How to Design a Schoolyard Forest

Design Principles and Components

This article provides school district facilities staff, landscape architects, and other partners working to improve schoolyards with guidance on how to design and build schoolyard forests in a way that maximizes the benefits for students and their communities. This article is not intended to be a comprehensive and in-depth analysis but rather an overview guide to use as a starting point when embarking on the design of a schoolyard forest.

Design Principles

Commit to equity and belonging

To meaningfully address systemic injustices, equity should be a central commitment that is infused into every decision related to the schoolyard forest, including but not limited to site selection, planning, community engagement, design, implementation, management, and use. The process and the built space should meaningfully engage, empower, and give agency to students and stakeholders of all ages, genders, cultural backgrounds, and abilities, including differing cognitive, sensory, and physical abilities. A space created by and for everyone will foster a sense of belonging and lead to long-term care for the schoolyard forest.

Protect and enhance existing assets

Although some tree species may have short lifespans, most trees are long-term investments of over fifty years, so if trees and forests are present at the school, those should be considered valuable assets and the design shall aim at enhancing and protecting them. Tree removal should be considered only in cases of poor tree health, tree fall hazard, and if the tree is poorly located and will create long term problems.

Please refer to the How Cool is Your Schoolyard Activity and Educator Resources section of our Schoolyard Forest System Library for more information on how to effectively engage students in schoolyard forest design, planting, and stewardship.

Including indigenous voices in your schoolyard transformation is important, and resources for this process can be found in our Schoolyard Forest System Library. In addition, you can learn more about Inclusive Design for Outdoor Spaces part of our online National Outdoor Learning Library.

Create spaces for learning and play

Schoolyard forests should be designed to support children's daily learning and play by creating spaces that foster exploration and by including a variety of tree species and other natural materials that have play value and connect to the curriculum. Native tree species provide habitats for birds, insects, and other animals and resulting opportunities for integration with science curriculum. Tree species may also be harbingers of the seasons, bear edible fruit, and drop loose parts such as leaves, seeds, cones, and flowers that can be used for learning and play. In addition, schoolyard forests may contain shaded, wind-protected, and comfortable seating areas for different-sized groups to allow for varied outdoor classroom configurations as well as social interactions.

Mature trees are considered assets at a schoolyard in Berkeley, California

Ayesha Ercelawn

Create spaces that foster mental and physical health

Schoolyard forests should be designed to maximize health benefits, which include improving mental health and social-emotional well-being, increasing physical activity, and helping develop balance and brain function. The design should foster students' contact with nature, encourage different types of play and exploration, and provide spaces for positive social interactions.

Including large shade trees in the design is important to create cooler and more comfortable microclimates, protect students from heat and UV radiation, and improve air quality. In addition, schoolyard forests should be designed to meet students' different developmental needs, from pre-kindergarten through high school. Different ages and genders have distinct physical, cognitive, social, and emotional needs, both as groups and as individuals. For example, tree stumps and balance logs of different heights offer graduated challenges for physical activity; a variety of plant species can provide sensory stimulation through color, smell, or touch; fruit trees offer opportunities to taste and appreciate healthy food; nature-filled secluded areas invite reflection and relaxation; varied seating configurations foster different types of social interactions; and beautiful views of nature may inspire awe and healing.

Create forests rather than isolated trees

A schoolyard forest's design should aim at planting multiple trees in groves to create a distinct forested space as opposed to planting individual trees in small boxes or individual pavement cutouts. This strategy creates a defined space for students in which to learn, play, and take refuge from heat when necessary and also reduces maintenance burdens.

Having trees on a schoolyard requires a certain level of maintenance compared to not having trees; however, planting trees in groves in unpaved areas reduces the need to sweep and clean up leaves and tree droppings. A forest has different maintenance expectations than other schoolyard spaces. Leaf litter and other tree droppings are more likely to be accepted as part of the forest floor where they can naturally decompose, as opposed to when leaves and droppings fall on pavement. Expectations around student behavior can also be different in a forested space, with students being encouraged to actively explore and interact with the trees and other forest materials. In addition, a contiguous patch of trees allows trees to create their own microclimate and provides a larger, shared volume of soil where roots from individual trees can interact and communicate. All these elements contribute to tree growth and long-term health.

Design to maximize climate resilience and environmental benefits

Schoolyard forests are nature-based solutions that provide climate resilience and environmental benefits. A schoolyard forest is an ecological, living, and evolving system, rather than a collection of objects. Therefore, in order for a schoolyard forest to thrive in the long-term, it needs to include compatible trees that are appropriate for the region, that can adapt to our changing climate, and that prosper in a schoolyard setting. Depending on the priorities of the region and district, the schoolyard forest can be designed to reduce temperatures, capture high amounts of carbon, help manage stormwater by intercepting and storing rainfall in the soil and canopy, act as wind buffer, be fire resistant, and support local flora and fauna by providing food, habitat, nesting materials, and other resources.

Trees planted in individual pavement cutouts (top) versus trees planted in a contiguous grove (bottom).

Design for low maintenance and long-term management

Selecting the right trees, placing them in the right location, and planting them correctly significantly reduces maintenance burdens. For example, tree locations should be planned to avoid conflicts with utility lines and structures as trees mature. Tree species that require excessive maintenance should be avoided. This includes trees with highly aggressive roots; trees that require excessive pruning, water, fertilizers, or pesticides; and trees that are highly brittle and drop branches.

Above all, to create a sustainable and thriving schoolyard forest, it is critical to have a long-term management plan. This plan needs to consider the maintenance requirements for different tree species at different stages of growth, assess the district's maintenance staff capacity and expertise, identify gaps and opportunities for support (i.e., professional training, volunteers, non-profit partners, and student participation), and clearly define roles and responsibilities.

Design spaces for multiple uses

There are always competing priorities for the use of outdoor school spaces, especially in urban school districts that may have less space. Therefore, it is imperative to be creative and plan for spaces to be used for multiple purposes. For example, a schoolyard forest can be used for physical education, outdoor classroom spaces, social gatherings, play, and exploration. In the same way, sport courts can sometimes function as lineup spaces before students go into their classrooms or as spaces to host events and gatherings.
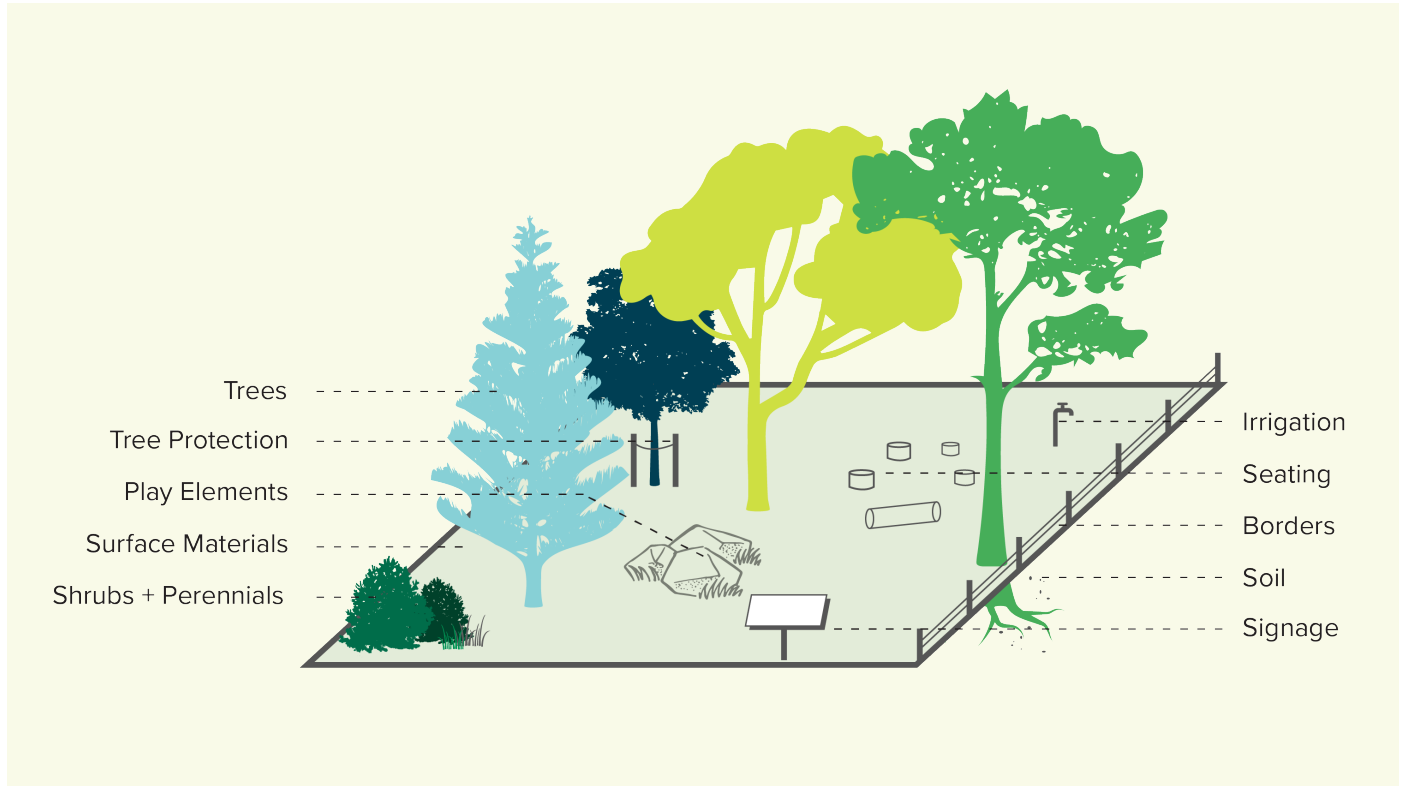
To learn more about benefits and design of nature play spaces please refer to our Nature Play Spaces section of our National Outdoor Learning Library.

To learn more about the health benefits of being outdoors refer to our Health Benefits and Guidance section in our National Outdoor Learning Library.

Schoolyard Forest Components

The following section outlines the basic components or elements of a schoolyard forest and highlights key considerations for each of these components.

Trees
Tree Protection
Play Elements
Surface Materials
Shrubs + Perennials

Irrigation
Seating
Borders
Soil
Signage

Soil

Soil is one of the most important components of a schoolyard forest. Soils in schoolyards, especially under pavement, are often extremely compacted and of poor quality. Trees need enough volume of "rootable" good quality soil for long-term tree health and growth. Trees planted in small compacted pits will most likely have stunted growth and poor health as they mature. As an example, Berkeley Unified School District facilities department recommends that tree planting projects should strive to provide 300 cubic feet of rootable soil for small tree species, 750 cubic feet for medium trees, and 1,000 cubic feet for large trees. (However, the school district recognizes that this is not always possible due to space and budget constraints.) Testing the soil for plant suitability will indicate what tree species will thrive as well as what types of soil amendments to use to improve soil quality. In addition, performing a percolation test will indicate how well the soil drains. Both are relatively simple tests that provide information to help increase tree survival and health.

Trees

Selecting tree species that are appropriate for the region and site and that support each other ecologically is critical for the long-term viability and health of a schoolyard forest. Tree size at time of planting should also be considered. A 15-gallon container-size tree is the largest size recommended to plant with students, given that larger trees are harder to lift and handle. A 15-gallon container-size tree, or even smaller container-size trees, often grow faster and are healthier than larger nursery sizes. However, depending on the species, larger tree sizes at planting may be considered if more instantaneous shade is desired.

Tree protection

Tree stakes are needed to hold trees upright to allow the root ball to anchor into the soil. Stakes can also protect trees from damage during establishment. Stakes should be positioned away from the tree and secured to the trunk at the point where the tree stands upright. The strap should not be made of wire or any material that will girdle the tree or damage the bark and should be loose enough so that the tree can sway in the wind, allowing it to build strong root systems. Stakes should be removed when the tree can stand on its own and the root ball is anchored, unless they are still necessary to protect the tree against damage by students at play.

Shrubs and perennials

In addition to trees, schoolyard forests may include other plant species such as shrubs and perennials that will provide additional health, learning, play, and environmental benefits for students and communities. Selecting climate-adapted, low-maintenance, and vigorous species and planting them in areas where they are somewhat protected from foot traffic will increase their chances of survival. In any case, shrubs and perennials are a much shorter-term investment compared to trees and can be replaced relatively easily as part of the regular maintenance and stewardship of the schoolyard forest.

Irrigation

For most tree species, even drought-tolerant ones, consistent deep irrigation is critical during the first two to three years after planting to ensure healthy establishment. After that initial phase, and depending on the species, irrigation may be less frequent or not necessary except during extended periods of drought. Once trees are established, irrigation requirements depend on species, planting site, climate, and soil conditions. To reduce potable water use and irrigation costs, the project may consider replacing old irrigation systems with new water-efficient irrigation systems, installing cisterns to collect rainwater, or using recycled water. If using recycled water, it is important to make sure the tree species can thrive with the salt levels in the recycled water.

Paige Green

Rainwater cisterns at a schoolyard in San Francisco, California provide water for irrigation and opportunity for students to learn about water conservation.

Surface materials

A minimum three-inch layer of organic mulch, such as leaf litter, shredded bark, or wood chips, protects tree roots from compaction and temperature extremes, conserves soil moisture, provides nutrients to the soil as it decomposes over time, helps prevent grass and weeds from competing with the tree for water and nutrients, and allows water to infiltrate into the ground.

Accessibility and compliance with the American with Disabilities Act (ADA) is a critical aspect of the design and selection of surface materials. For instance, there are wood chip products (i.e., engineered wood fiber) that, with adequate design and maintenance, are ADA compliant for wheelchair access and meet playground safety standards for impact attenuation. Other materials such as wood decks, decomposed granite, and pavers may also be used in the schoolyard forest to create paths or gathering areas.

Seating

Seating elements can create outdoor classroom areas for different-sized groups as well as places for social interaction. These areas can be created with logs, stumps, boulders, regular benches, and/or picnic tables, provided the design meets ADA requirements. Seating elements like stumps and logs can also provide opportunities for play and may be available for free or low-cost from a local arborist.

Engineered wood fiber at schoolyard in Oakland, California.

Play elements

Play elements can include manufactured equipment such as climbing nets, slides, or swings, but engaging play opportunities can also be created with less expensive natural materials such as logs, stumps, and boulders. It is important that play areas are designed to provide different play opportunities with enough level of challenge needed for child development and at the same time comply with safety standards. Engaging a qualified landscape architect who understands play and child development, and a certified playground inspector, will ensure that the play areas meet ADA and safety requirements and at the same time maximize children's benefits through play.

Logs, stumps and boulders act both as seating and play elements in Los Angeles, California.

Borders

Borders around a schoolyard forest can take different forms depending on their function. They can be flush concrete or wood bands, raised curbs, fences, logs, stumps, or topography. If asphalt is removed, wood or concrete borders are needed to stabilize cut edges and prevent the asphalt from crumbling. Raised edges such as curbs, logs, or stumps can be used to prevent loose materials, such as mulch, from migrating onto the pavement. Borders or edges can also be used as visual cues to demarcate different areas of the schoolyard with different maintenance and behavioral expectations. Well-designed edges can also frame a natural area and communicate that the area is intentionally wild but nonetheless cared for.

Signage

Signage and site design communicate explicit and implicit messages. Signs are powerful communication tools, can be temporary or permanent, and can be used to provide educational moments, outline expected behavior, and help people navigate through the environment safely. Examples of educational signage include diagrams of how to care for the schoolyard forest, how it functions ecologically, and information about tree species. Working with students in the creation of signage is a great way of getting them engaged in stewardship and appreciation for their schoolyard forest. In addition, including languages spoken by students and their families fosters a sense of belonging.

Please refer to our California tree palette, which includes climate-adapted trees for different climate zones in California and trees that are appropriate for a schoolyard setting.

Read more about the benefits and design of nature play spaces in our section on Nature Play Spaces which is part of our National Outdoor Learning Library.

For more information about how to create seating spaces for outdoor learning, refer to our section on Seating and Work Surfaces for Outdoor Learning which is part of our National Outdoor Learning Library.
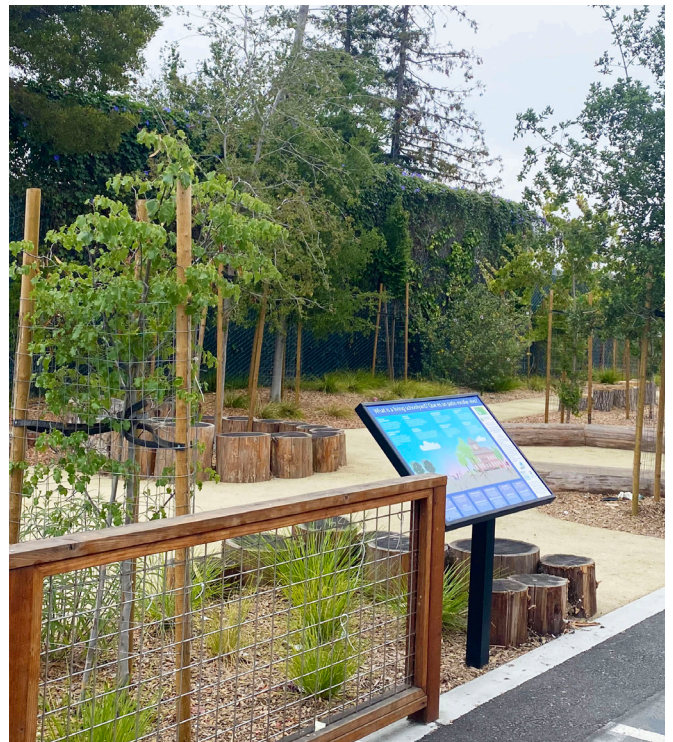
Informal painted sign on butterfly garden (top) and a more formal border and sign in Oakland, California (bottom).

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CALIFORNIA SCHOOLYARD FOREST SYSTEM

The California Schoolyard Forest System℠ seeks to create schoolyard forests across PreK-12 public school grounds statewide to directly shade and protect students from extreme heat and rising temperatures due to climate change. This initiative was founded by Green Schoolyards America in partnership with the California Department of Education, the California Department of Forestry and Fire Protection, and Ten Strands.

For more information, visit: **greenschoolyards.org/ca-forests**