Greening Montessori School Grounds by Design

by Robin Moore and Nilda Cosco

Robin Moore and Nilda Cosco view the Montessori approach to the prepared environment as overlapping their understanding of the naturalization of school grounds. As they present the possibilities for a naturalized setting to overcome sedentary lifestyles and maximize learning in the outdoors, they establish necessary components for success: professional design, careful attention to surface drainage, thoughtful use of a hierarchy of pathways, variety in elevation, transitional shelters and terraces, moveable parts, restoration of wild places, inclusion of fruit-bearing species, and, above all, establishing a sense of place.

Because of the growing concern that children are not spending enough time outdoors in contact with the natural world (most recently highlighted by Richard Louv's *Last Child in the Woods: Saving Our Children from Nature Deficit Disorder*), Montessori schools are seeking help to naturalize their grounds.

This green desire is also driven by a renewed interest in Maria Montessori's insistence on the importance of hands-on experience of nature as a vehicle for implementing the Montessori curriculum and her visionary interest in transition spaces connecting classrooms to the outdoors (see Figure 1, opposite page). NAMTA initiatives in the last couple of decades have reaffirmed for teachers the potency of everyday experience of nature to instill a sense of the oneness of planetary life and of our place in the universe by feeding young children's imaginations.

A focus on nature has a double significance. First, it addresses the emerging sedentary lifestyle health crisis (Berkowitz et al.). Even though this is a complex, perplexing issue, two causes are crystal clear. Children are not spending enough time outdoors, neither moving their bodies in sustained moderate-to-vigorous physical activity for sufficient periods of time, nor interacting with their surroundings and each other in ways that ensure their proper physiological, psychological, and social development. Lack of movement means insufficient energy expenditure to metabolize food intake, which, as we know, has increased substantially over the last several years. "Calories in" and "calories out" to an alarming degree no longer equate (American Obesity Association).

Second, of direct relevance to Montessorians (and, indeed, progressive educators in general) is the potential of a carefully and deliberately *designed* and *prepared* naturalized outdoor environment for engaging teachers and learners across the curriculum (Cosco et al.). Lushly naturalized school grounds offer particular advantages difficult or impossible to offer in other ways (Fjørtoft).

Increased sensory stimulation is the most obvious benefit of naturalized spaces. Enveloped by colors and smells in spaces replete with ever-changing textures constantly responding to the passage of air, children become unified with their surroundings. This unique effect of nature may help explain its attention-focusing impacts—even suggesting that nature exposure may be a treatment for attention deficit disorder (Faber Taylor et al.; Kuo; Wells).

Inclusiveness is another but less obvious benefit. Nature is an integrating medium for children by age, gender, ethnic/racial difference, learning styles, psychomotor skills, and personality traits. The dense diversity of life in natural settings offers a broad range of choice for children to engage their genetically endowed *curiosity* (Hannaford; Moore, "The Power of Nature"). There is no need to prompt children to investigate and discover the offerings of rich, natural settings—they just do it, simultaneously providing teachers with any number of possible connections for emergent Montessori curricular learning processes and content. However, the level of natural diversity must be sufficient and accessible to activate child-prompted processes and enable child-teacher collaboration in the learning

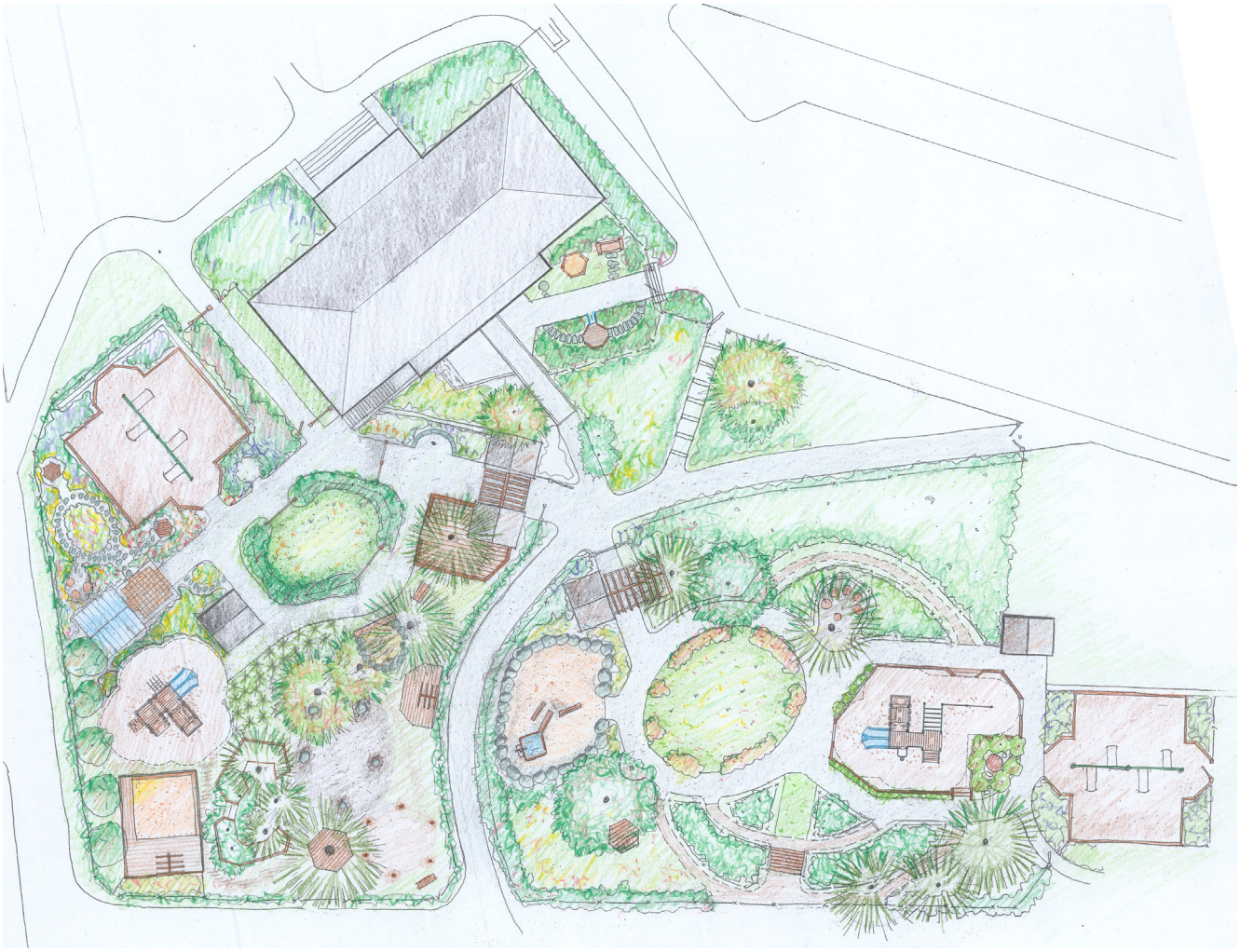

Figure 2. Layout of the renovated grounds of the Child Study Center, Wellesley College, Massachusetts. A system of looping paths links a diversity of natural settings. Design: the Natural Learning Initiative. Courtesy of Robin Moore and Nilda Cosco

process, and the space must be designed to retain its lush quality.

Renovation and New Construction

This article addresses school grounds renovation as well as new construction. Both are important. As hundreds of Montessori schools have been built in North America and around the world, renovation is a pressing need. New construction presents its own challenges—especially for educators who have had no construction experience. The good news is, if an appropriate design is developed from the beginning, expensive retrofitting will not have to be faced in the future.

Grounds vary in size, shape, topography, climatic zone, and vegetation cover as much as the schools that they are a part of. Some schools have ample space where all manner of settings are possible. At the other end of the spectrum are schools with restricted grounds that struggle to meet local or state space requirements. There are also sites that are classic examples of schools that have grown over many years without benefit of a master plan.

A General Construction Advisory

Over the last several years, the Natural Learning Initiative (NLI) has worked with approximately ten Montessori schools (and several other educationally progressive independent institutions; see Figure 2). Only two of these projects were for new construction from scratch on a virgin site. The majority included an addition to existing buildings as part of a school expansion plan. Often, however, this growth had not been addressed in the past through the development of a school expansion master plan. Thus, before we

could start work on the outdoor renovation plan, a time-consuming effort with the board of trustees was required to confirm the location and timing of proposed building expansion(s). In some cases, we have been called in when new construction was already underway or completed, usually presenting a design challenge if issues addressed below had been overlooked.

The focus of this article is *design* of the outdoor environment in such a way that the *prepared environment* (in the Montessori sense) is greatly facilitated. Based on our experiences over the last two decades, we would like to stress the following general advisory steps that apply to both new construction and renovation projects.

1. Master Plan

Develop a phased master plan for your school, projected at least twenty years into the future. Many schools start with a Montessori visionary and a dedicated group of parents. Often the first iteration of the school occupies a temporary building until capital has been raised for permanent quarters; perhaps initially a modest Children's House and single Lower Elementary classroom are all that can be afforded. However, as children age, parental pressure to expand continues to build year after year. Before too many years, Upper Elementary classrooms, and maybe even a middle school, are on the ground. If these inevitable expansions occur piecemeal and are not thought through as a unified, long-term vision for the school campus, the outdoors can end up becoming a fragmented mix, served by awkward, inefficient circulation—just to mention one of the many potential problems.

2. Seek Design Profession Advice

Seek advice from the state chapters of the American Institute of Architects and the American Society of Landscape Architects, if new construction is involved, about how to put together a "request for proposals" for professional design services and conduct a search for a design team. Don't make promises to the first architect that comes along. A parent architect or landscape architect can offer good advice about how to run a design team search, but may not be qualified by experience as a member of the team. Be careful to avoid potential conflicts of interest that could arise from employing a parent (or family relation) professional. Ensure that there is a formal, objective process in place and that an experienced landscape architect or landscape designer is on the team from the beginning. A reputable landscape "design-build" firm may also be appropriate. Whatever the choice, insist that a member of the architectural design team be certified by LEED (Leadership in Energy and Environmental Design, the primary developer of environmentally sustainable design in the United States) to ensure that sustainable design issues such as passive solar heating, natural air conditioning, day lighting, and water recycling are solidly addressed.

3. Civil Engineer

Ensure that a civil engineer is integrated into the team and that she or he is experienced and willing to implement the latest approaches to storm water runoff through rainwater harvesting and design of rainwater gardens to keep rainwater on site (see below), rather than traditional approaches of creating large, inconvenient "swales" to get the water into storm sewers as quickly as possible. When selecting a design team, probe deeply on these issues until you are satisfied that the technical design response will support your Montessori objectives. Ineffective surface drainage is the most common functional problem encountered in NLI's design assistance projects—not surprising, given the normal civil engineering approach, which treats the grounds of a school the same as a commercial landscape development, where, apart from gardens, a human footprint is unlikely to tread—let alone dozens of young children. In an office park, steeply banked swales (grassy, shallow, V-shaped ditches), large catch basins, and wet lawn are of no functional consequence. These same conditions in a school grounds can make them unusable.

4. Building Orientation

Ensure that the *building orientation* is such that all classrooms get sun exposure. In other words, avoid north-facing classrooms (south facing in the southern hemisphere). Correct orientation will ensure the feasibility of functional, plant-filled, sunny, indoor-outdoor transition spaces (see Figure 3).

5. Minimal Site Disturbance

Strongly stress to the design team that buildings and infrastructure should be located to minimize "site disturbance"—especially in relation to existing natural resources such as vegetation cover, mature trees, animal habitats, and natural streams.

Design Implementation

A full range of play and learning settings was previously described in *The NAMTA Journal* (Moore, "Outdoor Settings for Playing and Learning"). Here, a focused, two-step process of naturalization design is covered: first, designing and installing the *site infrastructure,* second, developing the *living landscape* as an ongoing process that can usually be linked to the curricular program.

Site Infrastructure

The two most common issues to be resolved before working on detailed design interventions are site circulation and site drainage. Typically, neither issue is appropriately addressed—if at all—in the initial building program. For most schools, getting the building constructed becomes an all-consuming task. The school grounds may receive some design attention earlier in the design process, but eventually concern for the grounds becomes overshadowed by the sheer drive to open the school doors on time, at the beginning of the school year. Now, two, three, or more years later, when the interior spaces of the buildings are operating smoothly, the dysfunctional, low quality grounds become the focus of attention.

Access and Parking

Carefully consider vehicular access, parking capacity, and pedestrian safety and comfort in the

Figure 3. Cloistered courtyard shades classroom but at the same time offers an intimate, transitional, sunny, sheltered space close at hand. Bright Horizons Design and Chris Smith with the Natural Learning Initiative. Courtesy of Robin Moore and Nilda Cosco

Figure 4. Protected, welcoming naturalized entry from parking area. Bright Horizons Child Development Center, SAS Institute, Cary, NC. Design: Leslie Booker. Courtesy of Robin Moore and Nilda Cosco

long-term site development. As the school expands, these needs will grow and become more serious functionally because of sheer size. There is nothing more disheartening than being forced into converting developed grounds into parking to fulfill local mandatory regulations. Realistically, set land aside in the master plan for this eventuality. Consider designing a group games open field with a prepared turf surface to accommodate overflow parking for occasional community events at the school. Make sure the entry driveway/vehicular approach to the school entrance will continue to serve efficient dropping off and picking up of children—including possible bus transportation (see Figure 4). Hurried parents, in the morning especially, do not need to suffer extra anxiety (then transferred to children) caused by hazardous, inconvenient drop-off and parking conditions.

Surface Drainage

School grounds surface drainage can be designed as a life-supporting system with finely differentiated lines of flow coinciding with appropriate division in the landscape between play and learning settings. The most common is alignment along the edge of pathways (see site circulation on the following page). Flows may also be designed as vegetated swales containing anti-erosion, wildlife-enhancing plantings (see Figure 5). The main point is that the surface drainage flows be more finely differentiated and be integrated into the design of other settings.

A growing number of communities have water quality and storm water management requirements, which should be viewed as opportunities for new types of enhanced learning settings. A required detention pond can be designed as a wildlife habitat

Figure 5. Vegetated swate ensures precipitation stays on site to recharge ground water to help sustain the local ecosystem. Courtesy of Robin Moore and Nilda Cosco

and as a place for special study. Although enclosed for safety reasons, it can be an exciting destination for classroom field investigation trips.

Site Circulation

Apart from surface drainage, effective site circulation is the most important aspect of the site master plan. Circulation is expressed as a pathway system, the purpose of which is to enable children and teachers to have safe, extensive access and intimate contact with the natural settings designed into the grounds. Pathways enable children to go on journeys through the landscape, exploring along the way, playing with friends, interacting with wildlife, collecting natural objects, imagining, immersed in sensory richness. Pathways are not only routes connecting different settings but offer channels of experience enhanced by adjacent beds of colorful, textured, aromatic planting. Arbors and low trees arching overhead may extend the third dimension. Benches offer resting places. The scale of pathways and related natural settings must be designed to expand in territorial scale with age. Access to a constantly changing, rich natural landscape will entice children to enjoy rediscovering it day after day. A hierarchy of three types of pathways (primary, secondary, and tertiary) can be considered. Together, they serve a variety of functions.

Primary pathways are a functional necessity. They should be designed to provide easy, attractive circulation throughout the outdoor space and connect classrooms to their respective play and learning settings. Primary pathways provide spatial structure and allow children and teachers to move easily and quickly through the space when necessary (see Figure 6). To satisfy accessibility requirements, primary pathways should also be designed to serve as accessible routes. Design specifics include the following:

- Wide curves and a minimum width of five feet will accommodate intense pedestrian traffic.

- Gently curving forms integrated with adjacent plantings and other play and learning settings will satisfy access requirements and provide an interesting, exploratory movement experience. Alignment should avoid sharp corners, bottlenecks, and dead ends.

- Small side niches can be designed to add interest and opportunities for group interaction and exploration.

- Primary path surfaces should be smooth and flat. Longitudinal slopes should not exceed twelve percent and should be limited in length. A cross-slope of not less than two percent should be provided for positive drainage.

- Concrete primary paths are preferable. As they are being poured, children may leave hand, foot, or leaf imprints in the wet surface (make sure hands are washed immediately). Alternatively, small, circular cut-outs eighteen inches (forty-five centimeters) in diameter may be left for children and teachers to later inset with artwork using pebbles, tiles, glass beads, broken china, and other interesting objects. Tinted concrete can be used to add visual appeal and blend with adjacent natural colors for a small additional cost.

- Asphalt is an acceptable primary pathway surface. However, its bland dark grey color is unattractive and provides low figure-ground contrast for visual orientation of children. Asphalt absorbs heat in the summer and can become unbearably hot in direct sun unless painted with special asphalt paint (available in many colors).

Secondary pathways should be considered as an independent circulation system intersecting with the primary pathway system, connecting intimate play and learning settings such as wildlife habitats, gathering places, sand-and-water-play settings, sensory mazes, storytelling corners, and flower and vegetable gardens. Widths can be as narrow as thirty inches (ninety centimeters). Appropriate surfacing materials include shredded hardwood mulch, gravel, decomposed granite (preferably with a polymer binder), and timber decking (see Figure 7).

Tertiary pathways may be considered as small-scale "animal runs" that can allow children to take short, perceived by children as "secret" exploratory journeys into intimate landscape settings. They can branch directly from primary or secondary paths and be as narrow as eighteen inches (forty-five centimeters) and just a few feet or meters long. They may be surfaced with the same materials as secondary pathways or designed with stepping-stones or slices of timber (see Figure 8).

Gathering/Meeting/Working Settings

Pathways afford movement through and in the landscape. Children together and children working with teachers also need places to meet, to work on outdoor projects, to collect and organize samples, conduct field observations, compile records, write field notes, etc. Think of these settings collectively as a substantial expansion (doubling) of indoor classroom space.

Depending on the children's age, outdoor activities may be supported by a variety of settings. Ground-level wooden decks are appropriate for children

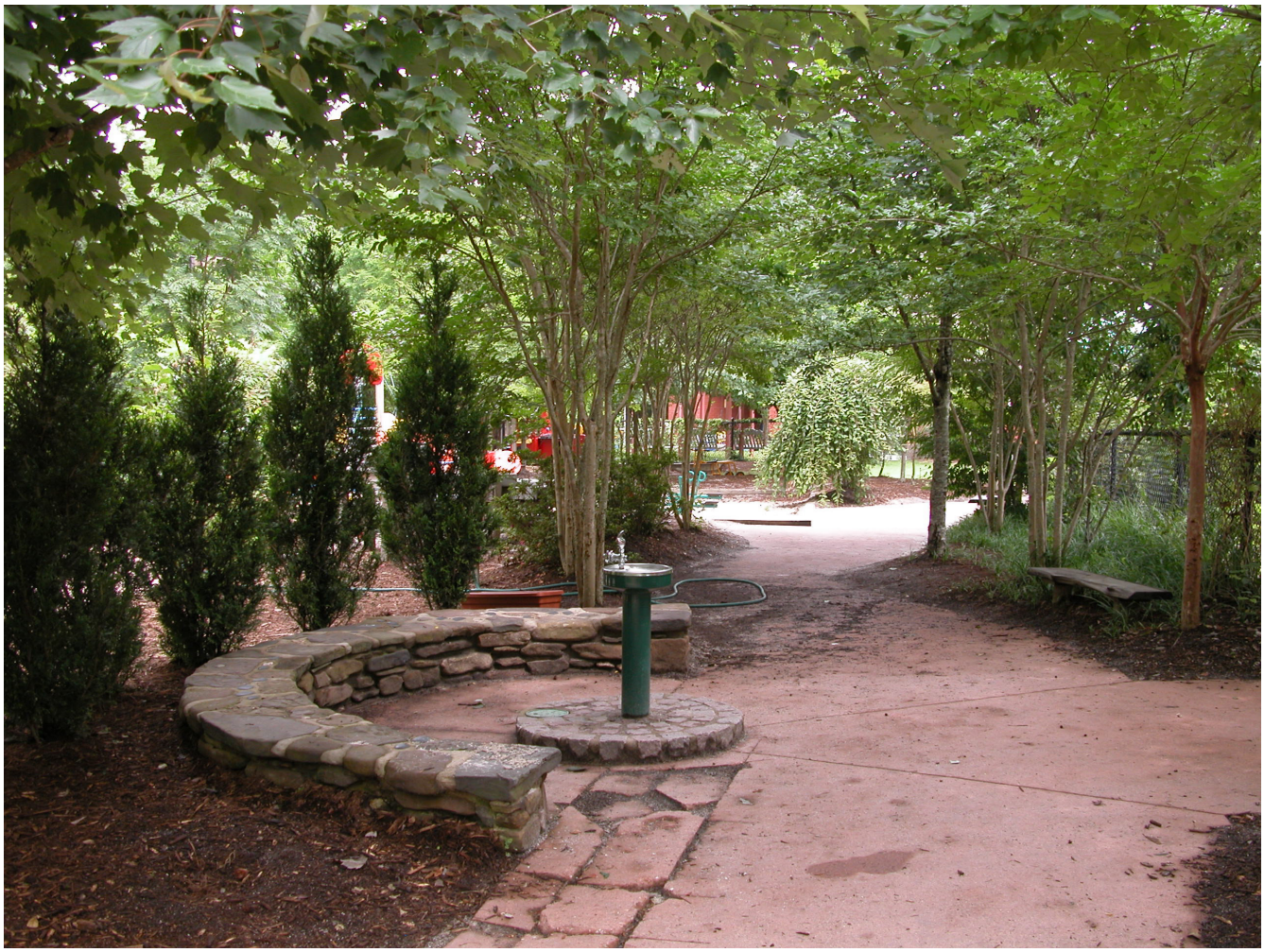

Figure 6. Shady, curvy, richly planted, hard-surfaced primary pathway connects to community settings such as a drinking fountain, gathering spot, and many other settings. Bright Horizons Child Development Center at GlaxoSmithKline. Design: the Natural Learning Initiative. Courtesy of Robin Moore and Nilda Cosco

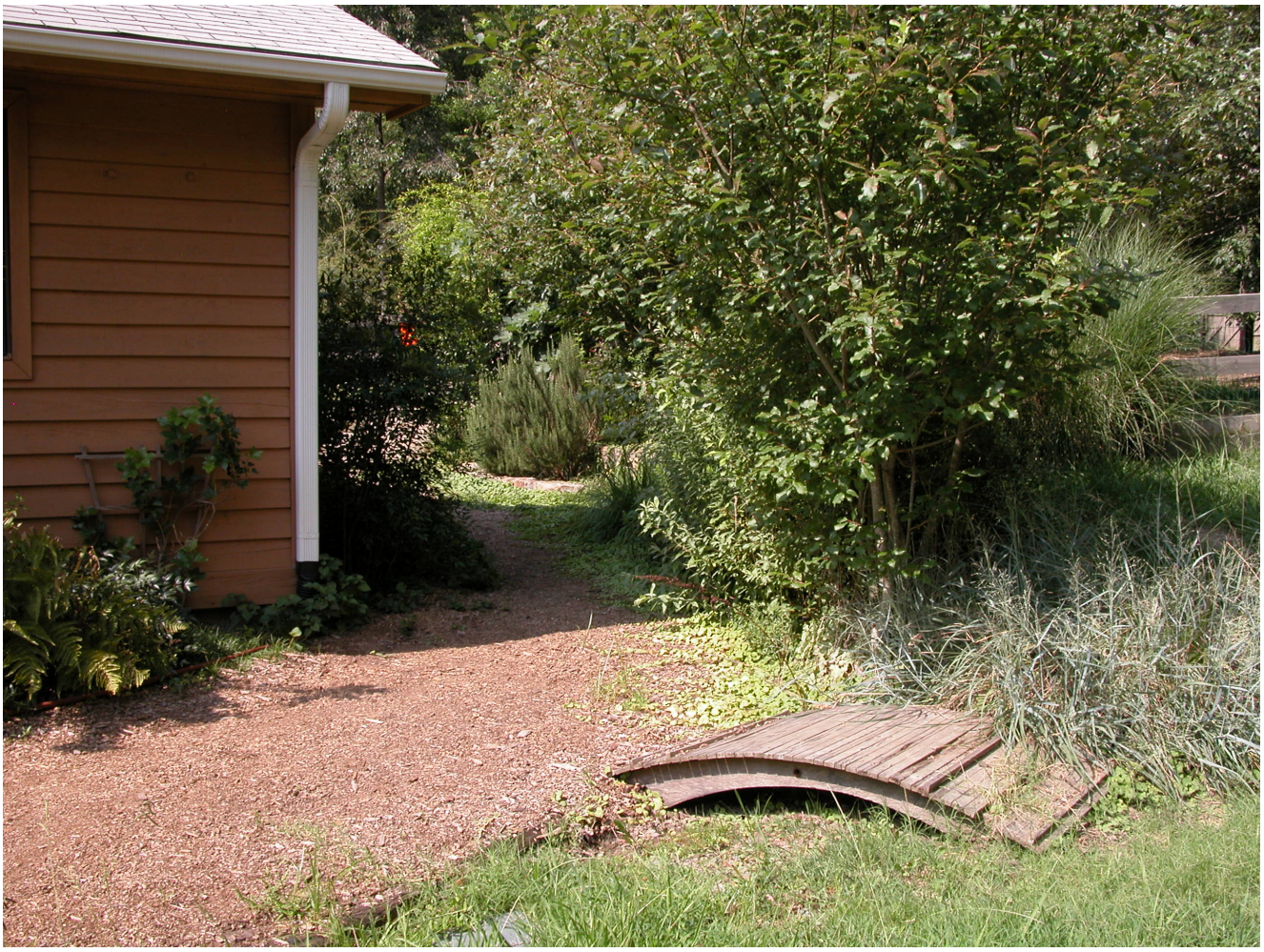

Figure 7. Soft-surfaced secondary pathway offers children daily exploration of the natural world. Courtesy of Robin Moore and Nilda Cosco

Figure 8. Narrow tertiary pathways offer children the quiet, intimate sensory stimulation of nature. Bright Horizons Child Development Center, SAS Institute, Cary, NC. Design-build: Chris Smith with the Natural Learning Initiative. Courtesy of Robin Moore and Nilda Cosco

three to six years old, or more dramatic elevations may be available (see Figure 9). Lower and Upper Elementary children will feel more comfortable at worktables. Upper Elementary and middle school ages may spend whole periods outside and require a covered setting with tools and materials available. Classroom groups of all ages benefit from outdoor classroom settings where extensive curricular activity can be conducted (see Figure 10). Such settings may be large enough to accommodate a whole class, roofed over to shelter from the rain, and partially enclosed, depending on the level of climatic protection desired. Whatever form the design may take (which may resemble the transitional spaces described next), this type of outdoor classroom can substantially change curricular dynamics by opening up the possibility of extended periods of learning in the outdoors, setting in motion a model of Montessori education that logically leads towards the Erdkinder middle school as exemplified by the Hershey Montessori School's Adolescent Community, a Montessori farm school model (Huntsburg, OH), where the "school" becomes a cluster of indoor/outdoor spaces, each devoted to a specialized, hands-on function.

Indoor-Outdoor Transitions

Where classrooms meet the outdoors are crucial spaces that, with appropriate design, can substantially expand the repertoire of learning activity (see Figure 11). In cold, harsh climates, winter gardens or conservatory-type glazed settings can serve as sheltered transition spaces between classroom and outdoors. Indoor plants and seedlings can flourish there for later outdoor planting. Unfortunately there are few design precedents for these types of spaces. Architects are either unaware of their importance, and/or there is insufficient collaboration between architect, landscape architect, and teachers to create them.

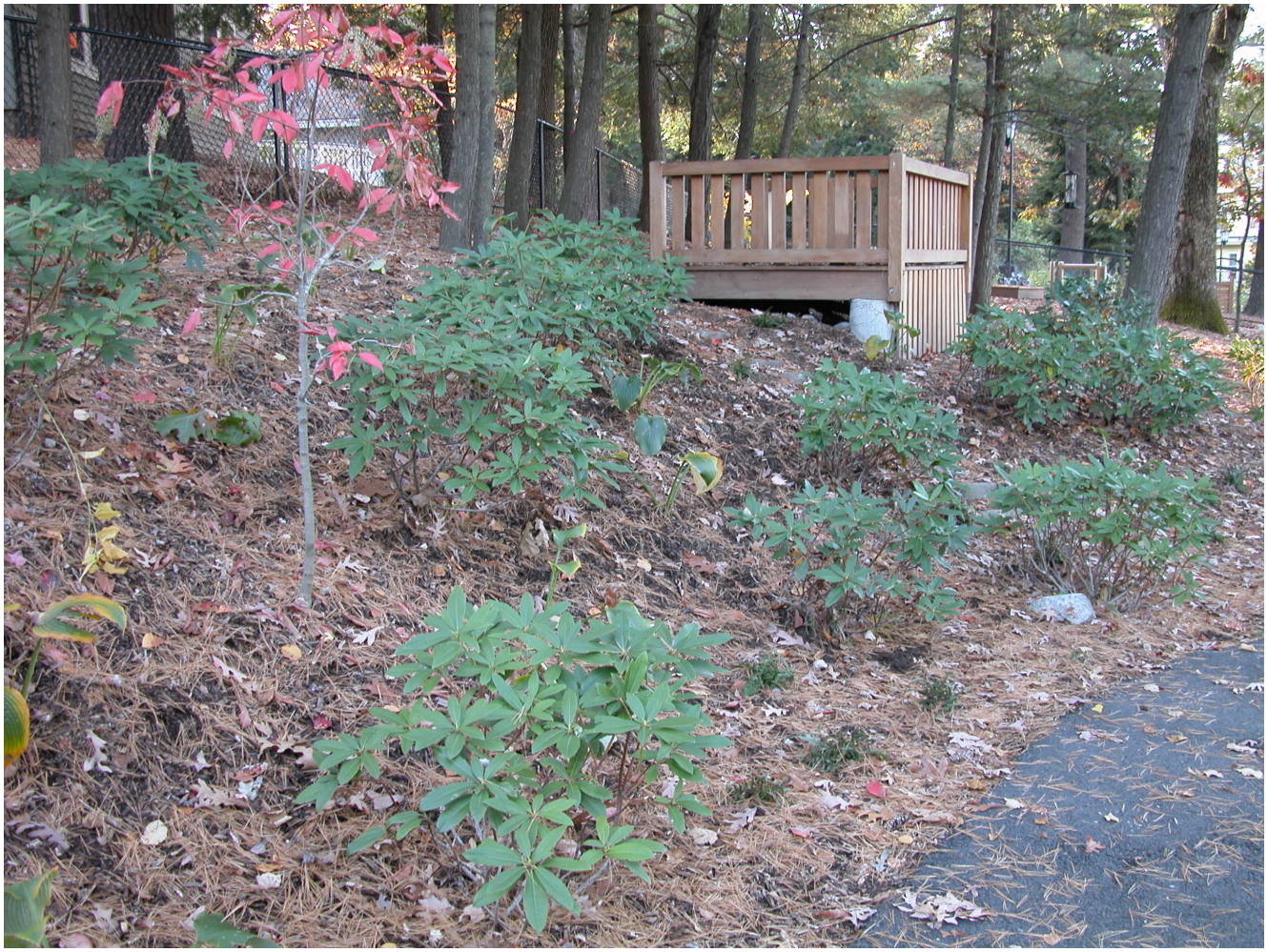

Figure 9. An elevated hillside deck offers children a commanding, secluded (yet visible to teachers) "prospect and refuge" at the Child Study Center, Wellesley College, Massachusetts. Design: the Natural Learning Initiative. Courtesy of Robin Moore and Nilda Cosco

Figure 10. Indoors moves outdoors in this ample, translucent, covered outdoor classroom. Bright Horizons Child Development Center at GlaxoSmithKline. Design-build: Chris Smith with the Natural Learning Institute. Courtesy of Robin Moore and Nilda Cosco

The Living Landscape

Once the grounds are served by a circulation system and related gathering/meeting/working settings, the spaces between, depending on topography, sun exposure, and existing vegetation (if any) offer a vast array of possible natural treatments. Aquatic settings described earlier offer one such possibility (see Figure 12). Other possibilities include flower and vegetable gardening (a key priority for healthy nutrition education; see Figure 13), fruiting orchards, and native habitats (butterflies, birds, amphibians, terrestrial insects; see Figure 14). Settings may be project-focused and include shelter building, craftwork with natural materials including the making of fired clay utensils, cooking, natural dyeing, and many other possibilities linked to studies of indigenous cultures and geography (see Figure 15).

Pedagogy in Place

Once the site infrastructure is in place, development of a nature-based Montessori curriculum depends largely on progressive pedagogical leadership to inspire sufficiently trained teachers to enthusiastically embrace the challenge of creating a place where pedagogy and designed landscape can be integrated (see Figure 16).

The impact of natural settings on children's emotional development and functional behavior is impressive and promising. Recent empirical research has produced dramatic evidence to support historical assertions that natural surroundings, even as little as a view of nature from indoors, can positively affect cognitive functioning (Wells), improve attention functioning, and thereby reduce symptoms for children with attention deficits (Faber Taylor et al.).

Figure 11. Transition area and outdoor classrooms. Children's House, Montessori School of Raleigh. Courtesy of Robin Moore and Nilda Cosco

Figure 12. Rain gardens are easy to install in a wet depression. Common aquatic plants rapidly establish themselves to create a mini-ecosystem attractive to a multitude of birds and insects. Courtesy of Robin Moore and Nilda Cosco

These data reinforce more general research conclusions that suggest better attention functioning and learning outcomes are linked to a variety of nature experiences such as gardening, viewing slides of nature, and simply having grass and trees in one's outdoor setting (Wells; Kaplan; Kuo; Faber Taylor et al.). Environments that are bland and bare or lack opportunities for hands-on activities become boring. Such environments actually provoke antisocial behavior in children and are not conducive to learning (Moore & Wong).

Territorial range development recognizes that maturing individuals explore, discover, and make sense of their expanding world through experience, learned skills, and spatial understanding (Moore, "Playgrounds at the Crossroads"; Moore & Young; Hart). To maintain this dynamic relationship with the environment, children repeatedly act at their territorial limits, constantly expanding the "known"

Figure 13. Easy to build multilevel learning garden. Construction above ground offers children a more comfortable, accessible working surface and provides space for higher quality planting mix. Courtesy of Robin Moore and Nilda Cosco

Figure 14. Moveable rocks offer children an irresistable urge to explore and discover what lives underneath. Courtesy of Robin Moore and Nilda Cosco

Figure 15. Rough ground in the edge of the school grounds offers learning opportunities for larger scale, hands-on projects. Courtesy of Robin Moore and Nilda Cosco

Figure 16. Fruiting plants such as grape vines provide opportunities for learning expeditions outdoors. Courtesy of Robin Moore and Nilda Cosco

world by pressing against the "unknown" (see Figure 17). For children to exercise their exploratory skills beyond the known, space must be designed with soft, extendable territorial boundaries. Territorial development, natural settings, and the learning they afford focus children's attention day after day as they progress through the school. Across successive generations experiencing a co-created landscape, children and teachers continue to evolve an outdoor culture that helps the whole school community understand their place in the universe.

Applied to design, this view of territorial development provides individuals with a landscape offering new exploration challenges and discoveries (see Figure 18) with each visit as well as novel educational opportunities. Given the range of ages, levels of ability, and variety of inter-personal relationships present among children, environments

Figure 17. Children explore the edge of their known world at further reaches of their school ground territory. Courtesy of Robin Moore and Nilda Cosco

with higher levels of diversity are likely to satisfy the exploratory needs of more children at any given moment. School grounds with effective territorial range development would thus hold the interest and attention of children regardless of their ability or learning style. Territorial design will similarly motivate the continuing interest of teachers who will be as excited to go outdoors as their children and feel comfortable once they are there. The greening of school grounds will then bear expected fruit.

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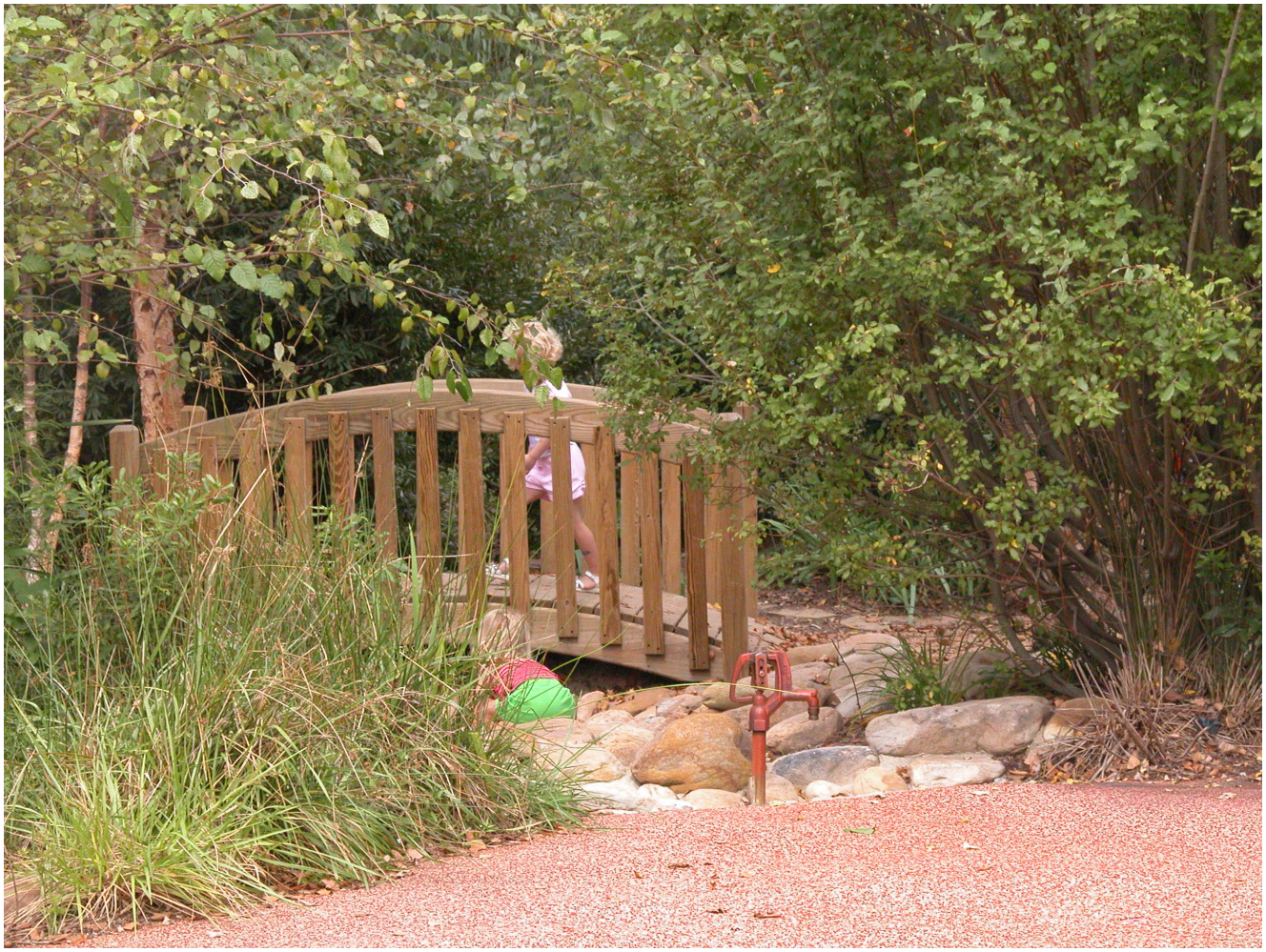

Figure 18. Landmarks offer experiential events along the way, marking the sense of an unfolding world day to day. Courtesy of Robin Moore and Nilda Cosco

Websites

Natural Learning Initiative: www.naturalearning.org

LEED (U.S. Green Building Council): http://www.usgbc.org/DisplayPage.aspx?CategoryID=19

Hershey Montessori School adolescent program on the farm: http://www.hershey-montessori.org/adolescentCommunity.cfm

Greensboro Montessori School: http://www.thegms.org/campus/permaculture_montessori.asp

Wellesley College Child Study Center virtual tour: http://new.wellesley.edu/csc/tour

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