

Early Childhood Health Outdoors (ECHO)
Naturalized Outdoor Learning Environments
Stewardship Guidelines

For Colorado



ECHO
EARLY CHILDHOOD HEALTH OUTDOORS

NC STATE Design
NLI
NATURAL LEARNING INITIATIVE

Photo by NLI

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For those working to
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and natural processes
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Photo by NLI

While any outdoor space that children use can be considered a place for play and learning, because of the increasing restrictions on children's spatial range¹ there is a national move towards intentionally designing and naturalizing spaces to support children's play, learning, and healthy development.²

Introduction

The *Naturalized Outdoor Learning Environment Stewardship Guidelines* are for those working to engage children, youth, and families with nature and natural processes in the places of everyday life. They include child development centers, schools, parks, nature centers, public gardens, children's gardens, zoos, and museums (including children's museums), and residential neighborhoods. Locations may include municipal, county, state, and federal lands. Those involved may include early childhood policy makers, childcare center owners and directors, school administrators and lead teachers, educators of all types working in both formal and non-formal sectors, park planners, landscape designers, and facility and landscape maintenance managers.

OUTDOOR LEARNING ENVIRONMENT AS A HEALTH PROMOTION STRATEGY

The term "outdoor learning environment" was first used as a legal term in 2007, when the North Carolina Division of Child Development (now the Department of Child Development and Early Education - DCDEE), substituted the term for "playground" in the NC licensing rules. The change transformed thinking about the role of outdoor space associated with early childhood facilities. POD (Preventing Obesity by Design) was launched as a health promotion strategy that same year, aimed at implementing outdoor learning environment principles statewide with a strong focus on naturalization (restoring nature in childhood places).³ By 2010, positive, visible results on the ground in the form of "demonstration sites" exemplified best practice in physical design and management and supported a broader, indoor-outdoor early childhood pedagogy.

The three-pronged POD strategy delivers physical change through participatory design processes, integrated with substantial professional development, and rigorous evaluation - informing and guiding future action. Participation helps instill a sense of ownership and responsibility to achieve four primary outcomes to promote child health: physical activity, healthy eating, outdoor learning, and social-emotional development. These outcomes result from diversifying

and extending the range of outdoor play and learning opportunities for all children.

NATURALIZATION

Naturalization offers children opportunities to engage with the natural world of plants and animals through self-motivated free play and learning experiences both informal (children alone) and adult facilitated (by educators, parents, play professionals, etc.).⁴ Naturalize means "to cause a plant or animal from another place to begin to grow and live in a new area."⁵ The term is important because the vast majority of childcare centers and other spaces where children spend daily time, especially in low resource communities, offer low levels of biodiversity. If these barren spaces are considered sites where the potential of natural ecosystems can be restored, they must be designed and managed to balance children's engagement with nature without unduly impacting restoration processes.⁶ Naturalization supports the many health benefits of exposure of children to nature by immersing them in diverse bio-settings.

Exposure to nature in childhood supports development of a conservation ethic across the lifespan, helping children become the next generation of environmental stewards armed with a deep understanding of the need to cultivate wildlife habitats. Naturalization, in other words, supports health of both children and ecosystems.⁷

"Edible landscape" is a complementary health promotion component of naturalization, consisting of permanent, fruiting species integrated into the outdoor learning environment, along with designated vegetable gardens. Stand-alone greenhouses or winter garden additions to buildings can extend the hands-on gardening season.

MULTI-STATE ADOPTION OF THE OLE/ POD STRATEGY

In 2015, the POD strategy of community-engaged design and outdoor learning environment (OLE) naturalization was adopted by the Texas Department of Public Health (as Texas OLE!), and in 2016 by South Carolina Department of Health and Environmental Control. In 2017, building on an existing NLI partnership with the National Wildlife Federation

(NWF), the naturalized outdoor learning environment/ POD strategy became part of ECHO (Early Childhood Health Outdoors) with major support by the Colorado Health Foundation.

The restoration/naturalization task is enormous. There are approximately 114,000 childcare centers in the U.S., where 4 million children are enrolled.⁸ A conservative estimate of the amount of land occupied is around 30,000 acres (equivalent to 35 New York Central Parks). There are approximately 90,000 elementary schools (public and independent) attended by more than 32 million children,⁹ occupying thousands of acres where every day children are exposed to ecologically deprived land and receive a seriously flawed message of uncaring attitudes towards the earth we live with. Naturalization offers a cost-effective means of attacking this issue by improving environmental quality and simultaneously creating outdoor environments rich enough to support active learning and education.

As childcare is highly regulated, the potential for change is substantial. The same is true of school systems. In urban areas with small proportions of park space relative to population, naturalized outdoor learning environments can increase exposure to nature. School grounds can serve as neighborhood parks during out-of-school hours (the larger proportion of time). The preschool outdoors is already a determinant of children's physical activity.¹⁰ Naturalization adds value by supporting play and learning with nature, improving microclimatic comfort for children and teachers, and motivating extended time outdoors, which also supports higher levels of physical activity.

STEWARDSHIP

Stewardship means, "The careful and responsible management of something entrusted to one's care."¹¹ Naturalized outdoor learning environments are living places, dynamic, and ever changing. Like a favorite teddy bear, they are subject to wear and tear. They need consistent care, management, and maintenance to allow children to engage with them. Items need to be updated or replaced over time.

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Creating a Stewardship Plan

To be effective, a stewardship plan needs to emerge from community participatory processes involving all stakeholders. It may take time to mature but the payoff includes key benefits:

- Awareness by the community of parents, staff, administrators, and decision makers of the importance of stewardship, and commitment to implementation.
- Serving as a resource to other programs, facilities, and institutions.
- Increased community capacity to resolve resource-related issues.
- Guidance for strategic investment in limited management time and resources.
- Promotion of healthy development of children and youth.
- Improved understanding about how outdoor environments can be intentionally created to support healthy human development and expanded educational opportunities.
- Increased understanding of important relations between healthy ecosystems, healthy young people, and healthy communities.
- Opportunities to engage youth organizations such as boy scouts and girl scouts, and other community groups in implementing outdoor learning environment projects.

Photo by NWF

Each outdoor learning environment needs a Stewardship Plan framed by the particular site characteristics, the type of institution, social context, and geographic location. These Stewardship Guidelines are intended as a reference to help each site to create an individualized, community-based Stewardship Plan for managing, maintaining, and caring for their naturalized outdoor learning environment.

Key topics include:

- Recognizing Colorado gardening traditions.
- Understanding key stewardship factors, including soil quality, water conservation, and use of native plants.
- Considering ecosystems as a mix of human, plant, and wildlife dimensions.
- Using non-chemical, sustainable, integrated pest management strategies.
- Managing naturalized outdoor learning environments to achieve predictable health, learning, and environmental outcomes.

GARDENING IN COLORADO

Design, management, and maintenance of naturalized outdoor learning environments is closely akin to domestic gardening in size and scale of site, materials used, the mix of natural, constructed, and manufactured components, annual management cycle, day-to-day maintenance, and more. However, the contexts and purposes are usually quite different to the typical domestic context. Nonetheless, an appropriate place to start thinking about stewardship is a review of gardening in Colorado.

Gardening in Colorado is defined by a dry climate, changes in elevation, harsh/windy conditions, a short growing season and damaging storms. Even with all of the challenges of gardening in the Rocky Mountains, on the Western Slope, along the Foothills, or in the Eastern Plains, with some key considerations, careful planning, and attention to detail, gardening can be as rewarding and successful as anywhere else throughout the United States.



Photo of Colorado's San Luis Valley, with Great Sand Dunes National Park in the distance, characteristic of the typical dry, harsh growing conditions and quick changes in ecosystems found throughout the state.—photo by NWF



A diverse mix of annual and perennial, native and ornamental pollinator plants, this habitat garden is a flurry of bird and beneficial insect activity year-round.—photo by NWF

Ecological/Habitat Gardens. There are a variety of gardens that are aesthetically pleasing and offer opportunities for learning outdoors. To name a few, pollinator gardens focus on providing food for pollinators such as bees (including many species of native bees that don't sting), butterflies, and hummingbirds; wildlife habitat gardens offer food, water, cover, and places to raise young for birds, beneficial insects, reptiles and small mammals; rain gardens, such as vegetated swales take advantage of low spots on the landscape where water collects and are good for plants that may require more water. The appropriate type of garden for your site largely depends on the local conditions, elevation, typical annual climate, and goals for the setting. For more specific information related to gardening in your area, refer to the 'Regional Colorado Guides' in Appendix A.

Container gardens and plants. Where space for gardening may be limited, containers can be a great way to grow vegetables and flowers on a balcony, porch, or patio. Seasonally, a favorite rosemary, lavender, or houseplant can be saved and taken indoors for the cooler months, and put back outside again once temps warm up, allowing for access to gardening activities all year long. Pots and containers are also a great way of strategically deterring foot traffic to protect plants or sensitive areas.



Containers can also be 'self-watering', having water reservoirs located beneath the potting soil, such as this one on a PreK OLE.—photo by NWF

Fruit and Vegetable Gardens. Edible gardens focus on growing fruit, vegetables, and herbs. Accessibility to edible plants in the outdoor learning setting will introduce new tastes to young pallets, and increase healthy eating habits starting at a young age in children. Did you know that it typically takes trying a new food 10 times before we like it? The phenomenon of planting a seed and observing the growth cycle is a powerful lesson that young children do not easily forget, and they will be more likely to try that fruit or vegetable repeatedly as a result. An incredible sense of pride and wonder is palpable as children engage in the responsibilities of watering, weeding, and caring for fruits and veggies.

Fruiting, perennial woody plants include trees, shrubs and vines. Fruiting trees such as apples, peaches, and plums add year-round value to the OLE. While the main goal of vegetable and edible gardens is to cultivate plants for human consumption, including other flowering non-edible plants in the same space increases biodiversity, rates of pollination of fruits and vegetables, and can help mitigate pest problems.



Thinking beyond science lessons, gardens of all types can also be useful to engage students in journaling, writing, sketching, painting and mathematics. —photo by LiftedLA

Garden maintenance. For the success of all garden types, regular maintenance and care is critical. While gardens typically require more labor and effort in the beginning, through routine practice, maintaining garden spaces gets easier over time. However, it's important to note that there's no such thing as a maintenance-free garden space! See Appendix A for more information regarding important seasonal considerations.

KEY STEWARDSHIP FACTORS: SOILS

A primary factor of successful plant growth is soil quality. Most plants require well-draining organic soils that are protected from compaction, although some species favor the wet, saturated conditions of slow draining clay soils. To quickly observe which type of soil you have, remember that heavy clay soils stick together when wet, while soils that are loose tend to be more sandy. Sandy soils dry out quicker than clay and are more susceptible to erosion during rain events. To tell the difference, squeeze a small handful in the palm of your hand. Clay will ball together, while sandy soils will fall apart. While many species of native plants can tolerate the extremes of sandy or clayey soils, many ornamental plants and vegetables require soils that have high amounts of organic content. These soils crumble, are dark brown, and have a spongy feel when squeezed in the palm of the hand.

Managing soil quality is critical for healthy plant growth, and while hand measuring soil texture is an excellent tool for observing general quality, the only way to really know the soil composition is to get a test through your local Extension office. Test kits are provided by your local Extension agent and can help you through the process. See Appendix A for more about soil testing. Once test results have been obtained, soil may need to be improved. Clay soils usually need the addition of organic material, i.e. compost, to create well-draining soil for planting success. Note that many native plants do not require organic rich soil and will be happier in the sandy or clay soils of their ecological niches.

Compost. Lots will be needed! When creating a new flower garden or in-ground vegetable garden, spread compost over the area 2 to 3 inches thick and work it in to the soil to a depth of 6 to 8 inches. Compost can be created on site, bought at a garden nursery, or obtained from a municipal garden waste composting facility. Garden waste, such as excess leaves, small twigs, and grass clippings can be composted within or near the OLE – perhaps just outside the fence. Once broken down it can be used as mulch or soil amendment in garden beds. In dryer climates, a compost pile may need to be occasionally watered and turned to promote aerobic activity and the breakdown of materials. There are a variety of efficient



Children enjoying the results of a rotating compost barrel. –photo by NLI

composting systems available for purchase at a local hardware store, including tumblers that can be turned with a handle. Alternatively, compost boxes can be constructed with reused pallets arranged in multiple bays for ease of hand turning piles. See Appendix A for more on composting yard waste. Composting can also be achieved through the use of worms, also known as *vermicomposting*.¹²

Mulch. Mulching garden beds properly is integral to the success of plant life within the OLE, as it helps to control erosion, suppress weed growth, and maintain consistent moisture levels. If we consider the sum of the networks of beneficial organisms in the soil, soil can be thought of as a living organism itself.

Just as all life requires water to survive, so does soil, and mulch will help your soil build and thrive. The most common mulches to consider are leaf mulches and shredded wood mulches. Leaf mulch is often free or inexpensive and works very well in garden beds, providing organic nutrients as it breaks down. Shredded wood mulches take longer to breakdown, but will last longer. Try to buy in bulk from landscape material suppliers to save on cost. Mulch can often be obtained very cheaply, if not free, from local tree maintenance companies. If the OLE is located in a schoolyard, check with facilities management as the school district may have a system in place to replenish mulch at no cost to the school.

If considering rock as garden mulch, remember that it gets very hot in full sun and should be used only with the appropriate plant material suitable for those conditions. In general, it tends to be rough on tools used for maintenance, and once it's installed, it is incredibly difficult to remove and poses a challenge for upgrading, replacing and/or adding new plant material to the space.

KEY STEWARDSHIP FACTORS: WATER

All living things need water. The only source is precipitation, either directly on the soil or via reservoirs, channels, and pipes.

Utilizing precipitation on site is an excellent way to provide plants with the water they need, and whenever possible is preferable to irrigation. Using rainwater on site can be done multiple ways: diverting downspouts into garden beds, grading to create low spots where water will flow to, and/or

using rain barrels or cisterns to temporarily collect rainwater for landscape use. Remember that water follows the path of least resistance! See Appendix A for important considerations on rainwater harvesting in Colorado.

All aspects of utilizing precipitation on site create opportunities for environmental learning and hands on experience. Lessons in measuring volume, observing the effects of gravity, documenting weather patterns and the action of hydrologic cycles can support and enhance math, science, and language arts curriculums, and serve as an integral part of teacher's and caregiver's instructional toolkits. Students may journal or graphically express their new discoveries to extend and reinforce the learning process beyond the four walls of the classroom, seamlessly blending together indoors and outdoors. Direct, memorable experience of nature outdoors can motivate learning and reinforce learning from print and online sources.



Installing a rain barrel (recycled pickled olive container)—photo by NLI

Irrigation Systems are the alternative means of getting water to plants.

In drier climates especially, consistent, routine irrigation is essential for garden success. Lawn and naturalized meadow areas require overhead watering delivered by sprinkler heads. Garden beds, however, are most efficiently watered through drip

irrigation that delivers water only to the roots. Drip tubing and emitter lines should be hidden between the mulch layer and soil surface, to protect them from inadvertent damage by children. For either system, watering times should be set to between 6pm and 10am, so water is absorbed into the soil to avoid evaporation during the heat of the day. Longer watering times are preferred to shorter, more frequent times, thus allowing water (and plant roots) to penetrate deeper into the soil. Deeper roots allow plants to resist harsher conditions typical at the surface.

All irrigation systems require consistent monitoring for leaks, as well as routine maintenance especially at the beginning and end of each growing season, typically determined by the first and last frost dates. In lower elevations water needs to be shut off and systems drained around October 15th. Around May 15th water needs to be turned on again. See Appendix A for more irrigation specifics.

Xeriscape (not to be confused with 'zeroscape') is a commonplace landscape term used throughout Colorado and the Southwest, referring to an approach to gardening with an emphasis on designing for plants with low water requirements. This type of 'low water gardening' is appropriate in many of the drought-prone and hot regions of the state/southwest, where other approaches to gardening may fail. Many cacti, succulents, grasses, and some native flowering annuals and perennials have evolved to thrive on annual precipitation alone. An added boost may be provided by rain runoff from nearby roofs, adjacent hardscape, or water from a rain barrel.



Many native plants do not require much water, such as this habitat garden in its first season in an outdoor classroom and community garden.—photo by NWF

3

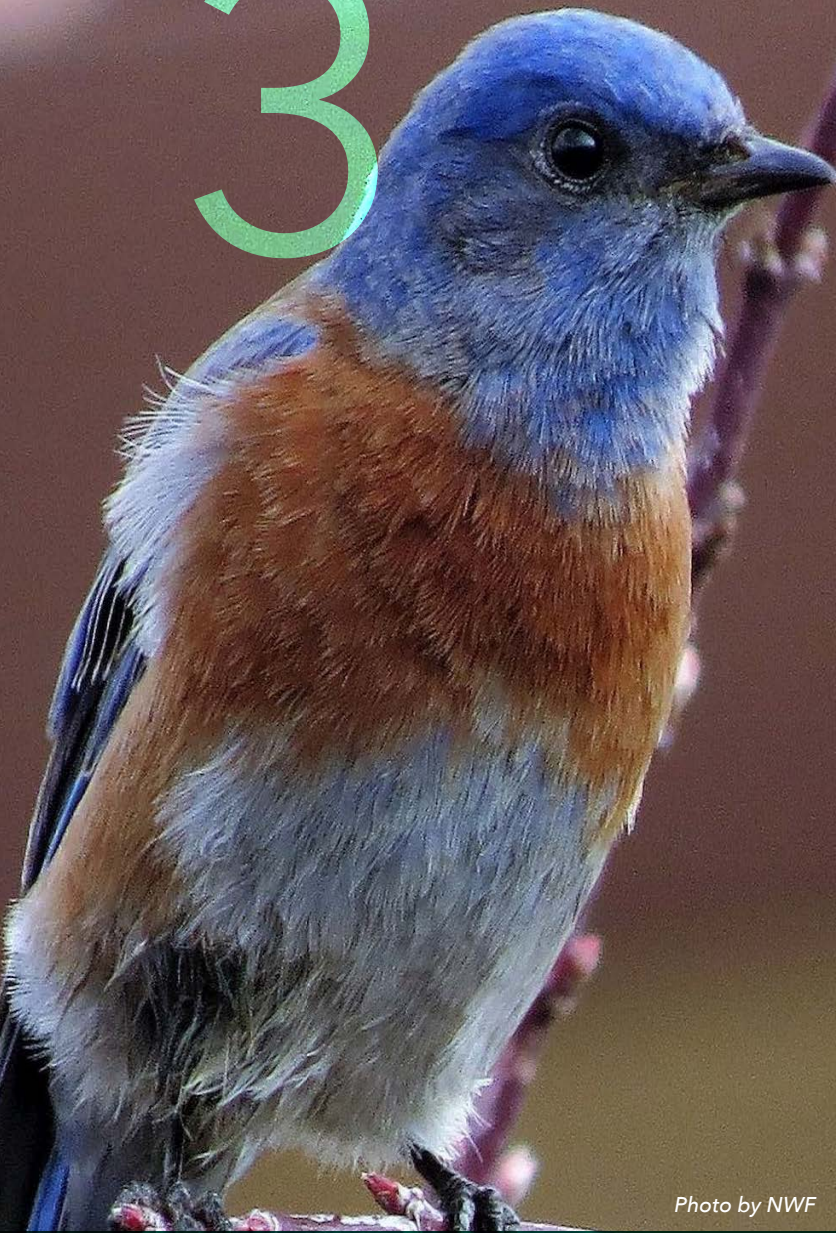


Photo by NWF

A key factor in naturalizing an outdoor learning environment is choice of plants, including trees, shrubs, perennials, and grasses. They all offer a variety of benefits including enhanced aesthetics, erosion control, education, and the opportunity to support local ecology and biodiversity including wildlife.

Managing Plants

All plants fit somewhere in the web of life that supports a myriad of species of birds, insects and other small critters that fascinate children. It's important to keep in mind the relationship between different plant types. For instance, trees can create shady conditions that some plants may or may not tolerate. Some flowering species require full sun to bloom. Evergreen species add interest, especially in the winter when other deciduous species have lost their leaves. The presence of native plants is essential to create effective habitat, as they provide the necessary food, cover, and places for wildlife to raise young.

FACTORS AFFECTING PLANT GROWTH

Sun exposure, annual temperatures, soil type, and water are critical factors influencing plant growth in relation to a plant's habit, underscoring the saying, "Right plant, right place," a good maxim to consider when making decisions about what to plant and where. See Appendix B for more information.

Other factors that may affect plant growth include foot traffic, which can result in soil compaction making it harder for roots to spread. See 'Protecting Plants from Impact' below.

NON-INVASIVE/INVASIVE PLANT SPECIES

In choosing species to include in the OLE, not all plants are created equal, and some in fact are harmful to local ecologies where they outcompete for nutrients and water and have little to no ecological value in that location. It's important to keep this in mind especially when going to a 'big box' garden center, which may still carry suspect species. See Appendix B for a list of invasive species to avoid.

PROTECTING PLANTS FROM IMPACT

To some extent, plantings are installed in outdoor learning environments for children to pick leaves, stems, and twigs or pull on branches. Typically, these activities do not permanently damage plants but provide necessary interactive experiences for children. However, sensitive planted areas, especially those located next to pathways should be protected from being trampled by children's feet, and the resulting compaction of soil.

Several effective commonly practiced methods are available for protecting plants for a few years after installation. Methods include adding railings around planting beds, strategically placed post & wire or sturdy rope barriers, tire planters, plant containers, boulders, stones, logs, and stumps. All help to reduce impact in sensitive areas, and encourage walking along designated paths.



An example of logs placed vertically to protect plants from harmful foot traffic—photo by NLI.

FLOWERING PLANTS

Two main types of flowering plants are *perennial* & *annual*.

Perennial flowering plants die back in the winter but regrow every year from the same root. Along with the colorful beauty and naturalizing effect, perennials also provide natural loose parts for play, change with the seasons, and enhance the ecological value for beneficial wildlife. They are best suited for borders and designated flower beds protected from children's foot traffic.

Annual flowering plants on the other hand do not regrow and only live for one growing season, such as sunflowers or nasturtiums. They can provide many of the same benefits as perennials, often with abundant flower blooms and interesting foliage. Annuals are great for containers and pots, and to include in classroom activities where children can participate in planting exercises.



Being an annual, sunflower plants die and drop their seed after each growing season, to germinate come the next Spring providing another season of enjoyment and food for pollinators and birds—photo by NLI.

Native Plants. A native plant is a scientific term that describes a plant that has co-evolved in a location over time with a community of other plants and animals. As such, they support local wildlife, including birds and other pollinators by providing their favorite foods, forage, cover and places to raise young. Adapted to local climatic and soil conditions (clay in Colorado), they tend to require less water and supplemental fertilizer than other species of common exotic garden plants. Native plants include perennial and annual species with the added benefit of providing strong ecological value in the OLE.



Native grasses and woody shrubs line this foot path in a PreK OLE in Denver.—photo by NWF

Pruning Flowering Plants. All flowering plants can be pruned of dead, diseased, or dying parts throughout the growing season. This is an important part of maintenance that can ensure a healthy and thriving OLE. Avoid pruning, or dead-heading the spent blossoms of species such as sunflowers as they will go to seed and provide a valuable source of food for birds and others. Consider cleaning up flower beds in the spring rather than fall to allow for winter interest, access to natural loose parts, and important habitat for beneficial insects.

Watering Flowering Plants. Native plants typically do not require as much water as some exotic plant varieties once they are established (establishment typically takes two full growing seasons). Similarly, there are plant cultivars, such as those through Plant Select® that do not require much water once established. It's helpful to keep in mind similar water and sunlight needs for the types of plants you have in an existing garden bed when choosing plants to add, or when planning a new bed. See Appendix B for more.

FRUITS & VEGETABLES

A couple of different approaches to growing fruits and vegetables are available: formal and informal. Each provides opportunities for tasting, snacking, or meals, as well as educational opportunities. In more formal settings, a designated garden area is intentionally organized to include (but not limited to), raised beds, paths, storage for tools, a greenhouse, seating and maybe an activity table or two for seeding and transplanting demonstrations. With this approach, all components required for growing fruits and vegetables are located near each other. Organized as learning gardens, teachers or care providers can facilitate specific activities. Be sure to leave enough space between raised beds and protect in-ground plantings from wandering feet.

If space for a formal learning garden is limited, the same components can be informally spread throughout the OLE. Rather than a destination for active learning, fruits and vegetables can be explored and discovered individually when incorporated into ornamental garden beds or placed in pots on little-used corners of patios and steps. Exposure to vegetables, fruits and herbs can happen 'along the way' between other activity settings. Pole beans or snap peas can be grown on teepee forms that function as living playhouses. Low maintenance species such as pumpkins, melons, or squash can be grown in otherwise neglected spaces.

Most fruits and vegetables require consistent watering at the roots, weeding and general maintenance. Some varieties may need to be staked for stability or trained to grow vertically. When locating, consider availability of sunlight, access to water, and distance away from gross motor settings and play equipment.



*A great planting location is in raised beds placed along existing buildings.
—photo by NLI*

GRASSES

Grasses of all sizes and varieties are a great consideration for adding interest and ecological value to the OLE. Unmown grasses also provide material for birds to build nests and seed heads for foraging birds and insects alike. Especially for the growing conditions found throughout Colorado, there are many grasses that universally thrive and require little maintenance. They offer fascinating annual growth cycles, seasonal interest, sensory stimulation and a good source of loose parts— seed heads, stalks, grass blades, etc. Grasses are one of the most effective ways of enhancing OLEs in a manner that reflects many of Colorado's local ecosystems as they are such prominent landscape features throughout the state.

As a setting in the OLE, consider planting grasses in clusters to create informal 'mazes'. As emphasized in the NLI Outdoor Learning Environment Toolkit (Booklet #5), grass mazes are a fun and easy way to support more active behaviors such as chase games like tag and hide-and-seek, as well as offer spaces for passive activities such as individual exploration and discovery, intimate conversations, reflection and rest. (pp.10 - 11) Grasses are great for enhancing ornamental garden beds, designating space, and buffering between OLE settings.

More water is required by large grasses than similar varieties. Consider planting them in wetter areas of the outdoor learning environment.

Prune grasses in the spring when new growth starts to appear at the base of the plant. Similar to pruning and maintaining non-woody flowering plants, this provides numerous opportunities for child engagement and sensory development as well as important elements of habitat throughout the winter including food, cover, forage and materials that support young-bearing activities for wildlife. See Appendix B for more information.



Bunch grasses require little water once established, provide great ecological and habitat value for birds and moths, and are a wonderful source of loose parts and sensorial experience.—photo by NWF

GROUNDCOVERS

Usually growing less than 12" tall, groundcovers are low-growing plants that spread along the surface of the ground along borders in garden beds, creating layered interest in relation to perennials, shrubs, and trees. Similar to the benefits of mulch, groundcovers help reduce soil erosion, suppress weed growth, and maintain consistent soil moisture and temperature, with the added benefit of the plant's inherent beauty and value for pollinators. Examples of groundcovers are vines, grasses, dwarf spreading shrubs, or low-growing perennial plants. Groundcovers can typically be approached the same way as perennial flowering plants. See Appendix B for more information.



These English ivy and vinca vines are low maintenance and help to reduce soil erosion, hold in soil moisture, and suppress weed growth similar to the benefits of mulch.—photo by NLI

LAWNS

Specifically designed and managed as a multi-use setting, a lawn can be an excellent open and spacious area for gathering for group activities, running, or spreading out. The ideal size of an area of lawn in the OLE would be to allow for the comfortable use of 25 children or the size of a classroom group. Small lawns have many uses and need not be expansive; even a 100 square foot circle or square can provide many play opportunities. An OLE lawn certainly does not need to be flat, and if graded with slopes, children will playfully respond with more varied running and rolling activities.

Turf varieties that are more appropriate and have adapted to Colorado conditions should be considered and selected to withstand child foot traffic. There are two main distinctions in turf varieties, *cool season* and *warm season*.

Cool season grasses, such as those of the iconic Kentucky bluegrass varieties thrive in the cooler temperatures of the spring and fall, and require A LOT of water to survive in much of Colorado's hot, dry climate. In comparison, for every gallon of water a pollinator or flower garden needs, traditional cool season turf grasses require 10 gallons! They are useful in small doses and should be considered in moderation.

Warm season grasses, such as buffalo grass and blue grama grass thrive in the heat and dry of Colorado summers, and provide ecological value for beneficial

insects, pollinators, and birds. Note that they typically cannot withstand the heavy foot traffic of the OLE and most warm season grasses typically do not do well in shade. Consider locating them outside of fenced licensed spaces, and where they are less susceptible to regular paths of travel.

With both instances of cool and warm season turf grasses, there have been recent developments of hybrids adapted to Colorado. Local sod providers and wholesale nurseries will be more likely to carry these varieties than commercial big box stores.

CARING FOR LAWNS

Rather than a fence-to-fence indiscriminate groundcover that requires a lot of water and maintenance, lawns in the OLE should be contained to a specific area. In this way, they will be easier to maintain and mow, and be more useful for play activities.

The best way to ensure a high-quality lawn is to make sure it is installed properly and *allowed to establish before use*. Starting the lawn with sod or high-quality grass seed selected especially for the OLE site conditions (sun/shade, soil type, use) can help ensure a healthy start.

Traditional lawn care includes regular mowing, over seeding, consistent watering, annual fertilization and aeration. Overtime, lawns can build up enough organic debris where root health can be compromised...in which case the lawn will need to be dethatched by a professional lawn service. See Appendix B for detailed resources on lawn care.

Alternative lawns such as blue grama-buffalo grass blends require less maintenance. They typically require full sun, do not grow taller than 4 to 6 inches, and may only need to be mowed a few times a season. They also do not require much water once established, do not require fertilization or seasonal aeration and are attractive to honey bees, butterflies and other pollinators. See Appendix B for more information.

TREES AND SHRUBS

Trees and large shrubs have incredible value in the OLE. While they efficiently provide shade, cool the air, and offer seasonal interest, they simultaneously provide ecological value in the forms of adding to biodiversity and habitat: food, cover, and places to raise young for

wildlife. They can provide a backdrop and help define an outdoor classroom and/or act as a buffer between OLE settings...a prized tree can even be the setting. Trees and shrubs provide a consistent renewable source of loose parts in the form of leaves, bark, seeds, nuts, fruit, and building materials for natural construction. At the end of a tree's life or during routine pruning, be sure to coordinate with the tree workers to save materials for tree cookies, balancing or seating logs, and teepees.

While trees are an important source of shade, care should be taken when considering varieties for height and spread, aiming for a variety of sizes and growth rates. Remember that other sources of valuable vegetation, namely fruits, vegetables, and flowering perennials also need sunlight. What may be a small tree or large shrub to an adult, can become an entire world unto itself for a small child offering a multitude of opportunities for discovery and observation. It is important to allow some branches and leaves to be within reach to add to the potential for access to and interaction with nature. Long arching branches can be trained to create tunnels, or large shrubs can be planted as a grouping to create a thicket that can be explored.

To fully thrive and serve these multiple functions, trees and shrubs need deliberate care and management, particularly after the first couple of years after transplanting. While larger caliper and mature ball-and-burlap trees and shrubs have more of an immediate impact, younger specimens such as those in #5, #10, and #15 containers tend to be more affordable and bounce back quicker from transplanting. As a long-term OLE investment, trees require regular water, annual care, pruning, and protection from damage. See Appendix B for more information.



A 'mini woods' offers opportunities for exploration, discovery, much needed shade, and habitat for beneficial wildlife. -photo by NLI

NATIVE TREES

Depending on where you are in the state, for instance along the Front Range where the natural habitat is grassland, native trees can be a bit of a challenge to consider as options are limited compared with the number of native species available in other states. However, there are a handful of good trees to consider for the OLE, and with a bit of imagination even some large native shrubs can be excellent alternatives to more common ornamental trees. See Appendix B for more information.

INSTALLING TREES & SHRUBS

Trees and large shrubs are one of the best, long-term OLE investments. Like any valuable investment, trees and shrubs need careful management from the moment they are planted to ensure their health and long-term survival.

Purchase high-quality, healthy stock from a reputable nursery or garden center. Some trees are grown in containers and others are grown in fields and sold as “ball-and-burlap” trees, meaning they are dug out with soil intact and their roots are wrapped in burlap tied with twine and wire. Ball-and-burlap trees are generally larger (read heavier!), and planting them involves far more labor and equipment; they require larger holes to be dug, as compared to planting smaller container-grown trees. If volunteer assistance is involved, a smaller tree sold in a 5 – 10 gallon container will be easier for the planting team to lift and install.

In general, the best time to plant trees and larger shrubs is in the fall when the weather is cooler but before most freezing weather sets in. In the fall, newly transplanted trees will require less irrigation than if planted during hot summer months. Also, the ground typically holds moisture over the winter, which allows roots to slowly establish in the damp soil. Note that in Colorado, winters in lower elevations can be dry and hand watering may be necessary come January, February and March. During the first year after installation, trees should be watered thoroughly every couple of days or when the soil becomes dry. Mulch is always necessary to reduce evaporation of moisture and to keep weeds at bay. Be sure that mulch is a few inches away from the trunk and not touching the bark as pests, rot or decay can be introduced in some instances. See Appendix B for detailed steps on planting trees and shrubs.



Student day of service tree planting fun!—photo by NLI

PRUNING TREES & SHRUBS

The pruning of trees and shrubs is an important management activity to ensure good OLE health and to maintain clear sight lines across the site. Most pruning can be done ‘in house’ but some pruning requires the expertise of a professional arborist.

Especially at child care centers, take care not to remove all vegetation from a child’s reach. Retain some branches close to the ground so that children can “hide” and interact with nature. Pruning should be done with discretion to avoid creating sharp ends of thin, horizontal branches that a child can run into. An added advantage of pruning is that children can use clippings as play props as long as they do not have sharp ends or splinters.

In general, any plant including trees and shrubs, can be pruned of the 3 D’s - Dead, Diseased or Dying - material *any time*. Keep in mind that there are important considerations when it comes to pruning, such as the proper way to cut, appropriate tools to use, how to prune for structure to reduce potential damage from snow, and seasonal considerations for flowers and fruit. See Appendix B for more information.



While pruning is essential for the health of trees and shrubs, dead material also has benefits in supporting a healthy habitat. Here, a male western tanager rests on a dead tree branch, a good vantage point without the presence of leaves.
—photo by NWF

VINES

Vines are plants that can grow using their own 'aerial roots' or they can be trained by twining around supporting wires, mesh, or wooden lattices attached to vertical structures. Some vines are annuals such as pole beans, peas, and gourds and can grow incredibly fast. Other vines are perennials such as honey suckle, virginia creeper, and hops and typically take longer than annuals to grow.

Vines are recommended as an OLE plant for providing fast naturalization on vertical structures to create patches of shade and comfortable spaces sized to young children.



Clematis vines are relatively quick growers, do not require much growth training, and are attractive to pollinators such as this carpenter bee.—photo by NWF

Growing vines on structures. Some vertical structures that vines like to grow along are fences, arbors, pergolas, lattices, sticks or tree limbs placed as a teepee, or rope/twine that is anchored to the ground near the plant and fastened to an eave or fence post above. Similarly, vines can help enhance archways or see through tunnels. Structures can be custom built or assembled from kits.

Although different types of vines have varied climbing behaviors and requirements to achieve growth, vines can easily be trained using twine or velcro strips to grow vertically or horizontally along support systems. Due to the nature of climbing vines such as *Clematis*, simply plant the vine close to the support system so the tendrils can easily find it and

grow upwards. Depending on the material, train vine tendrils or new growth along the support in the desired location and the vine will do the rest! Other appropriate OLE vines to consider are grapes, and trumpet vine.



Vines can play an important role in creating shade, such as the hops covering this garden arbor.—photo by NWF



Photo by NWF

"A well-worn cliché is that weeds are plants growing in the wrong place and in that sense, the problem can be that they are prolific, relentless invaders with no redeeming value. However, individual species are not viewed as weeds everywhere. Dandelions, for example, are an enemy of golf course managers but a valuable salad crop. For some, a golden meadow of springtime dandelions is beautiful. And of course, the "dandelion clock" has survived as a universally attractive game for children. (p.11).

Fertilizers, Pesticides, & Herbicides

WEED MANAGEMENT

The best way to reduce or eliminate weeds is regular weeding and garden maintenance. The trick here is to not get so far behind that the task becomes overwhelming. Some weeds are more aggressive than others and require more frequent attention; however, most OLE weeds can be handled during a few key times of the year: as spring cleaning, once or twice during the summer, and as end-of-season fall/winter preparation. Typically, early spring cleaning and mulching must be executed before weeds start emerging and pick up momentum. Subsequent, periodic weeding will be remarkably easier to handle throughout the growing season. Early spring cleaning will allow for only a couple of necessary weeding days in the summer, leading to an end-of-season fall/winter clean-up of leftovers that may have popped up since summer. With regular weeding, thorough mulching of garden beds, and drip irrigation (getting water only to desirable plants rather than indiscriminately everywhere for everything, including weeds), weeding time will shorten, be less back breaking, and will become more enjoyable. As desirable plants become established, they will out-compete weeds for space.

Weeds need to be removed, including roots, using hand tools. Do not compost weeds that have gone to seed on site. Take them to a professional composting facility to ensure that seeds are killed.

Beyond the scale of small garden spaces, some invasive plant species are capable of completely dominating the surrounding landscape— both visually and ecologically. At that point, machine and massive person power are required to remove them. The seriousness varies from region to region. For OLEs, Russian thistle is an example of a potentially invasive plant that should always be removed before it gets established. See Appendix C for an in-depth treatment of weeds.

CHEMICALS

Use when necessary, with caution. If other methods have been tried and proven unsuccessful, chemical use in the garden and OLE may be necessary. If using fertilizers, pesticides, or herbicides in a play and learning area is unavoidable, keep the following in mind:

FERTILIZERS

Healthy, thriving plants are a result of availability to abundant nutrients in the soil from soil amendments such as compost and worm castings, fulfilling the plant's water requirements, proper location as related to the sun, as well as planting healthy plants to begin with. If fertilizers are needed at some point, most commonly for potted plants, be sure that they are incorporated into the soil and not accessible so as to expose children to them.

Please refer to '*Protecting Water Quality and the Environment*' in Appendix C for important considerations when using fertilizers.

PESTICIDES & INSECTICIDES

The overall health of the OLE should be a priority when considering whether or not to use pesticides or insecticides. These chemicals indiscriminately kill all insects exposed to it, even the ones that are beneficial and who may be working in the background to keep the more harmful species in check. Biodiversity of plant material, rather than monocultures of the same tree, shrub, flower, or grass will help to keep populations of less desirable insects at bay. However, in general, most insects are beneficial.

The goal is to have a healthy environment, not to eliminate 100% of pests. When considering native plants, note that they attract beneficial native insects and evidence of chewed leaves is normal. Having a variety of plant species will ensure that even if one plant has leaves that are being chewed, not all plants will be impacted. Also, biodiversity will help attract bird populations and other beneficial animals, thus adding to the overall health of the OLE and offering valuable educational opportunities. See Appendix C for more information.

HERBICIDES

Herbicides can be avoided by pulling weeds by hand when they are small or digging them up with a shovel when they are larger. Regular, routine maintenance and proper mulching will make for an easier time managing weeds. Mulch in garden beds should be 2-3" deep.

In some instances, such as when dealing with an invasive and particularly difficult Tree-of-Heaven (*Ailanthus altissima*) or Siberian elm (*Ulmus pumila* L.), strategically applied herbicides may be the only viable solution.

5



Photo by NWF

If the right tools are broken or not available on site, necessary OLE stewardship jobs are less likely to get done. Having the appropriate tools on hand will allow for routine maintenance to be more easily achieved. If possible, consider providing on-site storage dedicated to garden and landscape tools.

Tools

ESSENTIAL HAND TOOLS

Every step along the way to transforming the outdoor learning environment will require specific tools to get the job done. Similar to common maintenance tasks or building projects indoors where, for example, you could not use a screwdriver to drive a nail, outdoors you wouldn't want to use a hoe or hand trowel to dig a large hole. While there are different tools that can be used to get the same job done, tools are designed to get specific jobs done efficiently and with minimum effort. Working the landscape to achieve quality is hard work to begin with. Using incorrect tools can cause frustration and discourage landscaping, rather than positive associations. When considering what needs to be completed, plan for the types and number of tools required for the working group.

Some of the most commonly used tools for OLE building and maintenance projects include: shovels (spaded, flat, and sharpshooters), hand trowels, hard rakes, leaf rakes, pruning shears, hand pruners, hammers (including sledge and lump hammers), picks, wheelbarrows, push brooms, tarps, garden hoes, and pitch and potato forks. Other necessary items include measuring tapes, gloves, eye protection, plastic 5-gallon buckets, garden hoses, watering cans, spray marking chalk, survey flags and string. Pick mattocks and rock bars can be incredibly helpful for breaking up and digging Colorado's hard clay soils. For this, shovels are helpful for scooping out loose material.

Involving children in OLE construction and maintenance tasks is a great way to help them develop ownership and a sense of wonder in unfolding natural processes. While many different tools are available for youth, including many toy or imitation tools, real tools are recommended. Useful child-size hand tools include gloves, trowels, shovels, rakes, brooms, wheelbarrows, watering cans, and tool belts. Similar to adult discouragement, children can also become disinterested in gardening when it feels like 'spinning wheels' because of using incorrect tools. It is important to reinforce positive associations early. Using real tools under adult supervision will help. Ultimately, children with direct hands-on experience coupled with guidance from educators and parents will gain a sense of responsibility and consider caring for plants as essential.

6

Managing Site Materials

CANVAS

Examples in the OLE: *Shade sails, teepees, performance deck backdrops*

- Keep an eye on the weather as canvas in the OLE may need to be taken down due to inclement weather such as thunderstorms or in winter for snow and wind.
- Periodically check fasteners, ropes and lashings, which may all need to be secured or cinched up.
- Canvas may be cleansed by hand or power washed.
- Damage can be patched, however over time and use, canvas materials deteriorate and will need to be replaced.



*Shade sails protect young children from overexposure to UV radiation.
—photo by NLI*

CONCRETE

Examples in the OLE: *Primary paths, sidewalks, steps*

- Regularly sweep to keep clear of mulch, sand, and other debris.
- Periodically power-wash to remove tougher stains or dirt.
- Can be hosed off, although keep an eye on local water restrictions.
- Over time concrete may need to be patched due to damage from freeze/thaw and wear.
- Depending on where it is in the OLE, the intention may be for it to be painted, and a fresh coat will be necessary every few years.

The following are typical materials found throughout naturalized outdoor learning environments, considerations for what to expect, and some recommendations for care.

Photo by NLI

- Keep clear of snow to mitigate melting and refreezing causing hazardous icy conditions, and to minimize the use of salt-based deicers which will harm adjacent planting beds. If it is necessary to treat ice, consider using sand instead.



Concrete primary pathway.—photo by NWF

EARTH

Examples in the OLE: *Earth and mud play*

A 50/50 blend of sand to peat, earth play offers a tactile experience different from sand, tends to drain more easily, and does not compact the same as sand. To make it more 'dirty' add 'mini' bark mulch to the surface and rake it in. Maintenance considerations for earth play digging areas are approached the same way as sand. Please see 'Sand' below.

Mud: Simply mix top soil with water. While mud play is a wonderful tactile experience for children, it needs to be intentionally planned and designed for. After all, if successful it makes a mess! For that reason, it may be reserved for special occasions as care providers need to coordinate with parents to provide a clean change of clothes that day.



Earth play contained by standardized plastic boundary.—photo by NLI

FABRIC & TEXTILES

Examples in the OLE: *Scarves, cotton sheets, blankets, performance deck backdrops*

- Fabric will need to be washed regularly depending on use.
- Some may need to be replaced when they start to fray or unravel.
- Seasonal considerations should be observed regarding storage and weather.



Textile blanket on lawn makes comfortable gathering spot.—photo by NLI

FINE CRUSHED STONE (CRUSHER FINES)

Examples in the OLE: *Paths, gathering areas, outdoor classrooms*

Commonly used for ground surfacing in gathering areas and paths, fine crushed stone is an excellent material for durability, ease of maintenance, and permeability. Compacted properly, it is appropriate for ADA access, and in some cases larger perennials and trees can be planted in it directly.

- Overtime in less trafficked areas it will become necessary to hand-pull weeds.
- Fine crushed stone can be gently raked of debris.
- Replenish with a top-dressing as needed to maintain the ideal depth of 4".



Decomposed granite pathway.—photo by NLI

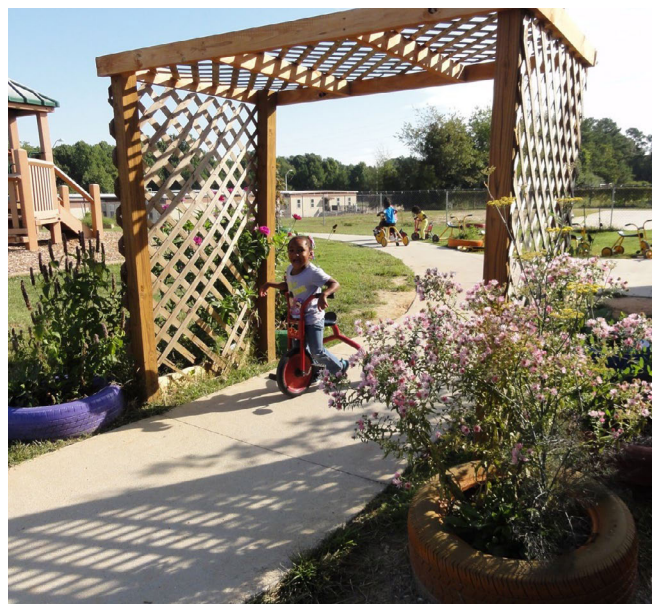
LUMBER

Examples in the OLE: *Arbors, trellising and lattices, balance poles, benches, bridges, decks/stages, fencing, low bridges with ballerina bars, outdoor storage, pallets, pergolas, playhouses, pull-up rails, raised beds, shade structures, tables, wheeled toy storage*

Dimensioned lumber is such a versatile material, it is commonly used in child care center OLEs for constructing the wide array of settings and components listed above that need to be maintained for safety and longevity. Tropical hardwoods, typically harvested from non-sustainable sources, should be avoided. Black locust (*Robinia pseudoacacia*) is a high-quality, dense, decay-resistant heartwood lumber, widely available in the U.S. that grows 20 to 40 percent faster than tropical hardwoods and offers a wide range of OLE applications in rough sawn, dimensioned, and debarked/sanded form as both horizontal and vertical members. Other dimensional lumber commonly used is cedar or douglas fir; Cedar being known for its rot-resistance, and douglas fir being structurally sound.

Composite lumber such as Trex™ has long been used on horizontal surfaces such as decks and stages that are exposed to both weather and heavy use by children. The material is excellent but expensive. Fortunately, several types of treated lumber are available as an alternative, including thermally modified, polymerized, or acetylated lumber.¹³ With the care and attention, the life expectancy of treated lumber, especially in dry climates, can be similar to manufactured play equipment, 10 - 15 years. All wooden components should be free of sharp edges, sharp hardware, and splinters. Common pressure-treated lumber should be additionally protected using a water-based sealant when used for raised planting beds or where children can have access. Below ground oil-based sealants may be used to slow the effects of moisture penetration and decay.

Note that some school districts may not allow timber construction on schoolyards. Be sure to check with facilities and grounds personnel when planning.



Lumber arbor with lattice.—photo by NLI

METALS

Examples in the OLE: *Shade structures, sheds, pergolas, wheeled toys, acoustic and music play, kitchen play elements, fencing*

Similar to rock, stone, and concrete, metals in the OLE are durable and relatively maintenance free.

- Susceptible to rust, some metals may need to have a fresh coat of paint applied periodically.
- Make sure that fasteners don't have sharp snags, that they are inaccessible where possible, and not coming loose.
- Routinely check fencing and sheds for damage or safety hazards.



Acoustic play: pots and pans.—photo by NLI

MULCH FOR PATHWAYS & FALL ZONES

Examples in the OLE: *Fall and use zones, pathways*

Mulch used for pathways can be similar to mulch used in garden beds, but for fall/use zones around climbing and play structures, licensing and play standards require at least 9" of playground mulch or engineered wood fiber. This can be found at a local landscape materials distributor, and/or some school districts may provide this at no cost to a school. For ADA accessibility, engineered wood fiber is specifically designed to allow for wheelchair access. In both instances of mulch used for paths or in use zones, landscape fabric should be used to discourage weed growth.

- Weeds may need to be pulled by hand.
- Replenish as necessary to maintain depth.



Engineered wood fiber mulch.—photo by NWF



Mulch-surfaced pathway.—photo by NWF

NATURAL PLAY ELEMENTS

Examples in the OLE: *Natural loose parts, logs, log stumps, tree cookies*

Natural play elements are subject to organic processes of decay and breakdown. Typical life

expectancy of wooden elements in the OLE is 10 years. Some natural loose parts are easiest to simply discard or compost where possible, switching them out for fresh, seasonal materials gathered from the OLE. Logs and stumps can be set aside from tree work done on site, or acquired from a local tree company. To extend the life of wooden components such as logs, stumps, and materials used for natural construction, a water-based sealant should be applied.

- For safety, be sure to sand or bevel sharp edges.
- Keep an eye out for splintering components .
- Reapply sealant every couple of years. Follow manufacturer directions for use.



Natural construction setting.—photo by NLI

PLASTIC, PVC, & COMPOSITE MATERIALS

Examples in the OLE: *Acoustic panels, artificial turf, music & art walls, manufactured tunnels, outdoor storage, tables, loose parts, raised water play tables*

- Plastics in the OLE will breakdown overtime due to exposure to the sun. Care should be taken to see that plastic elements are not brittle or beginning to splinter and crack.
- They can be easily washed and sanitized if needed, or simply rinsed off.



Plastic manufactured greenhouse.—photo by NLI

ROCK & STONE

Examples in the OLE: *Dry creek beds, boulders, stepping stones, flagstone patios or steppers, rock mulch*

Rock and stone are some of the longer lasting materials in the OLE, and are critical in achieving site naturalization. For childcare centers, boulders with a finish height greater than 18" from grade require a fall zone.

- Ensure that stepping stones or boulders are solidly placed, and do not wiggle when stepped on posing a risk hazard.
- While they have been standing the geologic test of time for ages and do not require much maintenance, rock and stone may periodically need to have dust and debris rinsed or leaves removed.
- Use rock mulch sparingly, it's hard on tools, and difficult to work around when planting.
- For areas serving very young children, consider smooth varieties for boulders.



Large boulders to climb and sit on. –photo by NWF

RUBBER

Examples in the OLE: *tires, rubber mulch, rubber pavers*

Rubber mulch is not recommended as it gets hot in the sun and is known to 'off gas', potentially being harmful to young children who spend a lot of time within 12" of the ground. Rubber is not biodegradable, so it will not break down over time, and is incredibly difficult to get rid of as it has a tendency to spread all over. Children who have been playing in it can get covered in rubber 'soot.'

On the other hand, recycled tires are a great way to create buffers, raised planters, and plant protection. Easily painted, they can add an element of OLE whimsy. Although, they make great planters for flowers and ornamental grasses, note that edible

plants should not be planted in tires as they can leach toxins.

- When prepping tires, wash them with soap and water. Take care that wire threading is not exposed.
- Paint tires with an enamel spray paint suitable for outdoor applications.
- If using tires as planters, staple landscape fabric to the inside walls to help hold potting soil.



Children planting double stacked, painted tire planters. –photo by NLI

SAND

Examples in the OLE: *Sand play*

- To allow for easy digging, regular raking will help to keep material 'fluffed'.
- For cleanliness, designated digging areas need to be kept covered when not in use to discourage neighborhood cats and other wildlife from creating unsanitary conditions.
- Digging areas should have high borders to help with containment, but inevitably the material will need to be replenished as it has a remarkable tendency to 'creep' beyond the setting.
- Maintain an ideal depth of 12" in toddler spaces, and a depth of 18" for ages Pre-K and up.



Sand play setting enclosed with logs and rocks. –photo by NLI



Appendix A: Landscape Considerations

GARDENING IN COLORADO

Gardening Challenges: <http://extension.colostate.edu/topic-areas/yard-garden/colorado-gardening-challenge-to-newcomers-7-220/>

Gardening in the Mountains: <http://extension.colostate.edu/topic-areas/yard-garden/colorado-mountain-gardening-basics-7-224/>

Sustainable Landscaping: <http://extension.colostate.edu/topic-areas/yard-garden/sustainable-landscaping-7-243/>

Fall Gardening Tasks: <http://extension.colostate.edu/topic-areas/yard-garden/fall-gardening-tasks/>

SOILS

Soil Testing: <http://www.soiltestinglab.colostate.edu/>

Useful Articles: <http://www.soiltestinglab.colostate.edu/articles.html>

Choosing a Soil Amendment: <http://extension.colostate.edu/topic-areas/yard-garden/choosing-a-soil-amendment/>

Soil Amendment Garden Notes: <http://cmg.colostate.edu/Gardennotes/241.pdf>

Composting Yard Waste: <http://extension.colostate.edu/topic-areas/yard-garden/composting-yard-waste-7-212/>

WATER

Overview: <http://extension.colostate.edu/topic-areas/water/>

Irrigation Systems: <http://extension.colostate.edu/topic-areas/yard-garden/operating-and-maintaining-a-home-irrigation-system-7-239/>

Dealing with Drought: <http://extension.colostate.edu/topic-areas/yard-garden/watering-a-home-landscape-during-drought-7-240-2/>

Fall & Winter Watering: <http://extension.colostate.edu/topic-areas/yard-garden/fall-and-winter-watering-7-211/>

Rainwater Harvesting: <http://extension.colostate.edu/topic-areas/natural-resources/rainwater-collection-colorado-6-707/>

Western Slope: <http://extension.colostate.edu/docs/pubs/native/WestSlopeSm.pdf>

Photo by NWF

Appendix B: Managing Plants

MANAGING PLANTS

Sun Exposure, Light, and Shade: <http://cmg.colostate.edu/Gardennotes/142.pdf>

Temperature: <http://cmg.colostate.edu/Gardennotes/143.pdf>

Water: <http://cmg.colostate.edu/Gardennotes/144.pdf>

Physiology, Photosynthesis, Respiration, and Transpiration: <http://cmg.colostate.edu/Gardennotes/141.pdf>

Avoiding Invasive Plants, Recommended Alternatives: http://www.conps.org/wp-content/uploads/2015/05/Garden_Smart_Colorado.pdf

Growing Plants from Seed: <http://extension.colostate.edu/topic-areas/yard-garden/growing-plants-from-seed-7-409/>

Large Deciduous Trees: <http://extension.colostate.edu/topic-areas/yard-garden/large-deciduous-trees-7-419/>

Small Deciduous Trees: <http://extension.colostate.edu/topic-areas/yard-garden/small-deciduous-trees-7-418/>

Evergreen Trees: <http://extension.colostate.edu/topic-areas/yard-garden/evergreen-trees-7-403/>

Native Trees: <http://extension.colostate.edu/topic-areas/yard-garden/native-trees-for-colorado-landscapes-7-421/>

Planting & Placement of Trees: <http://cmg.colostate.edu/pubs/Trees.html#Planting>

Deciduous Shrubs: <http://extension.colostate.edu/topic-areas/yard-garden/deciduous-shrubs-7-415/>

Evergreen Shrubs: <http://extension.colostate.edu/topic-areas/yard-garden/evergreen-shrubs-7-414/>

Planting and Placement of Shrubs: <http://planttalk.colostate.edu/topics/trees-shrubs-vines/1711-planting-trees-shrubs/>

Perennial Gardening: <http://extension.colostate.edu/topic-areas/yard-garden/perennial-gardening-7-402/>

Herbaceous Perennials: <http://extension.colostate.edu/topic-areas/yard-garden/herbaceous-perennials-7-405/>

Wildflowers: <http://extension.colostate.edu/topic-areas/yard-garden/wildflowers-in-colorado-7-233/>

Flowers, Edible and Toxic: <http://extension.colostate.edu/topic-areas/yard-garden/edible-flowers-7-237/>

Fruits and Vegetables: <http://extension.colostate.edu/topic-areas/yard-garden/#fruits>

Native Grasses: <http://cmg.colostate.edu/Gardennotes/581.pdf>

Ornamental Grasses: <http://extension.colostate.edu/topic-areas/yard-garden/ornamental-grasses-7-232/>

Groundcovers: <http://extension.colostate.edu/topic-areas/yard-garden/ground-cover-plants-7-400/>

Groundcovers for Mountain Communities: <http://extension.colostate.edu/topic-areas/yard-garden/ground-covers-and-rock-garden-plants-for-mountain-communities-7-413/>

Lawn Fertilizing: <http://extension.colostate.edu/docs/pubs/garden/xcm222.pdf>

Lawn Care: <http://extension.colostate.edu/topic-areas/yard-garden/lawn-care-7-202/>

Lawn-clipping: <http://extension.colostate.edu/topic-areas/yard-garden/eliminate-grass-clipping-collection-7-007/>

Lawn Establishing: <http://extension.colostate.edu/topic-areas/yard-garden/watering-established-lawns-7-199/>

Lawn Alternatives: <http://extension.colostate.edu/topic-areas/yard-garden/buffalograss-lawns-7-224/>

NATIVE PLANTS BY REGION

Front Range: <http://extension.colostate.edu/docs/pubs/native/FrontRangeSm.pdf>

Mountains: <http://extension.colostate.edu/docs/pubs/native/MountainsSm.pdf>

Prairie and Plains: <http://extension.colostate.edu/docs/pubs/native/PrairieSm.pdf>

Southeast: <http://extension.colostate.edu/docs/pubs/native/SESm.pdf>

Appendix C: Managing Weeds & Pests

MANAGING WEEDS

Weed Management: <http://cmg.colostate.edu/Gardennotes/351.pdf>

Weed Identification: <http://cmg.colostate.edu/Gardennotes/352.pdf>

Invasive Plants and Alternatives: http://conps.org/wp-content/uploads/2015/05/Garden_Smart_Colorado.pdf

Noxious Weeds and Invasive Plant Species: <http://www.extension.colostate.edu/topic-areas/agriculture/noxious-weeds-invasive-plant-species/>

Protecting Water Quality and the Environment: <http://www.extension.colostate.edu/docs/pubs/garden/xcm223.pdf>

MANAGING PESTS

Pesticides: <http://www.extension.colostate.edu/docs/pubs/garden/xcm220.pdf>



Photo by NWF

Glossary of Terms

Adze. A tool similar to an axe with an arched blade at right angles to the handle, used for cutting or shaping large pieces of wood.

Aerial Roots. Roots that grow above the ground.

Annual plant. A plant that usually germinates, flowers, and dies in one year. Annual plants often reseed themselves. Seeds may be collected, stored, and re-sown. Ornamental annual plants bought at the nursery or garden center typically do not reseed.

Arbor. A wooden framework with sides and a roof for which to walk under or through, and train vining plants to climb.

Arborist. A professional with expertise in managing and maintaining ornamental or shade trees. Arborists frequently focus on the health and safety of individual trees or wooded areas.

Armature. Structure to support plants and vines.

Ball-and-burlap. A plant that is grown in a nursery, dug with its soil, wrapped with burlap, and tied with twine or wire to be delivered.

Beneficial wildlife. Pollinators, insects, and birds that help control pests and keep soils healthy by recycling and eliminating waste.

Cooperative Extension Agent. Expert employed by the Cooperative Extension Service who provides useful, practical, and research-based information to agricultural producers, small business owners, youth, consumers, and others in rural areas as well as urban areas with communities of all sizes.

Cooperative Extension Service. A non-formal educational program designed to help people use research based knowledge to improve their lives. The service is provided by designated land-grant universities, usually in the areas of agriculture and food, home and family, the environment, community economic development, youth, and 4-H.

Cultivar. A plant variety that has been produced in cultivation by breeding. Cultivar means “cultivated variety” or a plant selected because it exhibits desirable characteristics. Cultivar names are designated by single quotation marks, and are written after the botanical name. For example, Forest Pansy, a specific cultivar of the Eastern Redbud tree (*Cercis canadensis*), known for having dark purple leaves, would be written as *Cercis canadensis* ‘Forest Pansy’.

Deciduous plants. Trees, shrubs, and perennials that lose all their leaves for part of the year. In most cases the loss of leaves coincides with winter. Plants may also lose their leaves during the dry season or during seasonal variations in different climatic regions.

Ecosystem. A natural unit that consists of plants, animals and micro-organisms (living or biotic factors) functioning together with the non-

living (abiotic) factors of the environment. An ecosystem is an independent unit of organisms sharing the same habitat. Living organisms are independent with every other element in their local environment.

Edible landscape. Natural area containing vegetation cultivated to be eaten by humans, for example, vegetable gardens or areas containing fruit trees or grape arbors.

Erosion. Gradual destruction of the ground surface by natural forces, most likely water, wind, or ice or pedestrian foot traffic.

Evergreen plants. Trees and shrubs that hold their foliage all year long.

Fertilizer. Chemical or natural substance added to soil or land to increase fertility.

French drain. Trench filled with gravel or rock that includes a perforated pipe to redirect surface and ground water.

Grass maze. Outdoor maze containing clumping grasses (typically upright grasses that grow in distinct tufts and do not spread) as dividers.

Groundcover. Any natural material that creates a cover to the ground. Usually vegetative, groundcovers serve to prevent soil from eroding.

Hardscape. Referring to the durable, more permanent elements of the landscape that are hard, as opposed to soft, e.g. stone, brick, concrete, etc.

Herbaceous Plant. A plant lacking permanent woody stems, which means it dies down to the soil level at the end of the growing season. The opposite of an herbaceous plant is a woody plant.

Herbicide. A substance that is toxic to plants and is used to destroy unwanted vegetation.

In-ground bed. Area of prepared soil on the ground.

Invasive species. A native or non-native species of animal or plant that heavily colonizes a particular habitat, adversely affecting that habitat economically, environmentally, or ecologically.

Inverted marking paint. Spray paint or chalk, in an inverted can used to create temporary markings on different types of ground surfaces (concrete, pavement, grass, gravel) where permanent markings are not allowed or desired. Often used to mark locations of landscape construction components such as pathways, trees, and play and learning settings.

Landscape architect. Is defined by the American Society of Landscape Architects (ASLA) by the work she or he does, which “encompasses the analysis, planning, design, management, and stewardship of natural and built environments.” Landscape architects are trained professionals (most have college professional degrees) and must be licensed and registered (PLA) in order to practice.

Landscape contractor. A licensed or certified, trained professional with expertise in landscape design, horticulture, and construction. Landscape contractors are qualified to supervise and install landscapes including construction, soil preparation and planting. They usually implement plans prepared by a landscape architect or landscape designer. Landscape contractors may also be landscape designers (see separate entry).

Landscape designer. Someone skilled in designing and installing residential and commercial landscapes. May be certified. Landscape designers are often also landscape contractors (see separate entry).

Lattice. Wooden or metal structure with square or diamond shaped spaces used as a screen, fence, and/or support for plants.

Lawn. Area of short, mown, turf grass.

Mattock. A hand tool similar to a pick axe used to break hard ground, with a double-sided head – one side chisel edged, the other side an adze.

Mulch. A layer of material applied to the ground surface to conserve soil moisture, moderate soil temperature, suppress weed growth, control/prevent erosion, and enhance soil fertility.

Mulch, bark. Mulch composed of bark chips produced from the outer layer of tree trunks, used to conserve soil moisture, moderate soil temperature, suppress weed growth, and control/prevent erosion. Chips can vary in size and color.

Mulch, leaf. Mulch composed of chopped, shredded, or whole deciduous tree leaves, used to conserve soil moisture, moderate soil temperature, suppress weed growth – and to add nutrients and organic matter to the soil.

Native species. A plant indigenous to a region or ecosystem, the result of natural processes without human intervention. Since a native species has evolved in response to local climatic and ecosystem conditions in a particular area it is often best suited to thrive there.

Naturalization. The process of re-introducing living landscapes (including trees, shrubs, flowers, groundcovers, wood material and stone) into a site, including a playground, “playground naturalization” (see separate entry).

Nutrients. Substances needed by plants to thrive, including macronutrients (e.g. nitrogen, phosphorous, sulfur, calcium, magnesium, and potassium) and micronutrients (e.g. copper, zinc, iron, manganese, boron, and molybdenum).

Ornamental grass. An annual or perennial grass plant valued for its texture, color, and aesthetic properties in landscapes.

Ornamental plant. A plant grown mainly for its resistance to insects and aesthetic qualities such as form, bark, leaves, flowers, color, texture, blooming pattern, fruit, seed heads or combination thereof.

Perennial plant. A plant that lives for more than two years. Perennials may produce one or more flower crops each year, depending on the variety. See ‘annual plant’.

Pergola. A garden feature forming a shaded walkway or sitting area of vertical posts or pillars that usually support cross-beams and a sturdy open lattice, often upon which woody vines are trained.

Pesticide. Substance used for destroying insects or other organisms harmful to cultivated plants or to animals.

Pollinator garden. Garden composed of plants that attract small flying insects (e.g. bees, beetles, butterflies, and moths) and birds (even some small bats!) that help transfer pollen from the male to female parts of the flower to secure reproduction.

Pruning. Trimming plants by cutting dead, diseased, dying or overgrown branches or stems to control plant size, stimulate growth, and/or control flower bloom patterns.

Rain garden. A planted depression designed to allow rainwater runoff to flow into it and be absorbed. The purpose is to reduce the amount of stormwater flowing off a site by allowing it to soak into the ground (instead of flowing into storm drains or across adjacent land, possibly causing erosion, water pollution, flooding, and diminished groundwater). Rain gardens are usually planted with native plants because they generally do not require fertilization and are adapted to the local climate, soil, and hydrologic conditions. Water quality is improved as plant roots filter and biologically treat water before it re-enters the groundwater system.

Raised planter bed. A garden bed installed higher than the surrounding soil usually contained by wooden boards, stone, or masonry.

Sanitation rules. Rules that enforce standards for human safety and health protection.

Shade tree. Tree selected for its shape and growth pattern and planted to provide shade.

Shrub. Perennial, multi-stemmed woody plant usually less than 15 feet tall.

Soil amendment. Any material added to a soil to improve its physical properties and quality, such as water retention, permeability, water infiltration, drainage, aeration, and structure.

Soil quality. Capacity of a soil to support plant and animal life, maintain or enhance water and air quality, and support human health.

Soil test. Analysis of a soil sample to examine its content (for nutrient and contamination), composition, and other characteristics to determine levels of fertility.

Soil, clay. Soil containing high amounts of clay particles and small air pores. This type of soil retains water and contributes to poor drainage conditions but is high in nutrient content.

Soil, compacted. Compacted soil is the result of stress applied to the ground surface causing densification as air is displaced from the pores between the soil grains. Compaction can be caused by heavy machinery, animals, pedestrian foot traffic or rain falling on bare soil.

Soil, organic. Soil composed of organic matter; i.e. plant and animal residues at various stages of decomposition, cells and tissues of organisms, and other substances produced by soil organisms.

Straw bale. Agricultural product created with dry stalks of cereal plants after the grain and chaff have been removed. Can be used loose as mulch, baled to partition spaces, to serve as seating, or to provide growing medium as raised planters.

Sun exposure. Aspect related to the orientation of a building or outdoor area in relation to the sun.

Surface drainage. Natural or artificial elimination of surface and/or sub-surface water from an area.

Survey flag. Marking flags (thin steel wire and small colored plastic tag) used by surveyors, architects, and landscape designers to lay out a site.

Tamp. Pack something down, e.g. soil around a tree root when being planted, or sand around a vertical post.

Trellis. See lattice.

Turf. Surface layer of earth containing a dense layer of grass and its roots.

Understory. Plant life growing beneath the forest canopy.

Vegetated swale. Swale that mimics a natural waterway that may include a rocky base, ponds, and vegetation that assists in filtering water and cleansing it of contaminants.

Vermiculture. Process of using worms to break down organic food waste into nutrient rich compost.

Vine. Climbing or trailing plant that gets its support from climbing, twining, or creeping along a surface.

Weed. Common term describing a plant considered to be undesirable within a certain area.

Welded mesh. A series of vertical and horizontal rods arranged at right angles and welded together at the intersection. Typically used to strengthen reinforced concrete. In landscape applications used to support perennial or annual vines.

Wildlife. Usually refers to animal species, plants, fungi, and other living organisms growing in the wild without human intervention.

Wildlife habitat. An area that offers food, water, cover and places to raise young for a variety of animal species native to that region.

Woody plant. Plant with hard stems supporting buds, which survive above ground over the winter. The opposite of woody plant is herbaceous plant.

Xeric. A characteristic of an environment or habitat containing little moisture and being very dry.

Xeriscape. A style of landscape design requiring little or no irrigation once established, used in arid regions.

Zeroscape. A common mispronunciation of the word 'xeriscape'.

Useful Resources

Children & Nature Network:

www.childrenandnature.org

www.childrenandnature.org/researchlibrary

Colorado Gardener:

<http://coloradogardener.com>

Colorado Native Plant Society:

<http://conps.org/>

Colorado Parks and Wildlife - Living with Wildlife:

<http://cpw.state.co.us/learn/Pages/LivingwithWildlife.aspx>

Colorado State University (CSU) Extension:

<http://extension.colostate.edu>

CSU Soil Testing Lab:

<http://www.soiltestinglab.colostate.edu>

Denver Botanic Gardens:

<http://www.botanicgardens.org>

International Play Association:

<http://www.ipausa.org>

Natural Learning Initiative:

<http://www.naturalearning.org>

Natural Learning Initiative - GreenDesk:

<http://www.naturalearning.org/greendesk>

National Wildlife Federation:

<http://www.nwf.org>

National Wildlife Federation - Early Childhood Health Outdoors (ECHO):

<http://www.nwf.org/echo>

National Wildlife Federation - Garden for Wildlife:

<http://www.nwf.org/Garden-for-Wildlife/Certify>

USDA Plant Hardiness Zone Map:

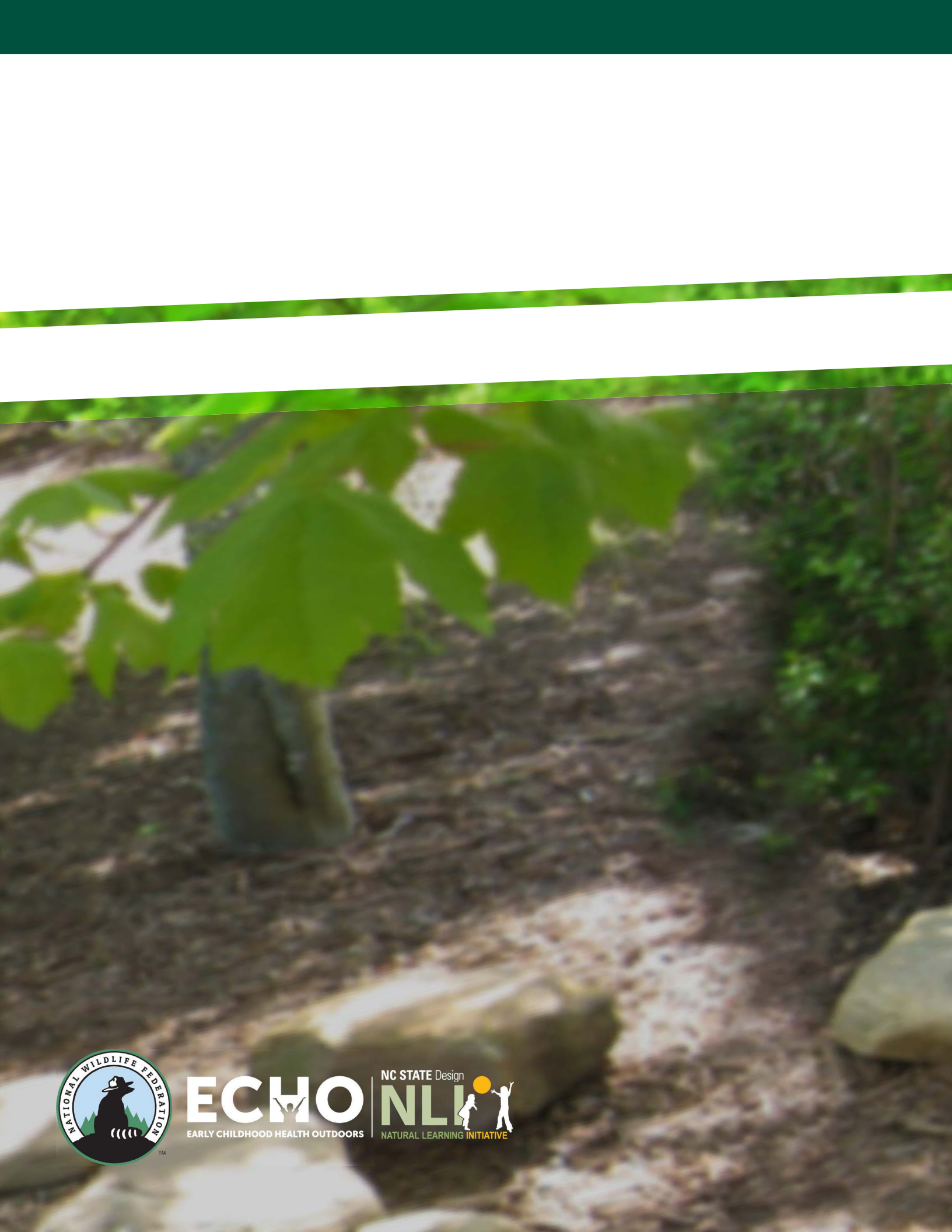
<http://planthardiness.ars.usda.gov/PHZMWeb/>

USDA Plants Database:

<http://plants.usda.gov/java>

Endnotes

- ¹ For understanding today's range restrictions see: <http://www.freerangekids.com/>
- ² See the Children and Nature Network: <https://www.childrenandnature.org/>
- ³ See Natural Learning Initiative programs: <https://naturalearning.org/programs/>
- ⁴ Moore, R. & Wong, H. (1997). Natural Learning. Berkeley, CA: MIG Communications.
- ⁵ Merriam-Webster Dictionary online (2014). Retrieved from: <http://www.merriam-webster.com/dictionary/naturalize> [10-6-18]
- ⁶ Moore, R. & Cosco, N. (2014). Growing Up Green: Naturalization as a Health Promotion Strategy in Early Childhood Outdoor Learning Environments. *Children, Youth and Environments* 24(2): 168-191.
- ⁷ Conservation Psychology.
- ⁸ Child Care Aware of America (2012). 2012 State Fact Sheets. Estimates based on data provided by Child Care Resources and Referral agencies.
- ⁹ Statista. <https://www.statista.com/statistics/238307/number-of-us-elementary-and-secondary-schools/> [retrieved 10-6-18]
- ¹⁰ Cardon, G., E. Van Cauwenberghe, V. Labarque, L. Haerens, and I. De Bourdeaudhuij (2008). "The Contribution of Preschool Playground Factors in Explaining Children's Physical Activity During Recess." *International Journal of Behavioral Nutrition and Physical Activity* 5(11): 1-6.
- ¹¹ Merriam-Webster Dictionary online (2014). Retrieved from: <http://www.merriam-webster.com/dictionary/stewardship> [10-6-18]
- ¹² For further information see Vermicomposting in Childcare Production Gardens. Retrieved from: <https://content.ces.ncsu.edu/childcare-center-production-gardens-8-vermicomposting-in-childcare-center-gardens> [6-4-19]
- ¹³ See "Promising New Alternatives to Tropical Hardwoods Come with Caveats" (2017). Meg Calkins, Landscape Architecture Magazine, April 2017, pp. 68-79. A useful table is included comparing various tropical and domestic hardwoods and treated lumber.



ECHO
EARLY CHILDHOOD HEALTH OUTDOORS

NC STATE Design
NLI
NATURAL LEARNING INITIATIVE