon with respect to the attitudes toward vegetation that we pass on to our children

The Value of Vegetation to Children

Research evaluating the benefits of vegetation for children is scant compared to work cited involving adults (Moore, 2001). However, several studies have found significant differences in the ways that adults and children see nature and vegetation.

The memory research previously cited indicates that vegetation is visible and prominent in adult memories of childhood, suggesting that humans do in fact see vegetation differently as children. Edith Cobb described nature for the child as "a passionate response" and "sheer sensory experience" (Cobb, 1977). According to Kenneth Olwig, who looked at differences in conceptions of nature in the texts of adult planners and school-age children in Denmark, the children tended to view nature in terms of "potentiality" and "nature is identified with activity, often play, with seasonal change, and as something which expresses social development"(Olwig 1989, p. 21). The adult planners of a Danish housing development, on the other hand, appeared to verbally recognize the importance of nature in the preface to their planning documents, but eliminated it in the discussion or body of text and thus, in the actual constructed environment (Olwig, 1989).

It appears that nature is more concrete or "visible" to children than to adults, primarily due to the conception of it and its elements as representing "potential" for play. Catherine Eberbach (1990) reached a similar conclusion more specific to the element of vegetation. She discovered through an analysis of children's drawings of gardens that children understand a garden to be a plant-dominated environment and also define gardens in terms of activity or what they can do in them. This coincides with the memory research previously cited by Sebba (1991) and Francis (1995) in which adult memories of vegetation from their childhood often involved activity or potentiality. Stephen Kellert contends that children are so intrinsically attracted to nature because it is "qualitatively different from anything the child confronts in the human-built world, no matter how well

simulated, technologically sophisticated, or "virtual" these manufactured representations may be." (Kellert 2002, p.138) Natural things (vegetation, water, rocks, wildlife) are diverse, unique and timeless and children seem to recognize this immediately (Rivkin, 1995).

While acknowledging that children are indeed attracted to nature and the vegetation found within in a way that is unique to them, is it possible to conclusively say that they benefit from experiences with it? This has been a topic of great interest and concern for adults in the fields of education, natural science, social science and landscape architecture over the last two decades. One study compared children who played in a playground with little vegetation diversity with children who played in one containing a field and orchard. Results suggested that the children in the latter environment had fewer days absent from school due to sickness, better motor skills and fewer ADD (Attention Deficit Disorder) behaviors (Grahn, 1997). Naturalist Stephen Trimble contends that experiences with natural elements often involve collecting precious natural objects, allowing children to gain self esteem through the power of discovery and temporary acquisition while understanding the importance of returning the acquired objects to where they were found and the knowledge that they might be discovered again (Trimble, 1997).

In terms of educative value, experiences with nature can be divided into 3 categories; direct, indirect and vicarious. Direct experience involves interacting spontaneously in a natural environment with the elements of nature. Indirect experience occurs in a more controlled environment, such as a zoo or botanical garden, and vicarious experience is that gained through other media such as television, books or the internet

(Kellert, 2002). Kellert and others have found that a variety of direct and various experiences with nature and specifically with vegetation does indeed lead to a greater sense of personal concern for the environment (Tanner in Chawla,1998; Kellert, 2002; Wilson, 1997) and that increased indirect or vicarious experiences "has little effect on developmental impacts" (Kellert, 2002).

Understanding that children see nature and vegetation differently and in many respects, more lucidly, and that their interactions with it are beneficial to them and instrumental in the formation of an environmental ethic makes it imperative that they be given opportunities to experience it. There is growing concern that children's opportunities for direct experiences with nature are shrinking and that the consequences to their development as well as to the environment could be devastating (Wilson, 1997; Moore, 1997; Kellert, 2001). Though it is believed that humans have an innate love of the natural world or "biophilia" (Wilson, E.O., 1984), there is evidence that biophilia can be replaced by biophobia, or a *fear* of nature. This has been investigated through studies involving children raised in urban environments without sufficient experiences with the natural world. Results indicate actual discomfort by these children in natural places as well as a tendency to regard nature merely as a resource to be exploited (Wilson R., 1997). Biophobia in adults can also lead to the aforementioned phenomenon of invisibility and a catch-22 situation whereby adults respond to children's naturalist intelligence in ways that are discouraging, negative and intellectually incongruent with the child's largely perceptual experience. An example of this would be an adult responding to a child's curiosity about ants crawling in the window by immediately

exterminating them (Hyun, 2001). Furthermore, diminishing contact with nature can result in the extinction of the experiences that can fuel human creativity and imagination provided only by the natural world. This not only influences the lives and future career choices of children, but can lead to stunted emotional and moral growth (Pyle, 2002).

Few examples of an adult attempt to reverse this situation of diminishing contact with nature exist. In Ruth Wilson's (1996) search for early childhood environmental education programs, she was only able to locate twelve out of a pool of thousands and many of them taught through indirect or vicarious experiences only. Furthermore, all the programs were tuition-based and served primarily upper middle class children. Robin Moore points to a disturbing lack of attention or even mention of children in the discussion of current environmental issues. This is especially apparent in the omission of children from most new texts on the subjects of new urbanism and ecological design in which discussions of sustainable living environments seem not to consider children as inhabitants (Moore, 1997). Moore is perhaps the most vocal proponent of reestablishing the link between nature and young people and calls for immediate action to "plan and design appropriate settings for children of all ages where they can interact safely with natural materials and phenomena." (Moore, 2001, p.213) He recommends focusing on the environments where children are legally required to spend many hours a day, that is , formal education environments. Preeminent naturalist and co-author of *The Geography of Childhood: Why Children Need Wild Places*, Gary Paul Nabhan, corroborates:

> "To counter the historic trend toward the loss of wildness where children play, it is clear that we need to find ways to let children

> roam beyond the pavement, to gain access to vegetation and earth that allow them to tunnel, climb, or even fall. And because formal playgrounds are the only outdoors that many children experience anymore, shouldn't we be paying more attention to planting, and less to building on them? (Nabhan, 1994, p.9)

The Evolving Role of Nature and Vegetation in Early Childhood Education

Using children's unique way of seeing nature and vegetation as a powerful tool in their education is not a new concept and actually goes back to the very inception of early childhood education as a discipline. Nineteenth century philosopher and social theorist, Jean Jacques Rousseau first introduced the idea that childhood was a separate developmental stage of life. Prior to that, children were thought of as "little adults" often required to participate in the harsh realities of adult life and work (Wellhousen, 2002). In his novel *Emile*, Rousseau hypothetically illustrates the ideal education through the story of a boy and his tutor. He distinguishes the time between birth and age 5 as "infancy" or the "age of nature" a time when education is to be confined to "fostering the development of the faculties immediately associated with (the child's) preservation. His desire for the pleasant and avoidance of the painful are given by nature. His senses are the natural means to those ends." (Bloom in Rousseau, 1979 p. 9) The boy, Emile, is encouraged to explore nature with the intention of sharpening his senses and allowing him to develop intellectual concepts through his own discovery.

Rousseau's controversial ideas interested Swiss educator, Johann Heinrich Pestolozzi who is credited with establishing early childhood education as a distinct discipline. Pestolozzi attempted to implement Rousseau's theory while tutoring two young boys by allowing them to freely explore the natural world, but found the method insufficient in actual practice. As a result, he introduced the "object lesson" , perhaps a predecessor of modern day theme-based education, in which an object, usually from nature, was chosen for a more focused version of pure sensory exploration (Wellhousen, 2002). However, he continued to encourage students to take nature walks for direct experience and observation and to learn the names of plants and animals. He also engaged students in gardening activities to better understand the source of their sustenance.

Perhaps most influential in the creation of what was to continue as a tradition in educating young children was Freidrich Froebel. Froebel visited Pestolozzi's school with 3 students in 1808 and became deeply interested in his educational theories. However, he felt they were lacking in a central theme or philosophy. An avid gardener and nature lover throughout his own childhood, Froebel coined the term "kindergarten". He believed in "the transcendental qualities he found latent in plant life and the potential for the garden to symbolize children's growth and their placement within social relations" (Herrington, 2001). Froebel engaged the children in both gardening activities and nature excursions, in which teachers were encouraged to help the children link their sensory experiences with the inherent symbolism of harmony and unity (Herrington, 2001).

Followers, mostly women, began to study his methods and open schools elsewhere in Europe.

Eventually Froebel's Kindergartens came to America, but by the late 19th century, emerging rational thought left little room for the mysticism so central to Froebel's original educational philosophy. The garden became a means of training young children for agricultural labor and the excess produce, which Froebel's students had always given to the poor, was sold for profit. The garden and landscape no longer served as a setting for exploration, discovery and contemplation, and eventually, gardening activity was cut entirely from the early childhood curriculum (Herrington, 2001).

During the early 20th century, American progressive educators John Dewey and Patty Hill Smith upheld the tradition of the child-centered approach initiated by Rousseau, but used the outdoor environment more as an arena for physical development with construction apparatus and scientific knowledge replacing Froebel's nature and symbolism (Wellhousen, 2002). Various forms of playgrounds and "playground movements" occurred in the second half of the 20th century, such as the adventure playgrounds popularized in Europe and the designed playgrounds of the 1960s and 70s. However, these playgrounds consisted primarily of built forms and the elements of nature, vegetation and gardening that were so central to the early educational philosophies, were all but eliminated.

Current philosophies about early childhood education extend the ideas of the progressive educators and have been more clearly defined in the last two decades through the establishment of the National Association of Education for Young Children

(NAEYC). This organization was created in an attempt to standardize "high quality education" based on Developmentally Appropriate Practice (DAP). DAP follows the theories of Jean Piaget, the leading authority on child development, suggesting that young children learn by constructing knowledge through their self-initiated activities (Bredekamp and Copple, 1997). Activities involving use of all the senses are required to develop the "whole child", that is, the physical, socio-emotional and cognitive domains of development. While this is an oversimplification of both Piaget's work as well as the goals for developmentally appropriate practice, the emphasis is on child-initiated, not teacher directed, play and investigation (DeVries, 2002).

The topic of play and its significance in early childhood education has raised tremendous debate as the very word brings with it connotations that often conflict with adult goals of education. Play has been viewed as "aimless", "irrational", "a nuisance", "entertainment" and contradictory to our Puritan work ethic (DeVries, 2002). Educators and advocates of developmentally appropriate practice have attempted to clarify the definition of play to legitimize its place in the education continuum. Fromberg describes the play of young children as "a kind of lymphatic process or lubricating oil for constructing meaning" (Fromberg, 2002, p.8). In other words, the function of learning for young children is dependent on play. Play is the medium by which relationships are drawn, questions are formed and knowledge unfolds. The sensory act of touching a leaf is not, by itself, educative, but the process of comparing it to something else represents the process of constructing knowledge. Play is simultaneously voluntary, symbolic, meaningful, rule-governed, pleasurable, episodic, and continually changing (Fromberg,

2002). A succinct interpretation of a developmentally appropriate program is one in which "play and work are integrated with social, emotional, moral and intellectual development and materials and play activities are abundant and challenging (DeVries, 2002).

However, this does not undermine the role of the teacher, who becomes more of a designer and facilitator, sensitively "scaffolding" or extending play through documentation and appropriate responses to children's inquiries. The teacher is also responsible for manipulating the environment of play , which includes "the space in which the play occurs and the materials present" (Frost in Saracho et. al.,1998 p. 255) Various sources have outlined the requirements for a quality early childhood learning environment as it differs greatly from a typical classroom setting of desks and chalkboard. An environment of play in a developmentally appropriate program must support the developmental domains as well as the environmental needs of the child which include encouraging movement, supporting comfort, fostering competence and encouraging a sense of control (Olds, 2001).

While the sensory qualities of an environment designed for play seem to be the most potent in terms of remaining in the memory into adulthood, Olds (2001) cautions against too much stimulation and recommends "difference-within-sameness", a balance of elements of sensory variety within a stable whole. She explains that "nature best exemplifies this difference-within-sameness concept, providing us with some of our most comforting experiences – wafting breezes, babbling brooks, sunlight dancing on leaves. The sense of calm we experience in a beautiful natural setting is perhaps due to nature's

capacity to establish rhythmic patterns of change akin to our own physiological rhythms." (Olds, 2001, p.10). Olds' research on favorite childhood places describes several common features, including a relationship to nature, sensorial richness, and privacy and control of intrusion. Congruent with the memory research previously cited, a predominant number of favorite places involve large trees with particular features, such as gnarled branches (Olds, 2001).

Interestingly, in many texts on early learning environments, the emphasis is on the indoor environment, yet advice to improve these environments often includes bringing nature indoors to "soften " hard surfaces and corners and extend nature study. Growing indoor plants is encouraged, given that they are kept alive, and natural objects arranged on a science table or used in a craft are standard (Isbell and Exelby, 2001). While bringing nature indoors is a common and very appropriate activity, it is important to use indoor nature areas as a supplement and not a replacement for experiences in the natural world (Olds, 2001). It is also recommended in developmentally appropriate practice that the curriculum indoors be extended outdoors whenever possible and that the outdoor area not simply be regarded as a space for gross physical activity. (Bredekamp and Copple, 1997)

Vegetation Value in The Outdoor Play Environment

Since the outdoor environments of early childhood programs are of primary consideration in this study, it is useful to look at the current trends in the design of outdoor play environments in the same light as indoor environments. Many designers and

educators have tried to escape from the "playground paradigm" (White and Stoecklin, 1998) of sterile vacuous spaces with fixed metal structures cemented into the ground for the purpose of gross motor development, a paradigm that has persisted since the turn of the 20th century. Yet, while the schoolyard habitat movement of the last decade has encouraged the greening and re-vegetation of elementary school grounds, little has been done to improve early childhood outdoor environments through the addition of carefully selected and placed vegetation. Instead, the role of the landscape in play has been limited to " the ground, the neutral setting where play is located....separated from the landscape both physically and aesthetically" (Herrington, 1997, p149).

Manufactured playground structures, usually "all-in-one" pieces of equipment made of a metal or plastic material, have become so prevalent in environments of play for several reasons including perceived ease of maintenance and safety. Many are well-made and can provide variations of mostly gross motor play. However, these structures, when standing alone in a sea of asphalt or concrete as they often do, provide few of the criteria for a quality outdoor environment and tend to support only a limited number of activities (Stine,1997). Their sensory value, though often touted in the sales catalogs, is limited to the smells and textures provided by synthetic materials and bright primary colors assumed to be preferred by children.

Furthermore, when an all-in-one structure is the only piece of equipment and dominates the entire play space, it can result in conflicts between children using it and the space around it to suit their varying developmental needs. For example, the physical play children may be constantly colliding with the dramatic play children and the child

seeking solitude is really at a disadvantage (Francis C., 1998). While acknowledging some of the advantages of these ubiquitous symbols of childhood, they should not alone constitute the meaning of play. Collaboration between landscape architects and early childhood specialists is necessary to create environments of play that are complex and diverse enough for children to experience on all levels of development (Herrington, 1997).

The issue of complexity is important when considering the potential value of vegetation in a play environment. The theory of complexity of play parts developed by Kritchevsky and Prescott (1977) categorizes play settings as *simple*, *complex* or *super complex* according to the number of children the activities of the setting can accommodate at one time. For example, a swing is considered *simple* and can accommodate only one child at once, while a sand area with toys and water is considered *super complex*, with the potential to accommodate 8 or more children, depending on the number and types of loose parts available. The theory of "loose parts" suggests that children prefer and can benefit more when loose, manipulative parts are made available, such as riding toys, sand toys, climbing structures that can be reconfigured, and plant parts, "the original loose parts" (Rivkin, 1995) A tree that can be climbed by several children at once and provides pods that can be used to make pretend "soup" below is super complex in itself. Vegetation almost always adds complexity to an existing play setting.

While theory is attractive, actual case studies offer more tangible evidence of the value of vegetation in outdoor play settings. Robin Moore completely renovated an

elementary school yard in Berkeley, California from a primarily asphalt covered space to an "environmental play yard" replete with wetlands and vegetation of all types. He studied, observed and interviewed children in this setting and discovered that the opportunities for all types of play increased dramatically (Moore and Wong, 1997). His observations especially give strong anecdotal support to the intrinsic attraction these school-aged children have for vegetation.

A similar project, The Infant Garden at the University of California, Davis, was designed for children between the ages of 18 months and 3 years of age. The Infant Garden had several design goals, including the use of sculpted terrain, plant textures and plant composition, the use of materials and forms that reflect the regional landscape and the creation of a landscape that would support all the domains of development (Herrington,1997). This design was significant in that it created a laboratory setting that could be used to study children's behavior and make comparisons in the children's play before and after installation. Some results included more varied and complex manipulations, differences in types and location of play (more locomotion and less sitting), more associative play with adult students and more play with natural objects. Plants play a significant role in this design which includes very few built forms. A pine circle acts as a semi-enclosed gathering space replete with fallen pine cones to manipulate and play with and a maze of low hedges of five different plant species allows contact with a variety of textures, fragrances and colors, all at a small child's scale. The design of the Infant Garden emphasizes thoughtful choice of materials, especially plants, to maximize their play value and potential to support children's development. It also

represents a play environment in which the *landscape* prevails and not the equipment placed upon it.

Characteristics of Vegetation that Support Early Childhood Development

Obviously, a great deal of evidence exists supporting the integration of vegetation into the outdoor learning environments of young children. The following sections cite studies that support more specifically how certain plant characteristics contribute to the goals of an early childhood program within the developmental domains of *sensory richness*, *socio-emotional development*, *physical development* and *cognitive or intellectual development*. These characteristics or potential play values (PPV) are later organized into a list of criteria to be used for assessing vegetation at existing early childhood outdoor environments. The potential play values of vegetation can directly and indirectly support the goals of a developmentally appropriate preschool program and provide the experience of nature for children that is fast on its way to extinction.

Sensory richness

Perhaps the most salient quality of a good early childhood learning environment is that of sensory richness. Knowledge begins in sensory experience (Cobb, 1977), and the literature clearly expresses the uniqueness of natural elements in terms of their sensory qualities as the primary reason that nature is so attractive to children and so prominent in their adult memories. "The senses of smell, touch, taste, as well as the sense of motion through space, are powerful modes of learning. Imagine holding a sage leaf, how simultaneously soft and leathery, how pungent a smell, how easily ripped. By contrast,

looking at a picture of a small greyish leaf reveals little. And since little is revealed, little is perceived." (Rivkin, 1995, p.7) Furthermore, the sensory experience of the environment overlaps with all opportunities for development and sensory cues can guide movement, especially for children with disabilities. (Moore, 1992) It follows that the vegetation in an early childhood outdoor environment should be selected to stimulate the senses with color in flower and foliage, texture, fragrance, and edible parts all at a height in which a young child can access them. Plants can be chosen that create sound either through the wind in their leaves or the potential of their parts to be used in making musical instruments. Physical comfort, which is also a strong component of socio-emotional development, can be supported by plants that provide shade or act as wind breaks. Aesthetic enjoyment or beauty, though subject to numerous interpretations, is generally found in the passive visual experience of all plants that are maintained and alive.

Socio-emotional development

As stated earlier, the mere presence of vegetation can contribute to the socio-emotional health of adults and presumably children as well. For young children, socio-emotional development involves successful acquisition of language and social skills. These come mainly through the medium of symbolic play and more advanced communication skills lead to socio-dramatic play in which children "practice" the social skills required by society without fear of failure or retribution. Outdoors, dramatic play expands with greater physical parameters and voice range and can be facilitated by both the setting in which it occurs and the available materials for manipulation. The plasticity

of the setting and materials, or the potential for it to be changed, is also important (Kirkby, 1984; Cobb, 1977; Nicholson 1971). Mary Ann Kirkby found that young children tend to prefer refuge settings for their dramatic play, that is, child-scale spaces which they perceive to be enclosed with "walls" and a "ceiling". Her study also suggested that vegetative refuge spaces were preferred over built ones. The type and diversity of dramatic play was greater in vegetative refuges, often due to the presence of associated plant materials which could be used as play parts (Kirkby, 1984). Plant parts used in play has been studied extensively by Robin Moore, who has meticulously observed children in the Environmental Play Yard and other play spaces and recorded their comments regarding their affinity for plant parts and the plasticity and variety of interpretations they invite (Moore and Wong, 1997).

The arrangement of plants can contribute to socio-emotional development in other ways. Large or distinctive plants placed in the center of a play space can serve as landmarks providing clear visual identity and increasing a sense of emotional comfort and control for children. While this is particularly important for children with visual or auditory disabilities, Moore points out that the full definition of accessibility includes psychological accessibility. (Moore, 1992) Vegetation can also be used to form enclosed areas inviting smaller group play and providing a sense of protection from the larger open space.

Physical development

Both large and small motor development can be supported by vegetation. Climbing trees is a favored activity of childhood for every generation and differs

dramatically from climbing built structures in the texture provided by the tree's bark, the variations of light and air felt through its leaves, and the flexibility of its branches underfoot. However, tree climbing has come under great scrutiny in recent years due to the perception of danger and fear of litigation and it is possible that contemporary children may never experience the joy and challenge of climbing a tree during their childhood. (Moore, 1992) One way to mitigate the fears of adults is to provide resilient surfacing below climbing trees, similar to that required below other climbing structures. Furthermore, it is important not to confuse risks with hazards and a certain amount of risk in children's play is necessary for their development (Cooper-Marcus, C., 2001). "Safe" climbing trees can provide graduated elements of challenge for young children , allowing them to take risks in relatively controlled and supervised environments. Trees can also serve as supports for swings if they are mature and their branches are sufficiently strong. Trees with horizontal branches may also be used by children in the same manner as "monkey bars" for hanging and swinging from, both important large motor activities.

Fine motor development is supported by plants primarily through the manipulation of plant parts. Leaves, pods, berries, seeds, flowers and cones make excellent and plentiful play parts for dramatic play or materials for crafts and collages. Removing the seeds from seed pods is an activity that requires both fine motor skills and intense concentration. As unstructured playthings, plant parts engage children in more imaginative and collaborative play than realistic playthings (Fromberg, 2002). It is important, however, for adults to discuss with children the difference between using plant parts that have fallen or that are easily and quickly replaced and destroying the plant by

tearing off its parts,. However, adults must be careful not to send the message that plants are not for touching. Touching and manipulating plants is the most effective way for children to learn from them.

Cognitive or intellectual development

Criteria that stimulate cognitive development include characteristics of plants that create situations of interest and opportunities for further intellectual investigation. One simple example involves the use of plant parts such as leaves and pods as abundant and inexpensive objects to sort, classify and count, all activities that are standard for teaching pre-math and science concepts. However, criteria in the area of cognitive development is somewhat subjective since we can only surmise that certain vegetation characteristics or settings can directly stimulate the acquisition of knowledge or facts. Often, the effectiveness of these criteria is relative to the degree that accompanying adults draw children's attention to them and facilitate the investigation. One such characteristic is that of seasonal changes and the sensory signals of different times of the year, such as changing leaf color or falling leaves. Most deciduous and blooming plants have the potential to signal seasonal changes, although some plants do so more dramatically. Others may require an adult comment or simple question such as "Do you notice anything different about that tree today?"

Another characteristic is a plant's ability to attract wildlife and facilitate investigation of animal species. Native plants are often the most effective for this and plants chosen specifically for their ability to attract safe species, such as birds and butterflies, can elicit conversations and "study" of those species. Plants that are very

distinctive of a region can provide the sense of "place" that is often mentioned as a quality important in all designed environments and distinguishes them from generically designed environments that give no clues as to where you are in the world (Moore, 2002; Herrington, 1997). For instance, in an arid region, drought-tolerant plants can be used to demonstrate the importance of water conservation to children as well as the adaptations of plants that make them require less water, such as small leaves or leaf drop (Moore, 2002). For children, the presence of native vegetation can create memories that are specific to that place and connected to the larger area from an ecological standpoint, a factor that may be very important in their future affection for the region and sense of stewardship (Moore, 2002).

Characteristics of Vegetation that Limit Use

Potential value of vegetation can be offset by negative plant characteristics that may harm children, cause significant problems for the adults responsible for managing the environment or simply be a result of the vegetation not being planted or maintained intentionally for the benefit of children. Obviously, vegetation that is toxic or dangerously thorny should be avoided. The safety of plant use in an early childhood environment also involves the form and size of the plant and the type of barrier it potentially creates. Plants with semi-transparent forms allow partial visibility so that a child playing in or behind it can still be seen by the supervising adult. Denser plants can be pruned for greater visibility, requiring more maintenance.

Maintenance is a significant issue when discussing the integration of plants into play areas. While certain plants can be selected for low maintenance and water use, all plants require regular maintenance in order to provide the desired functions and the presence of poorly maintained or dead plants can actually reverse the positive effects of vegetation and decrease emotional and physical well-being (Cooper-Marcus and Barnes, 1995). Because many early childhood programs are housed in public schools, churches or other "borrowed" properties with limited staff capabilities, the issue of maintenance becomes even greater. The best way to overcome this problem is through the use of low maintenance plantings and increased awareness of the immense value that vegetation can provide so that perceived value begins to outweigh maintenance concerns.

A factor that can limit or enhance the value of vegetation unrelated to the vegetation itself is the support of the supervising adults and their ability to, as mentioned before, "see" the value of vegetation in the context of early childhood education. Many early childhood educators try to share their fond childhood memories of the outdoors through their teaching and will make an extra effort to create or maintain the outdoor play environment, bringing in new vegetation or using what is there. One way to measure the "visibility" of vegetation by adults is to note how intentionally it was chosen or placed in the environment. This can be roughly determined through a visual analysis, the presence of new plantings, and the presence of other elements, such as sand areas placed under the shade of a deciduous tree, that clearly take advantage of the existing vegetation. Conversely, adults who do not value vegetation may not take advantage of existing vegetation or facilitate its play value.

Conclusion

The research of Rachel Sebba (1991), Mark Francis (1995) and Lynda Schneekloth (1989) demonstrates how experiences with nature and vegetation become embedded in our memories of childhood, yet the studies of Kenneth Olwig (1989) and Catherine Eberbach (1992) suggest that the adult phenomenon of "invisibility of vegetation" is possibly the loss of ability to see vegetation as potential or activity, relegating it instead to the background. Regardless of the fact that outdoor play is required and considered a necessary part of early childhood education, the "outdoors" may not necessarily reflect any of the qualities of nature, in particular, the presence of vegetation. Furthermore, the curriculum that is used to teach children about their natural environment may be equally devoid of experiences in and with it.

At the 2002 NAEYC National Conference, in a session about the importance of nature to young children, presenter Mary Rivkin acknowledged how ridiculous it was to have to justify with research the reasons that young children should be given experiences in nature when one only needs to take a child into nature for a short time and observe the level of interest, the endless activity and discovery that occurs, the increased attention span, and the lack of conflict (Rivkin, 2002). Yet at that same convention, a session about integrating plants into preschool play areas had 10 attendees when most other sessions saw people fighting for seats. It seems particularly preposterous to have to quantify the value of vegetation when it is necessary only to consider what we would do without it. Perhaps the assessment of the current status of vegetation both in existing play environments and in the minds of educators will be a step toward initiating change.

METHODS

Site Selection

Thirteen study sites were selected from 40 preschool programs in Tucson, AZ that are accredited by the National Association for the Education of Young Children. Accredited programs share certain characteristics based on accreditation criteria such as a minimum area per child for outdoor space, as well as similar standards for curriculum goals and teacher/child interactions that follow the guidelines of developmentally appropriate practice. Participation in the study was voluntary, but an attempt was made to select sites from different locations within Tucson, presumably representing a variety of ethnic and socio-economic backgrounds of children. Sites are not identified by name in the study. All sites serve children between the ages of 3 and 5, but 2 sites (Sites 10 and 13) included kindergarten classes, which serve children up to age 6. Sites differed in size and several were part of public school playgrounds (Table 1). Site measurements were restricted to the outdoor play areas.

Study Design

Sites were evaluated using a two-part assessment. Part I consisted of a physical assessment of the outdoor play area. Vegetation was evaluated using a Potential Play Value of Vegetation (PPVV) index (Table 2) to determine the characteristics of the existing vegetation that are potentially valuable for the constructivist play of young

Table 1. Site information for thirteen NAEYC-accredited preschools in Tucson, Arizona.

Site #	Location in Tucson	Approximate area of outdoor play space (sq. ft.)	Type of funding	Type of facility	No. of separate spaces used in play	Nearby vegetated open space used in play
1	West	4000	public	self-contained building	1	no
2	Northwest	4700	public	portable building	1	no
3	South	6400	public	portable building	1	no
4	Southwest	10,500	public	classroom within a school building	1	yes (park)
5	South	8000	public	portable building	1	no
6	West	6900	public	classroom within a school building	1	no
7	West	20,800	public	classroom within a school building	2	no
8	Central	10,600	public	classroom within a school building	1	no
9	Northeast	19,300	private	self-contained building	3	no
10	East	10,900	public	classroom within a school building	1	yes (park)
11	West	11,000	public	classroom within a school building	2	no
12	North	6400	private/public	self-contained building	1	yes (property)
13	Central	23,800	private	self-contained building	3	no

Table 2. Potential play value of vegetation index: Plant characteristics that provide potential play values (PPV) and references

Letter	Potential Play Value (PPV)	Plant characteristic providing value	Reference
A	Provides physical comfort	Modifies microclimate (provide shade) or reduce wind	Moore, Olds
B	Provides beauty	Appears well-maintained or softens hard surfaces and architecture	Moore, Olds
C	Provides unusual texture	Provides especially interesting textures (foliage, bark)	Moore, Herrington
D	Provides edible parts	Produces edible parts	Francis, M., Moore
E	Provides fragrance	Produces fragrant flowers or foliage	Moore
F	Provides sound	Produces wind effects or has parts that can create sounds	Moore
G	Provides color	Produces high color contrast in flowers and foliage	Moore
H	Provides a landmark or focal point	Exhibits distinctive form or is single, relatively large and planted near center of play area	Moore, Olds
I	Provides parts for manipulative play	Produces regenerating parts such as seeds, pods, flowers	Moore, Rivkin, Herrington
J	Provides structure for safe climbing or swing attachment	Supports climbing or swinging, have horizontal branching structure	Moore, Francis M.
K	Forms enclosures or refuge spaces that support dramatic play	Grows naturally or can be pruned to form child-scale refuge space	Kirkby, Moore
L	Attracts wildlife	Provides food or shelter for wildlife	Moore, Rivkin, Wilson
M	Shows the passage of seasons	Exhibits noticeable seasonal changes (leaf color, leaf drop)	Moore, Olds
N	Contributes to regional or cultural identity	Native or drought tolerant plant, distinctive of the region	Moore, Herrington
O	Is safe for young children	Not toxic or dangerously thorny Does not create a complete visual barrier. Has resilient surfacing as required below climbing trees	Moore, Rivkin
P	Does not create significant maintenance requirements.	Produces minimal litter and requires minimal pruning and irrigation	Schuler, Jones
Q	Is accessible to children	Exhibits features at a young child's scale	Herrington, Francis, C., Moore
R	Is well-maintained	Appears healthy and is actively growing	Cooper-Marcus and Barnes, Moore
S	Is intentionally planted or placed	Appears to have been planted in relation to potential use by children.	Herrington, Moore

children. The presence of 19 potential play values (PPV) was also determined for each site and an overall index value calculated. This index was developed from the literature and recommendations by the NAEYC. In addition, plant species were identified and total plant density, density of native plant species, and growth structure of vegetation was recorded for each site. Presence of other landscape elements, including lawns or cultivated gardens, other natural elements, and built elements, was also recorded. Characteristics unique to individual sites were recorded to be used in site narratives.

Part II consisted of structured interviews of the lead teacher or director of each site to determine their perceptions of the value of vegetation to young children in these environments. Interviews were conducted both in person and by telephone. All respondents were asked the same questions. Other information spontaneously offered by the educators as well as relevant observations that might serve to further expand or explain the results were recorded.

Data Collection

Data was collected in November and December of 2002 and January of 2003. A data collection sheet (Appendix A) was used to record physical data of the outdoor play area. Square footage of the outdoor area for each site was estimated using scaled aerial photographs of the sites. Responses to interview questions were recorded verbatim and respondent's understanding of the questions was also noted.

Data Analysis and Interpretation

The physical data was analyzed and interpreted to determine the species frequency, total density and density of native plants for all sites and the frequency and richness of species, growth structure and potential play value of vegetation for each site.

Content analysis of responses to interview Questions 1 (Appendix A) was used to identify reported values of vegetation corresponding to the PPV index. A value of 1 was assigned to each reported value and added for a total score. Frequency of individual values reported was determined across all sites as well as richness of reported play values for each site. Content analysis of responses to Question 2 was used to identify relative curriculum emphasis on 1) use of vegetation, 2) regionally relevant material, 3) direct experiences with nature, and 4) use of the outdoor environment. Sites in which educators reported using these types of curriculum often were given a point value of 3, while occasional use was given a value of 1.

Richness ranking was determined by assigning a value of 1 to the site with the highest richness value based on species, growth structure, and potential play value of vegetation and on frequency of vegetation values and curriculum content reported by educators in interview responses. All other sites were ranked by dividing their richness value by the highest value. To compare sites, richness values for each category were then added for a total value and sites were ranked from 1 to 13 based on this sum.

Threats to Validity

While the study attempts to quantify data such as identified potential play values and play values stated by interview respondents, it is primarily qualitative in nature and results based on quantitative data are not conclusive, but are used to identify possible trends in the use of vegetation in early childhood outdoor environments. Opportunities for bias exist throughout the study although every attempt has been made to eliminate or acknowledge them. The potential value of vegetation is, as aforementioned, a subjective designation and the interpretation of interview responses also contains potential for bias. An example of this is in responses to Question 1, "How do you believe vegetation can contribute and be valuable in an early childhood outdoor environment?", in which educators gave general values of vegetation, such as sensory value or source of science concepts, but not specific sensory qualities, such as color, fragrance or texture. In addition, numerical values given to responses were based on the suggestion of importance as stated in the literature. For example, a response to question 2 regarding curriculum that included the frequent or regular use of direct experience of nature as opposed to indirect or vicarious experiences (Kellert, 2001), was given a value of 3 while the infrequent use of direct experiences was given only a value of 1. Furthermore, only the lead teacher or director was interviewed under the assumption that she was the most knowledgeable about the values and curriculum used in her program. Interviewing other teachers would no doubt reveal more variety of responses

RESULTS AND DISCUSSION

Results suggested trends in both physical data analysis and analysis of interview responses relating to 5 categories: 1) plant species and their frequency across all sites, 2) vegetation presence and characteristics for each site, 3) presence of other landscape elements and relationship to vegetation presence across all sites, 4) vegetation visibility and 5) cumulative richness ranking.

Discussion of trends within the results is followed by site narratives that further describe the results. These narratives consist of expanded descriptions of each site, species and play values present, additional information about the site or voluntarily offered by the educators interviewed, a summary of the site's opportunities and constraints, and photographs of the site.

Plant Species and Their Frequency

Fifty-five plant species were identified across all 13 sites (Table 3). Of these, 38% were native species. However 67% of those native species appeared in only 2 sites (sites 12 and 13). The most persistent species among all sites was mulberry (*Morus alba)* which appeared in 46 % of the sites. This is interesting in light of the fact that mulberry can no longer be legally planted due to allergy problems associated with it. However, as an existing tree, it offers several play values and is the sole food source of silkworms that are often raised in early childhood classrooms.

Table 3. Total species density and frequency for all sites.

Species botanical name	Species common name	Total density	# of sites species present
Acacia constricta	whitethorn acacia	1	1
Acacia salicina	willow acacia	4	1
Agave vilmoriniana	octopus agave	1	1
Asclepius linaria	pineleaf milkweed	1	1
Asclepiuas subulata	desert milkweed	1	1
Asparagus densiflorus 'sprengeri'	asparagus fern	2	1
Baccaris sarothroides	desert broom	1	1
Baileya multiradiata	desert marigold	1	1
Buxus japonica	Japanese boxwood	2	1
Carya illinoiensis	pecan	4	2
Celtis reticulata	Western hackberry	1	1
Cercidium microphyllum	foothills palo verde	1	1
Chamaerops humilis	Mediterranean fan palm	1	1
Encelia farinosa	brittlebush	1	1
Eucalyptus leucoxylon	white ironbark	2	2
Eucalyptus microtheca	coolibah tree	2	1
Fraxinus velutina	velvet ash	10	5
Jasminum mesnyi	primrose jasmine	3	2
Juniperus chinensis	Hollywood juniper	2	1
Lantana camara 'radiation'	bush lantana	1	1
Larrea tridentata	creosote	30	1
Ligustrum lucidum	common privet	1	1
Lonicera japonica	Hall's honeysuckle	1	1
Morus alba	mulberry	8	6
Muhlenbergia rigens	deergrass	1	1
Nandina domestica	heavenly bamboo	2	1
Olea Europaea	olive	1	1
Olneya tesota	ironwood	3	1
Parkinsonia aculeata	Mexican palo verde	3	1

Table continued

Table 3. continued

Species botanical name	Species common name	Total density	No. of sites species present
Penstemon eatonii	Firecracker penstemon	1	1
Penstemon parryii	Parry's penstemon	1	1
Phoenix canariensis	Canary Island date palm	2	1
Pinus eldarica	mondel pine	1	1
Pinus halepensis	aleppo pine	2	2
Pittosporum tobira	Japanese mock orange	3	1
Pladycladys orientalis	arborvitae	1	1
Podocarpus macrophyllus	yew pine	3	1
Podronea ricalosiana	pink trumpet vine	1	1
Prosopis hybrid	mesquite	9	3
Prosopis velutina	velvet mesquite	3	2
Punica granatum	pomegranate	1	1
Pyracantha sp.	pyracantha	2	1
Pyrus kawakami	evergreen pear	1	1
Quercus buckleyi	Texas red oak	5	1
Raphiolepsis indica	Indian hawthorne	14	2
Rhus lancea	African sumac	5	3
Rosa sp.	rose	4	1
Salvia farinacea	mealy cup sage	11	1
Salvia greggii	red sage	4	1
Strelitzia reginae	African bird of paradise	1	1
Trachelospermum jasminoides	star jasmine	3	2
Ulmus parvifolia	Chinese elm	2	1
Verbena rigida	rock verbena	1	1
Washingtonia robusta	Mexican fan palm	2	1
Zaushneria californica	hummingbird trumpet plant	1	1

Other species that appeared often were velvet ash (*Fraxinus velutina*), which was present in 38% of sites and native and hybrid mesquite species (*Prosopis velutina* and *Prosopis* hybrid), also present in 38% of sites. Velvet ash, though a native tree, is a riparian species and not drought tolerant. However it has lovely Fall color and plentiful play parts (hairy leaves and fruits). Mesquite, particularly the thornless hybrids, are hardy and their multi-trunk forms can provide for climbing. Most notable about predominant species identified at the 13 sites is that they are consistently large, single trunk trees, a form and growth structure that is less accessible relative to the scale of a young child. A smaller tree, such as the native feather bush (*Lysiloma thornberi*), would be a better choice in terms of scale and accessibility, also providing many other play values such as refuge potential, plant parts with sound (pods), texture (feathery leaves), regional identity, and wildlife (butterfly) attraction. Although non-native, the pomegranate (*Punica granatum*) is also a good tree choice, offering the additional value of edible parts and distinct seasonal changes. For climbing and refuge, the sterile olive (*Olea europaea*) is an excellent choice due to its multi-trunk structure, smooth wood and dense shade-producing foliage. A shrub with high PPV diversity is the native creosote (*Larrea tridentata*), identified only at Site 13. It provides semi-transparent refuge, plant parts, texture, color, cover for wildlife and a strong regional identity that is connected to its fragrance. Sites with existing creosote should take care to preserve them.

Vegetation Presence and Characteristics for 13 Sites

Vegetation was assessed by its physical presence relative to the area of the play space(density), origin and growth structure (Tables 4 and 5) and the potential play value it could provide in the setting due to the characteristics of the species (Table 6). Vegetation densities ranged from 0 to 48.4 plants/ 10,000 sq. ft, consistent with the hypothesis that even among accredited programs, the density vegetation would vary greatly.

The density of native plants was highest in Site 12 (23.4/10,000 sq.ft.) due to the presence of a recently planted native hummingbird and butterfly garden, and Site 13 (16.8/10,000 sq. ft.), due to this site's preservation of large stands of native creosote (*Larrea tridentata*). Species richness (Table 4) was also greatest at Site 12 (31.25/10,000 sq. ft.) with 20 different species present. Site 11 had a relatively high plant density (21.9/10,000 sq. ft.) but low species richness (6.4/10,000 sq. ft.). Furthermore, several plants at this site were not well-maintained, rendering their potential value somewhat useless.

Diversity based on growth structure richness indicated that the majority of plants among the 13 sites were large trees. A groundcover plant appeared at only one site and vines at only 2 sites. All sizes of shrubs appeared infrequently, which is unfortunate since shrubs tend to be at more of a child's scale and their qualities (i.e. plant parts, fragrance, texture) more accessible to young children. Shrubs are also more likely to form enclosures and refuges. Site 13, with its large number of medium to large-height

Table 4. Density /10,000 sq. ft., native plant density/10,000 sq. ft., diversity based on species richness/10,000 sq. ft., and richness ranking for thirteen sites.

Site #	Density 10,000 sq. ft.	Native plant density 10,000 sq. ft.	Diversity based on species richness 10,000 sq. ft.	Richness ranking
1	0.0	0.0	0.0	0.00
2	2.1	0.0	2.1	0.04
3	3.1	0.0	3.1	0.06
4	2.0	1.0	1.9	0.05
5	6.3	0.0	2.5	0.09
6	8.7	0.0	2.9	0.11
7	2.9	1.9	1.4	0.06
8	12.3	0.0	6.6	0.18
9	8.3	6.2	3.1	0.17
10	17.4	10.1	6.4	0.33
11	21.9	1.8	6.4	0.29
12	48.4	23.4	31.25	1.00
13	19.3	16.8	6.5	0.41

Table 5. Growth structure frequency, structural diversity based on growth structure richness, and richness ranking for thirteen sites.

Site #	Growth structure								Structural diversity	Richness ranking
	large tree	medium tree	small tree	large shrub	medium shrub	small shrub	vine	ground-cover		
1									0	0.00
2	x								1	0.14
3	x								1	0.14
4	x								1	0.14
5	x	x							2	0.29
6		x	x						2	0.29
7	x								1	0.14
8	x	x	x	x	x	x			6	0.86
9	x	x	x						3	0.43
10	x				x	x	x		4	0.57
11	x	x			x	x			4	0.57
12	x	x	x	x	x	x		x	7	1.00
13	x	x	x	x	x		x		6	0.86

Table 6. Frequency, richness and ranking of potential play value (PPV) of vegetation for thirteen sites.

Potential play value (PPV) of vegetation	No. of plants possessing PPV for each site													Frequency of each PPV (n = 13)
	Site #													
	1	2	3	4	5	6	7	8	9	10	11	12	13	
A: Provides physical comfort		x	x	x	x	x	x	x	x	x	x	x	x	12
B: Provides beauty		x	x	x	x		x	x	x	x	x	x	x	11
C: Provides unusual texture		x		x	x	x		x	x	x	x	x	x	10
D: Provides edible parts								x	x	x			x	4
E: Provides fragrance											x	x	x	3
F: Provides sound		x	x			x	x			x	x	x	x	8
G: Provides color		x		x		x		x		x	x	x	x	8
H: Provides a landmark or focal point		x	x	x	x	x	x	x	x	x	x	x	x	12
I: Provides parts for manipulative play		x	x	x	x	x	x	x	x	x		x	x	11
J: Provides structure for climbing or swing attachment									x				x	2
K: Provides enclosure or refuge space								x		x			x	3
L: Attracts wildlife			x	x		x	x	x	x	x		x	x	9

Table continued

Table 6. Continued

Potential play value (PPV) of vegetation	No. of plants possessing PPV at each site													Frequency of each PPV (n = 13)
	Site #													
	1	2	3	4	5	6	7	8	9	10	11	12	13	
M: Shows a passage of seasons		x	x		x	x	x	x	x		x	x	x	10
N: Contributes to a regional identity		x	x		x		x		x	x	x	x	x	9
O: Is safe for young children		x	x	x	x	x	x	x	x	x	x	x	x	12
P: Does not create significant maintenance			x	x	x		x	x	x	x	x	x	x	10
Q: Is accessible to children		x		x	x	x	x	x	x	x	x	x	x	12
R: Is well-maintained		x	x	x	x		x	x	x	x	x	x	x	11
S: Is placed intentionally for children's use					x	x		x	x	x	x	x	x	8
Richness ranking	0.00	0.63	0.63	0.58	0.63	0.58	0.63	0.79	0.79	0.84	0.74	0.84	1.00	

creosote shrubs providing several child scale refuge areas, was the only site in which shrubs were clearly used for this purpose. In general, the diversity of structure was low, minimizing a child's direct contact with a variety of plants offering variation in texture, size, color and potential for play.

However, high potential play value of the vegetation can compensate for low plant density, species richness and growth structure richness and may be a better indicator of the amount of complexity being added to a play environment by vegetation. Results regarding potential play value of vegetation among all 13 sites indicated relatively high frequency (10-12 out of 13) for the values A (provides physical comfort), B (provides beauty), C (provides unusual texture), H (provides a landmark or focal point), I (provides parts of manipulative play), M (shows a passage of seasons), O (is safe for children), P (does not create significant maintenance), and R (is well-maintained). Of the PVV identified, the relative absence of certain values is significant. Values D (provides edible parts), E (Provides fragrance), J (provides structure for climbing), and K (Forms enclosures or refuge spaces) all appeared infrequently despite their strong connection to sensory and motor development and their relative importance as expressed in the literature. In particular, absence of climbing trees and vegetation refuge spaces may indicate a lack of knowledge about vegetation combined with fears of safety, liability, and maintenance. Further research is needed to more clearly identify obstacles to use of vegetation for climbing and refuge.

While the absence of potential play values indicates that there is no potential for those types of play occurring through vegetation, the presence of values is somewhat

deceiving because it only measures *potential*, not actual, play value. Whether or not some of these values are actually being exploited may be relative to vegetation visibility, or the value placed on vegetation by teachers, and the degree to which teachers draw children's attention to the vegetation or allow sufficient time outdoors. Vegetation visibility is often dependent on an individual teacher's knowledge about plants as was indicated by interview responses at Site 4 (see Site 4 narrative). The inclusion of education about vegetation, ecology and the importance of direct contact with nature to children in early childhood educator training and in the stated goals of the NAEYC is needed to increase vegetation visibility.

Presence of Other Landscape Elements

The frequency and richness of other significant landscape elements in the 13 sites gives information about the value of vegetation relative to built and other natural elements (Table 7). The frequency of outdoor cultivated gardens was identified in 62% of all sites. Lawns were also present in 62% of all sites although only 2 sites (Sites 9 and 13) had well maintained, year-round lawns. Among other natural elements, all sites had sand, 38% had wood chips (mostly used as a resilient surface and not for play), and only one site had other natural elements (stones, boulders and logs).

The frequency of built elements was both high and consistent among all 13 sites. Seventy-eight percent of all sites had built shade structures made of cloth, metal and in one instance, wood (Site 13). Seventy-eight percent of the sites also had permanent play equipment pieces, although only one site (Site 13) had pieces that could be manipulated.

Table 7. Frequency, richness, and ranking of related landscape elements.

Site #	Lawn	Cultivated garden		Other natural elements			Built elements				Richness (n=10)	Ranking
		in-ground	container	sand	wood chips	other	shade structure	stored equipment	permanent pieces	permanent all-in-one		
1				x			x	x	x	x	5	.63
2				x	x		x	x	x	x	6	.75
3	x			x	x		x	x	x	x	7	.88
4			x	x			x	x		x	5	.63
5		x		x	x		x	x	x	x	7	.88
6	x			x				x		x	4	.50
7	x			x			x	x	x	x	6	.75
8		x		x	x		x	x	x	x	7	.88
9	x		x	x				x	x	x	6	.75
10	x		x	x	x			x		x	6	.75
11	x	x		x			x	x	x		6	.75
12	x	x	x	x			x	x	x		7	.88
13	x	x		x		x	x	x	x		8	1.00
Frequency (n=13)	8	8		13	5	1	10	13	10	10		

All sites had stored equipment such as wheel toys, large blocks, water tables, and sand or digging toys. Permanent all-in-one play structures were present at 78% of the sites. Most of these consisted of synthetic, primary colored structures although Site 10 had a designed and built, natural wood all–in-one structure. Sites 12 and 13 did not have all-in-one structures, but had a much higher proportion of vegetation than other sites.

The high occurrence of built elements, particularly shade structures and all-in-one structures occurring together, suggests a prioritization of these over their natural counterparts. This is consistent with literature citing the bias toward built structures for the purpose of primarily large motor development in children's outdoor play rather than natural elements and settings providing for additional types of play. Furthermore, these built structures tend to give a generic quality of all play areas, undermining the importance of a "sense of place" or elements that are meaningful to a specific region and population (Olds, 2001; Herrington, 1997; Bredecamp and Copple, 1997). While a "pure" landscape such as the U.C. Davis Infant Garden may not always be realistic, a successful integration of built and natural forms can be effectively accomplished (See Site 13 narrative).

Vegetation Visibility

Measurement of the "visibility" of vegetation is a largely subjective determination by the researcher of how the adults responsible for the design of early childhood learning environments appear to "see" or value the element of vegetation. While a direct correlation between vegetation visibility and actual effectiveness of vegetation was not

tested in this study, the assessment of both serves to show that a relationship potentially exists and can be used as a guide for future study about this phenomenon. Information regarding vegetation visibility was gleaned from educator interviews and characteristics about the existing vegetation assessed by the researcher. Table 8 tabulates responses to Question #1 "How do you believe vegetation can contribute and be valuable in an early childhood outdoor environment?" fourteen potential play values correspond to those assessed for vegetation. Three additional values mentioned by educators that were not included in the vegetation assessment of the researcher were added. For example, "a source of science concepts" was an additional value reported by educators at 11 sites. Out of 17 possible values, the most mentioned by an educator was 8. A surprising result was that the educator was from Site 4, which had relatively low ranking for vegetation richness (0.05/10,000 sq. ft.) However, this site was unique in other ways; the class frequently played in a nearby park with native vegetation, the lead teacher was very knowledgeable and enthusiastic about plants (see Site 4 narrative) and the school was in the process of obtaining a grant to redesign their play area. Another inconsistency between existing and reported vegetation value occurred at Site 11, a site with relatively high vegetation density (21.9/10,000 sq. ft.), but only 2 values reported by the lead teacher.

A more relevant interpretation on reported vegetation value is in the frequency of individual values reported. Value A (provides physical comfort) and value B (provides beauty or aesthetics) were reported most frequently (10 sites), corroborating research suggesting that adults tend to value vegetation more as background or scenery, not as

Table 8. Interview response analysis of reported vegetation value (RVV): Sites in which value was reported, RVV for thirteen sites, richness based on RVV and ranking.

Potential play value of vegetation	Sites in which teachers reported this as a value of vegetation													Total frequency of RVV (n = 13)
	Site #													
	1	2	3	4	5	6	7	8	9	10	11	12	13	
A: Provides physical comfort (shade)		x	x	x	x	x	x		x	x	x		x	10
B: Provides beauty	x		x	x	x	x	x		x	x				8
C: Provides unusual texture			x							x			x	3
D: Provides edible parts														0
E: Provides fragrance														0
F: Provides sound														0
G: Provides color														0
H: Provides a landmark or focal point														0
I: Provides parts for manipulative play										x		x		2
J: Provides structure for climbing or swing attachment				x				x					x	3
K: Provides enclosure or refuge space				x		x								4

Table continued

Table 8. continued

Potential play value of vegetation	Sites in which teachers reported this as a value of vegetation													Total frequency of RVV (n = 13)
	Site #													
	1	2	3	4	5	6	7	8	9	10	11	12	13	
L: Attracts wildlife		x						x	x			x		6
M: Shows a passage of seasons	x	x		x				x	x			x		6
N: Contributes to a regional identity														0
Other: Provides a source of math and science concepts	x	x	x	x	x	x		x		x	x	x	x	11
Other: Provides places to rest			x	x		x		x	x				x	6
Other: Provides real life experiences				x				x				x	x	4
Richness (n=17)	3	4	5	8	3	5	2	6	5	5	2	5	6	
Ranking	.38	.50	.63	1	.38	.63	.25	.75	.63	.63	.25	.63	.75	

potential activity. The additional value of "a source of science concepts" reported by educators at 11 sites is quite general and open to interpretation, whereas more specific values seem to suggest a greater understanding and perhaps experience with those values of vegetation. Nine of the 17 values were mentioned specifically by only 4 or fewer of the educators. Of particular concern was the absence of reported values D (provides edible parts), I (provides manipulative parts), J (provides structure for climbing), and K (forms enclosure or refuge space) as they seem to be the vegetation characteristics most prevalent in adult memories of childhood (Francis, M., 1995). As mentioned above, many of these values appeared infrequently in the existing vegetation as well. Value A (provides physical comfort or shade) and value B (provides beauty) appeared frequently in both existing vegetation reported value of vegetation, consistent with studies suggesting that adults tend to see vegetation inn terms of scenery or passive, rather than active values (Schneekloth, 1989; Olwig, 1989; Eberbach, 1992). Interestingly, value I (provides parts for manipulative play) was present in the existing vegetation at 11 of the sites, but it was only reported as a value by 2 educators, suggesting that although the plant parts are available, teachers may not be encouraging children to use them in play, again possibly due to lack of education and subsequent lack of ideas or additional materials to support the use of play parts in play (see Site 7 narrative).

Suggestions about visibility of vegetation also come from responses to interview question 2, "How do you teach children about plants, nature and the environment?" These responses were analyzed for the presence of 4 curriculum characteristics: use of vegetation, regional emphasis, direct experiences with nature and use of the outdoors as

these characteristics were cited in the literature as being important, both in the context of developmentally appropriate practice and instilling an environmental ethic (Table 9). Seventy-eight percent of the educators mentioned using the outdoors in some way but the degree varied from one-time activities (i.e. releasing butterflies that had been raised inside) to regular experiences (observing seasonal changes, feeding hummingbirds, finding small wildlife, hiking in nearby desert). Playing outdoors was mentioned specifically by only 23% of the educators as being a substantial part of their daily environmental curriculum. Use of vegetation was reported by 62% of the educators and also ranged from occasionally collecting acorns to having climbing trees available. Use of direct experiences with nature was mentioned by only 46% of the educators and while several educators included a plant theme in their curriculum, the activities mentioned often occurred indoors as indirect or vicarious experiences. Hands-on activities, such as planting seeds in cups and having a science table were mentioned frequently, but opportunities to explore nature *in* nature were not.

Finally, when responding to the additional question of "Do you do anything (in your curriculum) that is specifically related to the desert?", the range of answers included "No, but I don't know why.", reading desert books , field trips to Tohono Chul Park (a local desert botanical garden), eating *nopalitos* (prickly pear pads) and frequently exploring the desert in a nearby park or property. Again, regionally specific experiences tended to be short term and only one educator said that it was part of the NAEYC criteria that the curriculum include "meaningful experiences" every day, which she interpreted to be regionally based. While more in-depth observation and interviews with other teachers

Table 9. Interview response analysis of curriculum content: Degree of vegetation use, regional emphasis, use of direct natural experiences, and use of outdoors (3 = often, 1 = sometimes, 0 = never or not mentioned)

Site #	Curriculum content				Total score n = 12	Ranking
	Vegetation use	Regional emphasis	Use of direct experiences	Use of outdoors		
1	0	1	0	0	1	.08
2	1	1	1	1	4	.33
3	0	3	1	0	4	.33
4	3	3	3	3	12	1.00
5	0	3	1	1	5	.42
6	1	1	1	1	4	.33
7	0	1	1	1	3	.25
8	3	3	3	3	12	1.00
9	3	1	3	1	8	.67
10	1	0	3	1	5	.42
11	0	1	1	1	3	.25
12	3	3	3	3	12	1.00
13	3	3	3	3	12	1.00

who are implementing the curriculum would be more conclusive, these responses give some clues about the nature of environmental curriculum and how it reflects vegetation "visibility" (Wilson and Smith, 1996).

The presence of potential play value R (plants are well-maintained) and S (plants are placed intentionally) also suggest an association between "visibility" in terms of care of vegetation and how it is used in the environment. The vegetation at most sites was well-maintained (Table 5). Site 11, while having a relatively high vegetation density also had many plants that were not well-maintained. Responses to interview questions also revealed a lower degree of "visibility" of vegetation. However, this site (See Site 11 narrative) was one of few in which an element was clearly placed intentionally in relation to vegetation (a sandbox built around a tree). All these factors again suggest that The value placed on vegetation for play can be measured in different ways. Sharing these results with educators will likely increase their visibility and awareness of vegetation as an element supporting their teaching goals.

Cumulative richness ranking

All sites were ranked according to the sum of their individual rankings for each richness category (Table 10). Sites 12 and 13 were ranked 1st and 2nd as their individual rankings were consistently high. It is significant to note that these sites are both private, tuition-based programs (although the special needs program at Site 12 is publicly funded). Site 4 ranked a relatively high 5th regardless of its low vegetation rankings due to strong rankings in reported vegetation value and curriculum. Site 8 was also ranked

Table 10. Cumulative richness ranking for thirteen sites in species, growth structure, PPV, related elements, RVV and curriculum.

Site #	Species (Table 4)	Growth structure (Table 5)	PPV (Table 6)	Related landscape elements (Table 7)	RVV (Table 8)	Curriculum (Table 9)	Total	Ranking 1-13
1	0.00	0.00	0.00	0.63	0.38	0.08	1.09	13
2	0.04	0.14	0.63	0.75	0.50	0.33	2.39	11
3	0.06	0.14	0.63	0.88	0.63	0.33	2.67	8
4	0.05	0.14	0.58	0.63	1.00	1.00	3.40	5
5	0.09	0.28	0.63	0.88	0.38	0.42	2.68	7
6	0.11	0.28	0.58	0.50	0.63	0.33	2.43	10
7	0.06	0.14	0.63	0.75	0.25	0.25	2.08	12
8	0.18	0.86	0.79	0.88	0.75	1.00	4.46	3
9	0.17	0.43	0.79	0.75	0.63	0.67	3.44	4
10	0.33	0.25	0.84	0.75	0.63	0.42	3.22	6
11	0.29	0.25	0.74	0.75	0.25	0.25	2.53	9
12	1.00	1.00	0.84	0.88	0.63	1.00	5.35	1
13	0.41	0.86	1.00	1.00	0.75	1.00	5.02	2

high (3rd) and represents a good balance of vegetation richness and educator visibility at a publicly-funded program serving low income families.

Site narratives

Site 1 (Figure 1)

Site 1 is located on the West side of Tucson in a self-contained building. It is a full inclusion program with a percentage of children with disabilities. Classrooms are windowless, yet are arranged nicely and children's work is displayed with care. A large paper tree trunk and branches with leaves painted by the children covers one wall. However, the outdoor area does not have any vegetation. A large cloth shade structure is the primary element and focal point outside and the entire play area has sand as a ground surface. Many separate permanent and stored equipment pieces are available for the children. The play area is directly adjacent to a busy street separated by a chain link fence. Responses to interview questions by the lead teacher revealed that most children in the program spent their days in childcare and opportunities for them to play outdoors were few. She felt that children with disabilities were actually discouraged from being outdoors.

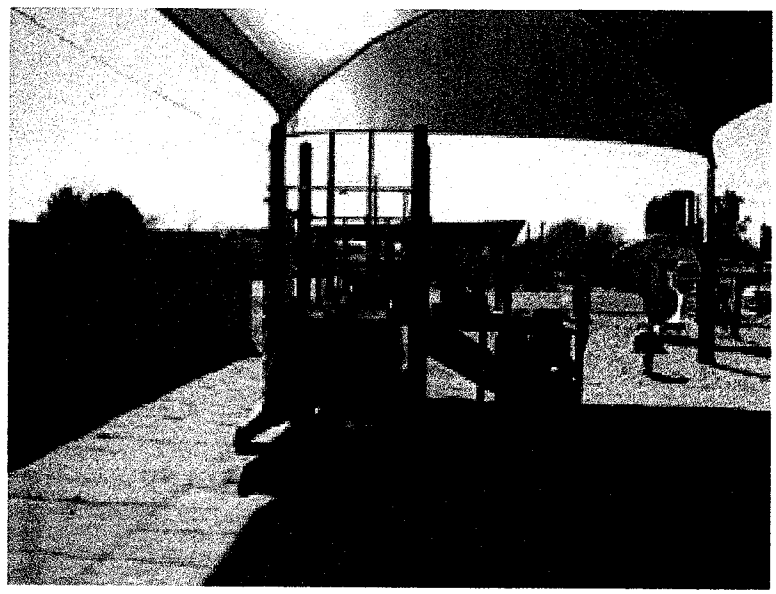
Constraints:

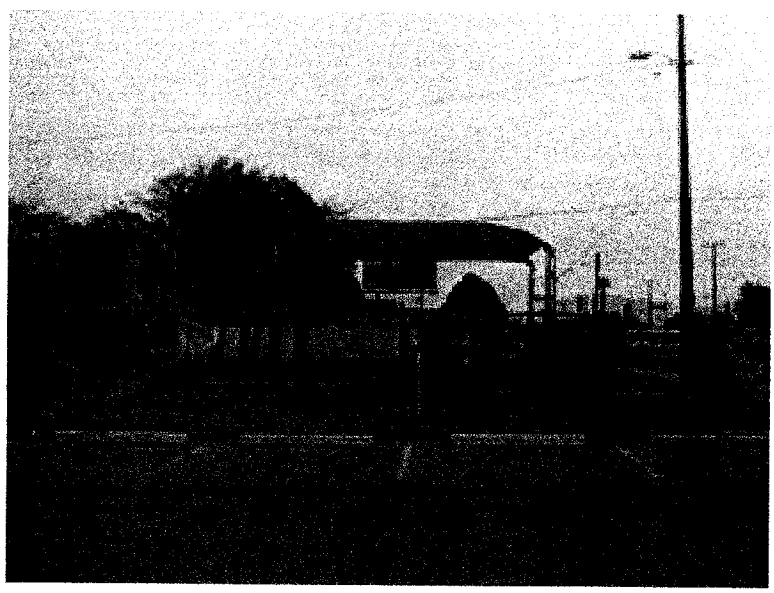
- Play area is small
- Space is undifferentiated
- Educators' awareness of vegetation value appears low

Opportunities:

- Very little carefully chosen vegetation could provide multiple play values, screen the street and dramatically change the appearance and feel of this play area

Figure 1. Site 1 photographs





Site 2 (Figure 2)

Site 2 is located on the Northwest side of Tucson in a portable building on the grounds of a public elementary school. There is significant noise here from a nearby freeway. There are also very nice views of the Tucson mountains to the West. The school serves low income children from the surrounding residential neighborhood. The play area is separated from the adjacent trailer park by a tall chain link fence. The most prominent elements are a shaded sand area, all-in-one play structure and a mature mulberry. According to the director, this mulberry is the centerpiece of their yard and they enjoy observing the seasonal changes. She wasn't aware that the leaves were the food source of silkworms, nor did she indicate that the children used the leaves in their play. The director was very enthusiastic about learning other ways that the tree could be incorporated into their curriculum and also about integrating more vegetation into the play area, such as vines on the chain link fence.

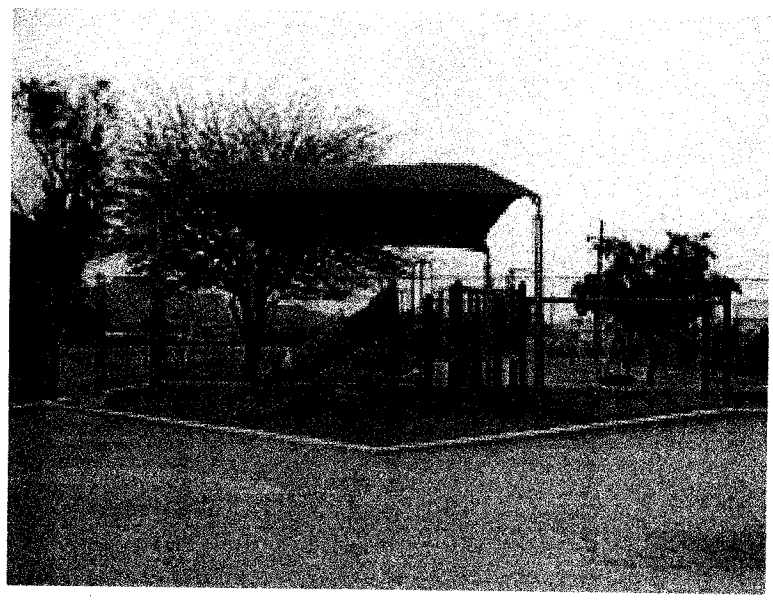
Constraints:

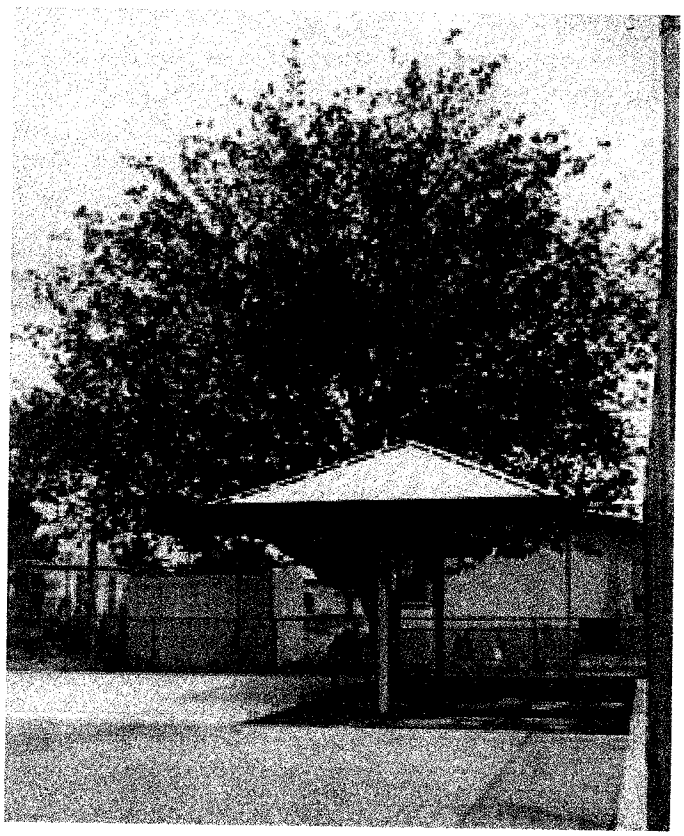
- Play area is small
- There is noise from a nearby freeway

Opportunities:

- Many activities could be supported by the mulberry tree
- Additional shrubs could provide much needed refuge and "private" space
- Enthusiastic educator would be open to more ideas for integrating vegetation.

Figure 2. Site 2 photographs





Site 3 (Figure 3)

Site 3 is located on the South side of Tucson in a portable building on the grounds of a public elementary school. This site has only two trees, but one is a native hackberry (*Celtis reticulata*), a plant with high potential for wildlife attraction. The lead teacher was one of few in the study who mentioned rest and relaxation as being values of vegetation. She was disappointed that their lawn was not well-maintained and could not provide "softness". On the other side of the portable is an area that the elementary school children started developing as a wildlife garden with native plants and paths. The teacher said this area was not used by them and seldom used by the older children either.

Constraints:

- Teacher suggested that school maintenance of vegetation (lawn) is inconsistent and that teachers have little control over maintenance.

Opportunities:

- There may be opportunities for participation in development and future use of "wildlife" garden in front
- More medium to small shrubs around existing vegetation could create vegetation "clumps", refuge spaces and sensory values without sacrificing space

Figure 3. Site 3 photographs

Site 4 (Figure 4)

Site 4 is located on the far Southwest side of Tucson. The program shares its outdoor space with two other preschool programs that are not yet NAEYC-accredited. The vegetation consists of two large trees, both located on the perimeter and one in the center of a small paved area. The class maintains several small vegetable gardens contained in painted tires. The lead teacher expressed a great deal of knowledge and enthusiasm about plants and her responses to questions regarding vegetation value were the most extensive of all educators interviewed. She named many activities that emphasized the desert region, such as bringing in creosote branches and looking for creosote growing in a nearby desert park. She felt that exposing children to the vegetation of the desert and teaching them the names of desert plants would give them a reason to protect the desert in the future. A design for this play area has been developed through a grant by a landscape architecture student that does integrate more vegetation.

Constraints:

- Security of the area is a concern
- The play area is shared by many classes, limiting the amount of time used by each

Opportunities:

- There is access to a nearby desert park
- There are beautiful panoramic mountain views from the play area
- The lead teacher at this time has a love of plants and the desert that she appears to share with children.

Figure 4. Site 4 photographs

Site 5 (Figure 5)

Site 5 is located on the South side of Tucson in a portable building on the grounds of a public elementary school. The play area is large relative to similar programs with a nicely design combination ramada/sandbox area. Several willow acacias (Acacia salicina) have been recently planted along the North edge, potentially providing shade and screening a view of large industrial plants. The director expressed great interest in the integration of vegetation and related a story about her young niece being fascinated with the pods from a red bird of paradise in her yard, "planting" them everywhere. She admitted that as a teacher, she always considered outdoor play time as her "break" but imagined that having a nicely vegetated play area would enhance even this. She reported some unique desert activities in her curriculum such eating nopalitos (prickly pear pads) and talking about which plants need more or less water and why.

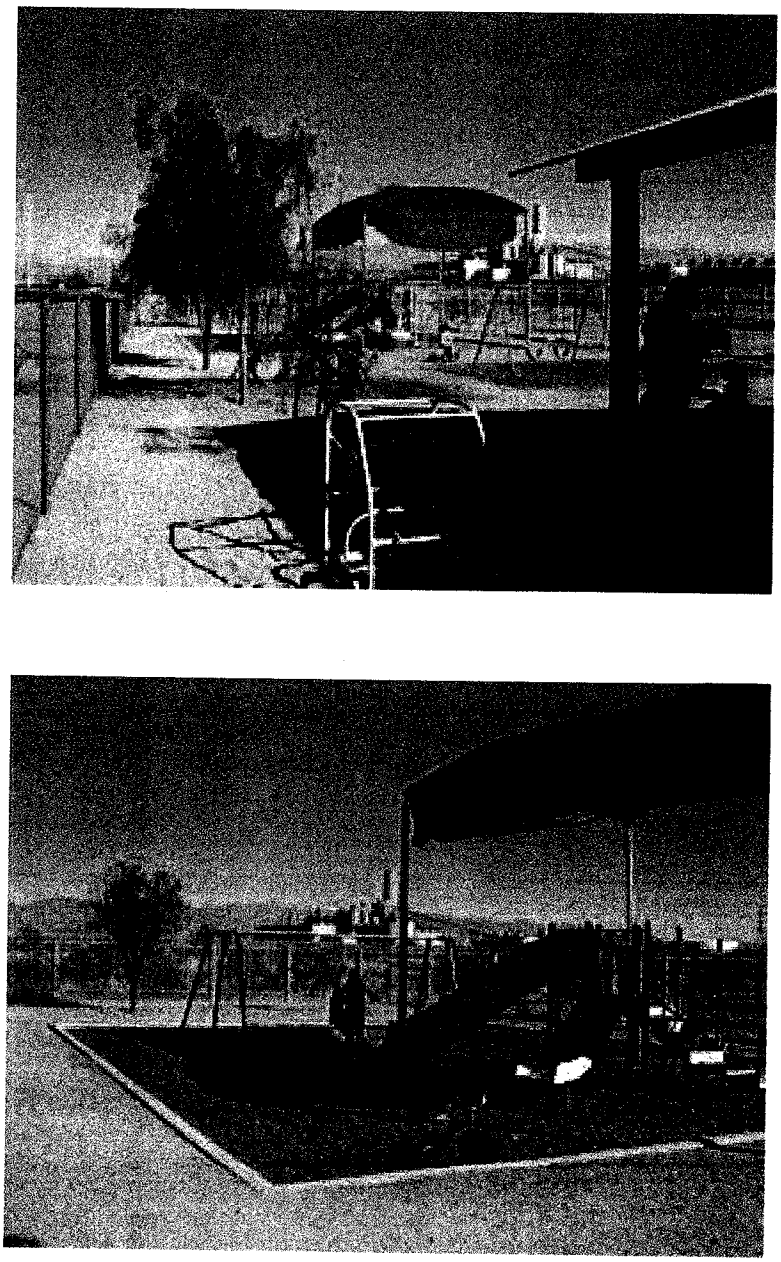
Constraints:

- Play area is adjacent to noisy street
- New trees are all the same species (*Acacia salicina*), single-trunk with relatively low play value

Opportunities:

- Play area has ample space for more vegetation, especially small and medium shrubs
- Director seems very supportive of adding vegetation

Figure 5. Site 5 photographs



Site 6 (Figure 6)

Site 6 is located on the West side of Tucson in a classroom within a public elementary school. It has a self-contained play area with a large combined ramada/storage shed which the lead teacher said was "very well equipped". About 5 years ago, a grant was used to pay for a large all-in-one play structure and 5 new trees. All are Texas red oak (*Quercus buckleyi*). There is also an older mulberry tree on the site. While both species have high potential play value (seasonal changes, leaves, acorns, color, texture) they are poorly maintained and the oaks have not reached the size they should have by now. The lead teacher reported that the maintenance is unreliable and that keeping bermuda grass out of the tree wells is a challenge. After telling her that the oaks had potential to be very nice trees, she said she was going to put in a maintenance order right away to check the irrigation system. One of the vegetation values she reported was "a quiet space to reflect", suggesting that she thinks the outdoors has potential to support more than loud, physical play. She also reported taking walks through the neighborhood, teaching children about dumping trash and playing with acorns, although she wasn't sure where the acorns came from.

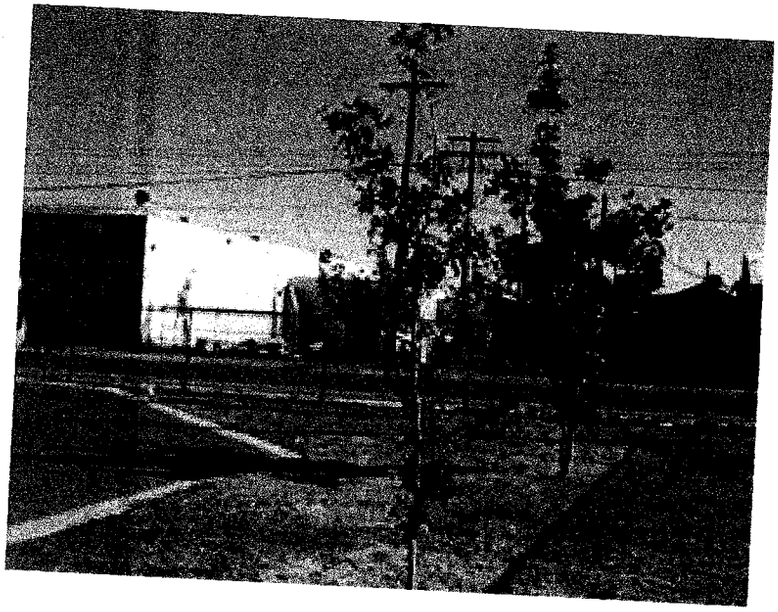
Constraints:

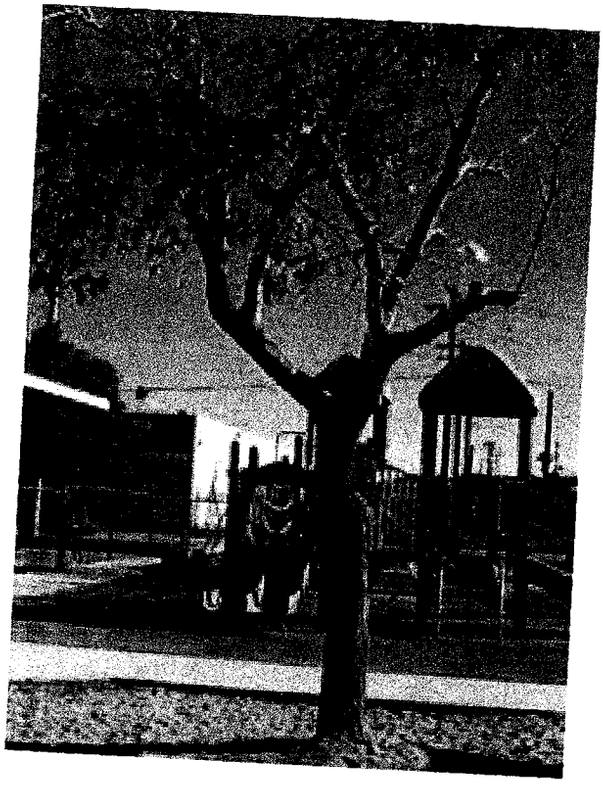
- Maintenance is inconsistent
- New trees planted are all the same species and older mulberry is in poor condition.

Opportunities:

- Mulberry could be replaced by a hardier species such as mesquite
- Lead teacher seem supportive of improving quality of existing vegetation

Figure 6. Site 6 photographs





Site 7 (Figure 7)

Site 7 is located on the West side of Tucson in the classroom within a public elementary school. The class uses two spaces, one a courtyard space adjacent to the classroom and the other a larger space that is part of the school playground. The courtyard space has 6 large trees, 2 velvet ash which are very close to the classroom door. At the time of the visit, the bright yellow leaves blanketed the ground, which the lead teacher said were not really used by children in any way. She said she often moved the inside center outside to the paved part of the courtyard but expressed concern about children using the entire courtyard space due to supervision. She also worried about leaving any materials or doing any additional planting in the courtyard because other classes also use it. The other play area was much larger but had only one mesquite within its boundaries. It was amply equipped and a recent grant was used to pay for a large shade structure. However, much of the area was not shaded.

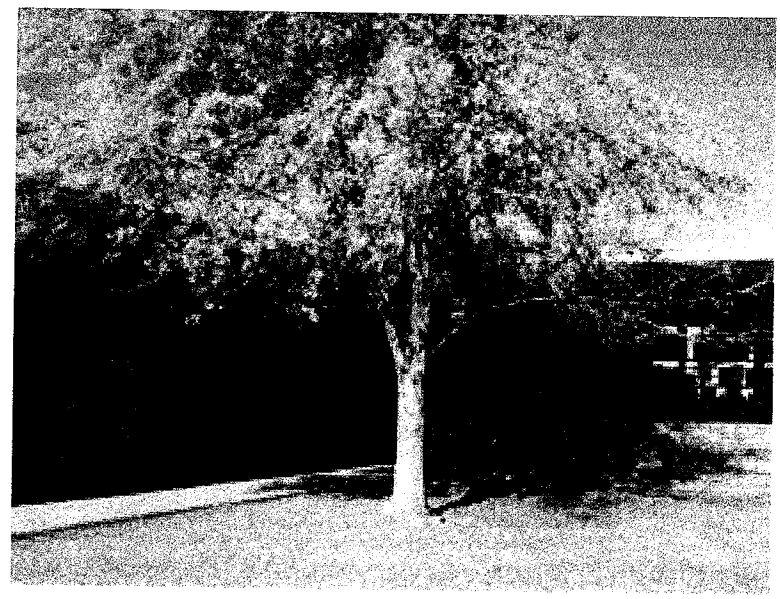
Constraints:

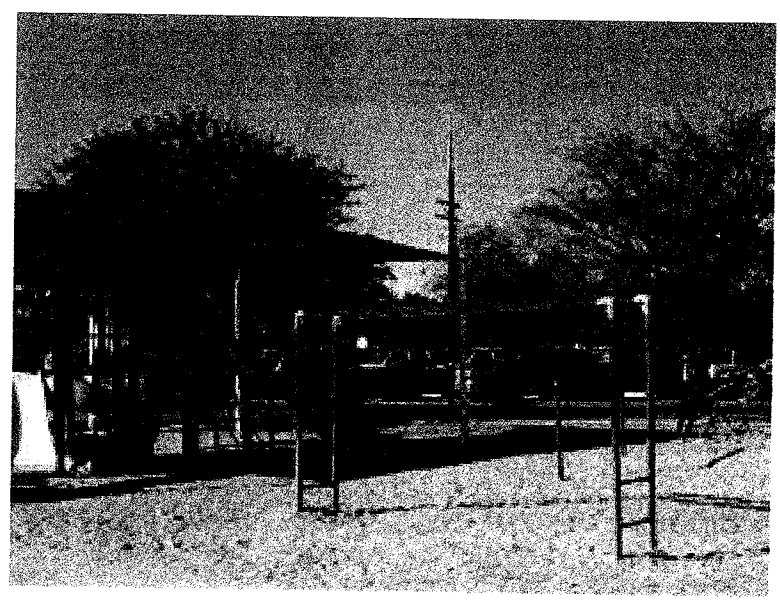
- Lead teacher seemed somewhat resistant to vegetation integration and didn't feel it would be that beneficial to children

Opportunities:

- Space is ample and the need for additional shade, especially in the larger play are, is great
- Existing vegetation has many play values, particularly manipulative parts, that could be integrated into the curriculum (raking leaves, art and math projects using mesquite pods)

Figure 7. Site 7 photographs





Site 8 (Figure 8)

Site 8 is located on the East side of Tucson in a classroom within a public school building. The interior of the classroom is beautifully decorated with many details such as small baskets of fruit on the snack tables, off-white fabric draped over comfortable oversized chairs and large black and white photographs of each child along the wall. Though the outdoor space does not approach this level of attention to detail, there are many positive features. A memorial garden adds diverse vegetation and the presence of a large alleppo pine (Pinus halepensis) and olive (Olea europaea) add shade and plant parts. This site had, at the time of the assessment, 2 pyracantha shrubs, one which formed a perfect refuge space. It was later pruned out of that form and finally removed because of the thorns. However, the lead teacher said that the play area boundaries were being extended to include some other trees, including a large mesquite. Responses to interview questions at this site were very detailed and lengthy, suggesting a high value placed on a curriculum that includes plants and nature at every available opportunity. This teacher even bought raincoats for all the children so that they could play outdoors in any weather.

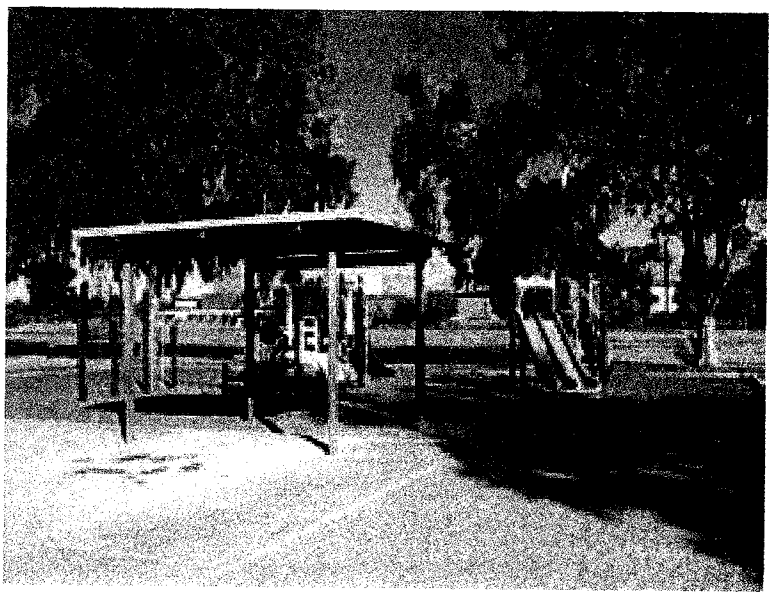
Constraints:

- Public school setting limits planting options

Opportunities:

- Nature and vegetation seem to be valued more at this particular public school and the school regularly obtains grants for nature-oriented projects, such as schoolyard habitat

Figure 8. Site 8 photographs



Site 9 (Figure 9)

Site 9 is located on the Northeast side of Tucson and is a private preschool and kindergarten in a freestanding facility near commercial and residential properties. The play areas have been designed around large, existing vegetation, mostly ironwoods (*Olneya tesota*) and mesquites (*Prosopis*). Play structures were designed and built by the owners and are made of wood and this was one of only 2 sites in the study with a climbing tree. The owner/director is a strong believer in planting trees, mainly because, as she stated, "It makes it feel less institutional." She felt that teachers didn't do as much as she would like to teach about plants, nature and the curriculum, but that they often use recycled materials in their craft projects. Occasionally she will take children to her 2-acre property to wander in the desert. She felt that children in her program had few to no opportunities to play outdoors outside school because most have working parents and don't get home until dinnertime.

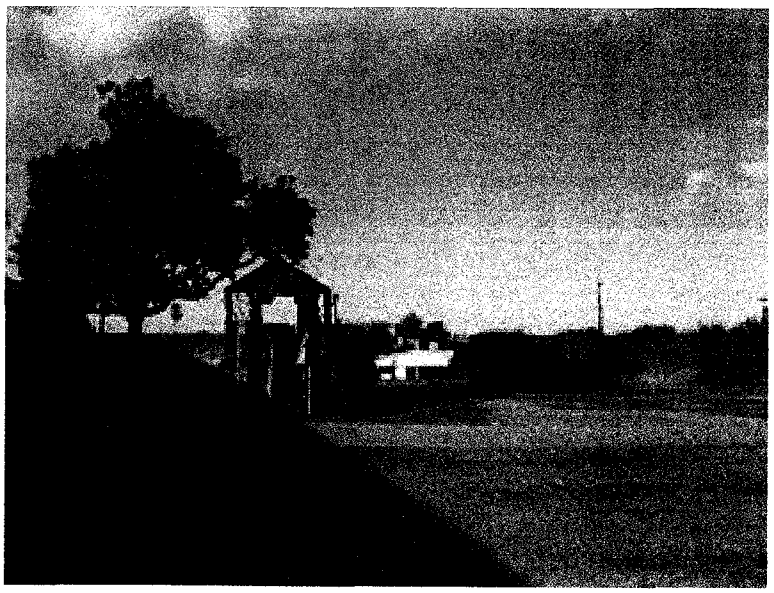
Constraints:

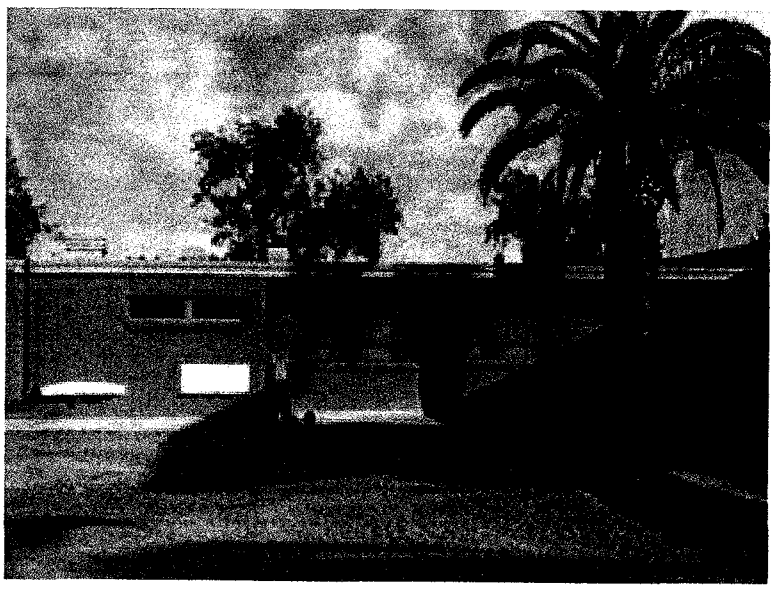
- Director is supportive of vegetation use mostly for aesthetic reasons, not necessarily as a part of curriculum

Opportunities:

- Facility is owned by director, who is open to ideas on how to better use and integrate vegetation
- Much of the vegetation is mature and integrating more vegetation with diverse growth structures and play values could really enhance this play area which already has a strong natural feel.

Figure 9. Site 9 photographs





Site 10 (Figure 10)

Site 10 is located on the East side of Tucson in a classroom within a public school building. The play area is a courtyard space with many positive features, including a stage area and raised planters, currently used for vegetable gardening and also containing several mealy cup sage plants (*Salvia farinacea*). A large common privet (*Ligustrum lucidum*) tree stands next to an all-in-one play structure and a large bush lantana (*Lantana camara*) is planted near the back wall. The class had also just planted 5 vine plants against a small stretch of wall. The lead teacher was very interested in how vegetation could be integrated into the yard and said that she could easily procure free plants and dig planting holes. However, she also said that the irrigation system needed upgrading and that the school district was reluctant to spend the money. She mentioned that children often used the flowers and berries (which she did not realize were poisonous) from the lantana to make crowns or to decorate mud pies. While she didn't do anything specific to teach children about the desert, she included nature in many indirect and vicarious ways in her curriculum.

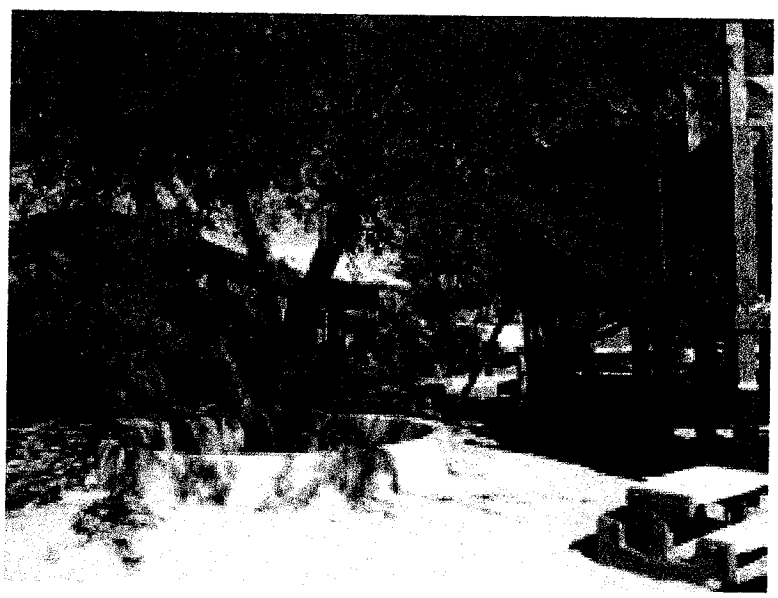
Constraints:

- Adding and maintaining vegetation seems to rely on extra work of already overworked teachers, without a great deal of support from the school

Opportunities:

- The lead teacher was one of few to report "picking things" as a vegetation value
- The play area has been enhanced slowly with vegetation and indirect and vicarious experiences with vegetation are frequent.

Figure 10. Site 10 photographs



Site 11 (Figure 11)

Site 11 is located on the West side of Tucson in a classroom within a public school building. This program uses two separate play areas, one a courtyard space and one a part of the school playground. The courtyard was clearly identifiable as a preschool play area, with a sandbox built around a velvet ash (*Fraxinus velutina*), a tricycle path with children's handprints pressed into the concrete and a yellow picket fence demarcating the vegetable garden. Raised brick planters and planting beds along the perimeter contained a variety of vegetation, including some rose bushes. However, much of the vegetation was not very well maintained and set against a wall so that it could not be used as refuge. Furthermore, the species provided few play values. The other yard had mainly large, inaccessible trees and metal play equipment set in a sand area. The program is bilingual, with much of the instruction in Spanish. During my visit, the teachers took children into the courtyard to practice Mexican dances. The lead teacher did not indicate verbally that he felt vegetation was valuable for more than shade and science activities. To study the desert, students take notebooks and identify plants and animals at Tohono Chul Park, a local desert botanical garden.

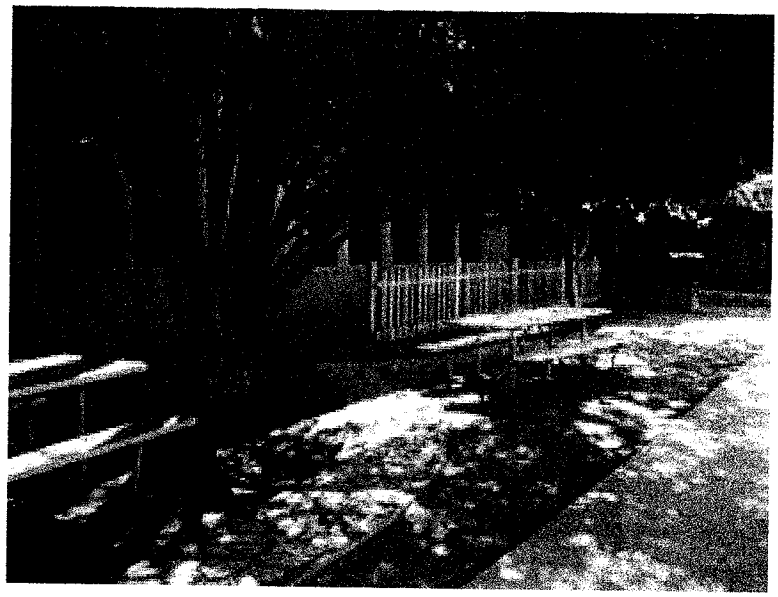
Constraints:

- Maintenance appears to be inconsistent and choice of existing plants is not optimal for young children

Opportunities:

- Replacing some of the inappropriate plants with species of higher play values would not be difficult

Figure 11. Site 11 photographs



Site 12 (Figure 12)

Site 12 is located in an upper middle class residential neighborhood on the North side of Tucson. It is a private preschool with a special needs class that is funded by the public school district. The building was formerly a private residence converted into a school, so much of the existing vegetation, such as foundation plantings of mock orange (*Pittosporum tobira*) and yew pine (*Podocarpus macrophyllus*) is left. Several trees, mainly velvet ash (*Fraxinus velutina*) were purchased and planted by parents. A large Foothills Palo Verde (*Cercidium microphyllum*) is the focal point and holds two bird feeders. Adjacent to it is the recently planted bird and butterfly garden in an area that used to contain rosebushes. This school was ranked high in all areas assessed because of high species richness and a high "visibility" or value placed on vegetation by the director. She was also one of the only educators who seemed to define environmental curriculum as needing to be meaningful and ongoing, both qualities recommended by the NAEYC.

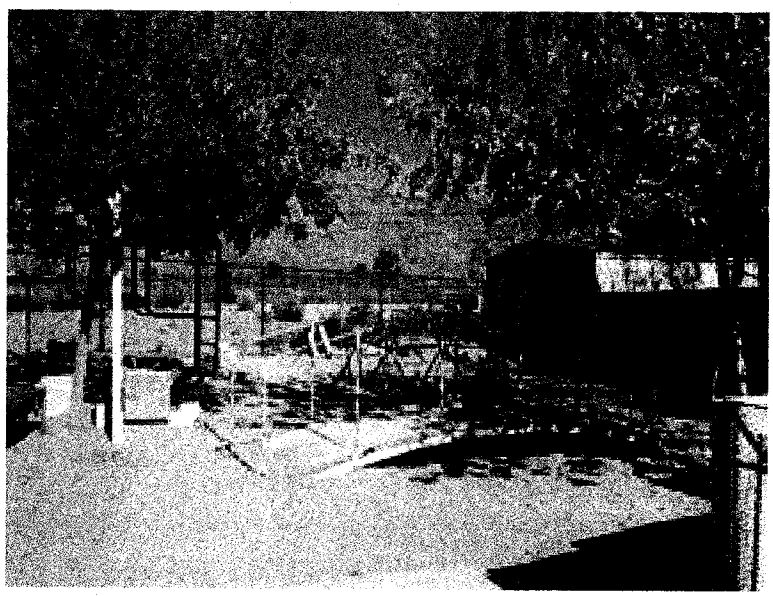
Constraints:

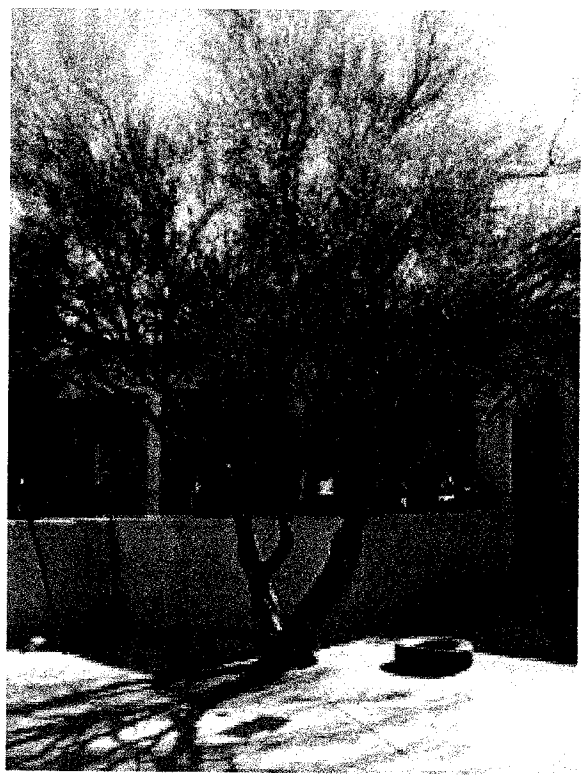
- The play area is small and there is ample vegetation as well as "loose parts", leaving little open space.

Opportunities:

- This is one situation in which removing vegetation that is no-native and has low play value and slightly modifying the space would be more valuable that adding vegetation.

Figure 12. Site 12 photographs





Site 13 (Figure 13)

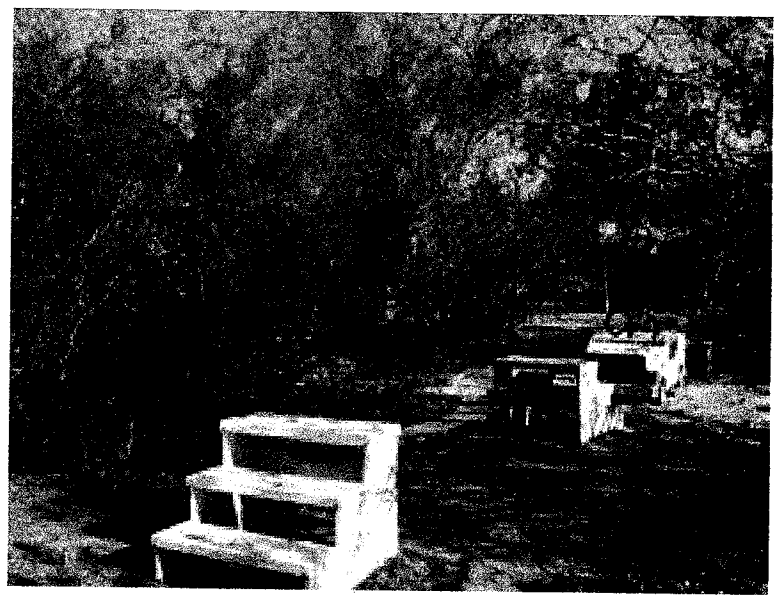
Site 13 is located in central Tucson in a self contained building within a residential neighborhood. It is a private parent cooperative preschool and kindergarten that has been in existence for over 50 years. Vegetation and outdoor play have always been prioritized and this is reflected in vegetation density, species richness, and play value. The school has 3 separate play areas as well as a "meeting" area in front with a popular climbing tree. Two of the other areas have climbing trees as well and the all areas have vegetated refuge spaces. Edible plants are present and native vegetation accounts for 74% of the plant density. The play areas also use other natural elements such as logs, boulders and large river rocks that can be moved by children. Recently a water harvesting system has been installed to use rainwater for irrigation and play. This site is only one of 3 that does not have an all-in-one play structure. However, it does have several separate play pieces and in some cases, they are integrated with vegetation. For example, a metal climber with a rope is set among the branches of a large whitethorn acacia (*Acacia constricta*) climbing tree so that children can go from climber to tree and also feel as though they are in the tree when on the climber.

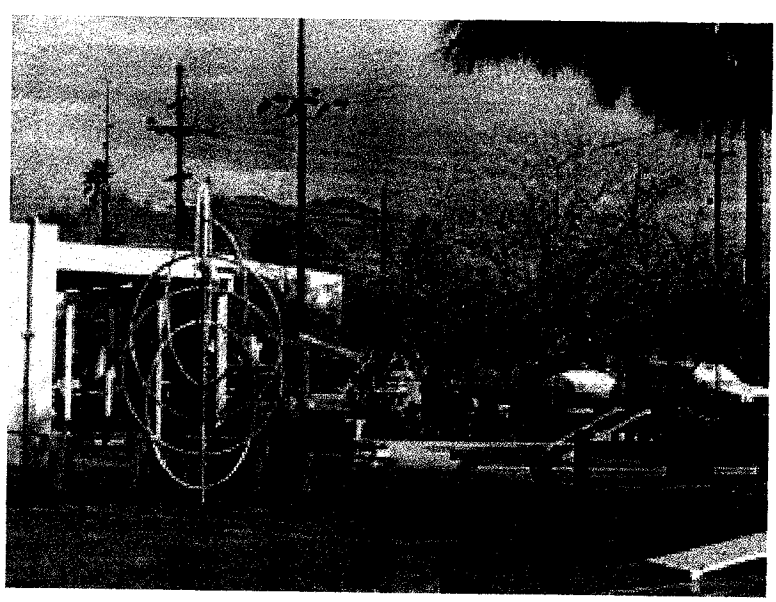
Constraints:

- There are few small shrubs and flowering plants

Opportunities:

This site could be used to observe young children playing in an environment in which vegetation provides many potential values and native vegetation and as a model for other schools wishing to integrate vegetation with built elements.





Summary of Results

What are the implications of these results and how do they provide new knowledge for educators and designers? The major implications are:

1) Vegetation species in these environments consists primarily of non-native, single trunk tree species, many at a scale that is not proportional to the scale of young children. As a result, the existing vegetation does not support regional or structural richness.
2) Existing vegetation in these environments rarely or never includes the potential play values of providing structure for climbing or enclosure or refuge spaces for dramatic play opportunities values regarded as being very important in the literature for physical and socio-emotional development as well as in adult memories of childhood. (Moore, 2002; Francis, 1995; Olds; Kirkby, 1984)
3) The proportion of vegetation and other natural features varies greatly among accredited schools compared to the proportion and presence of built elements, consistent with the literature citing a bias towards built play structures over natural elements (White and Stoeklin, 1998; Herrington, 1997)
4) Vegetation is valued by educators primarily for shade, beauty and a source of science concepts, but rarely for the specific qualities assessed, in particular the more activity oriented values of tree climbing, refuge space, and manipulative play parts.
5) The curriculum used to teach children about plants, nature and the environment does not consistently include a focus on the desert region, use of direct

experiences with nature, use of the outdoors, or use of vegetation, all regarded as being important in the literature and by NAEYC curriculum standards.

6) A loose correlation is suggested between vegetation visibility and potential play value (PPV) of existing vegetation. However, more important is the implication that even sites with high PPV may not be using the vegetation to its full potential due to low visibility or value of vegetation reported by educators.
7) Overall ranking of sites suggests a correlation between the presence of both high vegetation presence and visibility with sites that are privately funded and serve middle to upper class children, a phenomenon found in the literature (Wilson, 1996). This is inconclusive due to the relatively small number of private programs in the study (3) and requires further investigation. Site 4, a public program in a low socioeconomic area had little vegetation density but a high degree vegetation visibility suggested by educator responses would be a good site in which to study more closely the relative significance of vegetation visibility to vegetation presence. Also, Site 8 is an excellent example of how a publicly funded program housed in a public school facility appears to combine vegetation richness and high educator "visibility" to create a diverse and valuable outdoor learning environment and would also be a good site to use in future research.

Discussion

Interestingly, the indoor environments of the 13 sites maintained a great deal of consistency in that they were all well-organized, warm and inviting, with children's work

displayed with great care. Similarly, the teachers I encountered were also consistently well-educated, genuinely friendly and obviously dedicated to their work. The variation in the outdoor environments in the degree of vegetation and natural features present suggests that the accreditation criteria of the NAEYC is not addressing the quality of "naturalness" in outdoor environments, and subsequently not providing adequate teacher training about the topic. While variety and complexity of play may be accomplished through the presence of built structures and play equipment, the unique and necessary relationship to nature is largely missing and the presence of nature as reflected by vegetation seems more a function of chance or a school's available funding. The sad corollary to this may be that nature is being made available only to privileged children who are also more likely to be given experiences with vegetation outside school. When educators were asked "How many experiences do you believe the children in your program have to play outdoors outside school?" over half believed the children had few to no opportunities, mostly due to time constraints and parental fears. Educators reported that many children in their programs live in apartments and unsafe neighborhoods. Those who believed children had many experiences to play outdoors often cited play in more controlled or sparsely vegetated environments such as soccer fields or school playgrounds. Clearly the integration of appropriate vegetation and natural features should be prioritized in the design of play environments for young children and professionals involved in the planning of these spaces play a critical role in addressing these needs through deliberate education, the creation of vegetation guidelines and recommendations for vegetation integration and use. Through education of both teachers

and designers, vegetation may become more "visible", increasing the opportunities for children to have frequent and diverse experiences with it.

CONCLUSIONS

Application and Future Potential Research

This study could be expanded in several ways, including refinement and application of the assessment to other sites in which young children are potential users, such as public parks and urban plazas. More collaborations between landscape architects and educators could result in development of early childhood environments that incorporate carefully selected vegetation and other natural features and that serve children of varying socio-economic backgrounds. These sites could then be used in the same way as the UC Davis Infant Garden to study in-depth the impacts that natural elements have on behavior, environmental ethics, maintenance and safety through direct observation and longitudinal studies. Furthermore, the information gained regarding appropriate plant species could result in regionally appropriate plant selection guides for children's environments as well as curriculum that integrates vegetation. This is a need that was expressed by several educators interviewed in the study.

A recurring problem in the design of outdoor environments for children is that designers often apply their perceptions of what they think children like rather than considering what children need and how they play. This is especially true with young children, who require a delicate balance of safety, supervision and controlled risk as well as plentiful and indestructible materials and settings that are at their scale. While vegetation is certainly not the only element necessary for a quality early childhood outdoor environment, this study illustrates how vegetation combined with an adult

consciousness of its potential value can greatly contribute to the play and education of young children.

Conclusion

Clearly there is a relationship between what we value and the physical manifestation of that value. If we value more technologically-advanced, built elements over the elements of our natural world that truly sustain us, we will see the proliferation of the man-made at the expense of nature. Diminished contact with nature during childhood may result in memories that do not include the strong sensory qualities that vegetation has to offer and future generations may have even less regard for environmental concerns than ours. Integration of vegetation in environments of play seems a logical step in the direction of ensuring the future appreciation of the natural environment as well as providing memorable learning experiences for children that are necessary for their healthy development.

"If we assume that early childhood experience becomes embedded in the psyche of healthy adults, permanently affecting their behavior, attitudes and values, then we had better start paying greater attention to the quality of the environments where those dimensions of personality have their experiential roots."

-Robin Moore (2001)

APPENDIX A

DATA COLLECTION SHEET

Site name and #: **Date of assessment:**

Type of facility: classroom in school, self-contained building, self-contained portable, other:

Approximate sq. footage of play area:

Total # plants :

 # native species :

Lawn: yes no **condition**: good medium poor

Outdoor gardening: yes no **type:** container, in-ground, other:

Other natural elements present: sand, wood chips, boulders, water, stones, other:

Built elements : permanent all-in-one play equipment, permanent equipment pieces, stored equipment, shade structures, other:

Plant species name	Type	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S

DATA COLLECTION SHEET continued

Interactions between children and vegetation spontaneously observed or described by teacher?
yes no
Describe:

Questions for directors/lead teachers: Teacher or Director name:

1. **How do you believe vegetation can contribute and be valuable to an outdoor play area for young children?**

2. **What do you do in your curriculum to teach children about plants, nature and the environment?**

   Do you do anything specifically related to the desert?

3. **How many opportunities do you believe the children in your program have to play outdoors outside school? (many, some, few)**

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