Paige Green

Making the Academic Case for Schoolyard Forests

A California Framework

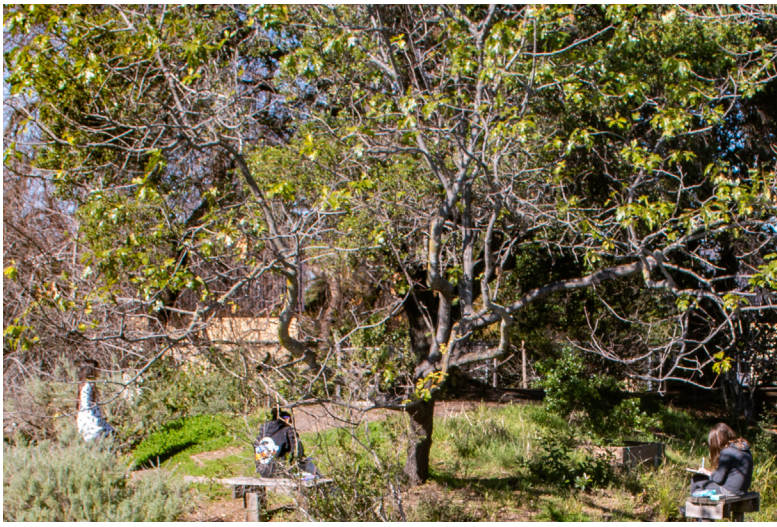
In this document, we make the case for the use of schoolyard forests to support academics across grades and subjects. The sections of this document are divided by subject and explain how a schoolyard forest system can be an outstanding resource in implementing the instructional shifts outlined in California's content frameworks in Science, Math, English Language Arts, Social Studies and Civic Engagement, Career Technical Education, Arts, World Languages, and Health.

Introduction

Schoolyard forests are groves of climate-adapted tree species that include large trees and high biodiversity. They are designed to invite students in to nurture and protect them from extreme heat during outdoor learning, physical activities, social gatherings, and play. They are adaptable to most campus sizes and useful for all age groups. Schoolyard forests provide opportunities to experience and connect with the natural world and strengthen students' understanding of their local environment.

A schoolyard forest system can provide an immersive and engaging learning environment that can help students learn and apply the California content standards in various subjects. It can also foster a sense of stewardship and responsibility among students, which is essential to our state's definition of environmental literacy. While learning outdoors is a natural fit for science, the forest is also an invaluable resource to support academic achievement across the curriculum.

This document is divided below into sections by subject to demonstrate how a schoolyard forest system can be an outstanding resource in implementing the instructional shifts outlined in California's content frameworks.



For a curated collection of schoolyard forest lessons and activities that span California's content frameworks across topics, please visit Green Schoolyards America's online Educator Resources for Schoolyard Forests toolkit.

California's Environmental Principles and Concepts

According to California's Blueprint for Environmental Literacy (2015), "An environmentally literate person has the capacity to act individually and with others to support ecologically sound, economically prosperous, and equitable communities for present and future generations. Through lived experiences and education programs that include classroom-based lessons, experiential education, and outdoor learning, students will become environmentally literate, developing the knowledge, skills, and understanding of environmental principles to analyze environmental issues and make informed decisions." These key understandings are defined in California's Environmental Principles and Concepts (EP&Cs), big ideas that highlight the interconnectedness between human and natural systems.

Because they cut across and integrate content from so many disciplines, these were codified in the Education Code through Senate Bill 720 (Allen, 2018), which updated Section 51227.3 to state that the EP&Cs shall be integrated into the content standards, curriculum frameworks, and criteria developed for textbook adoption. The EP&Cs are now embedded into Frameworks for Science (2016), History–Social Science (2016), Health (2019), Arts (2020), World Languages (2020), and in the upcoming Math Framework. These concepts can be used to inform standards-based instruction, fuel student inquiry, and promote environmental literacy—especially in the context of a schoolyard forest system.

California's teachers understand that guiding inquiries around local phenomena—on school campuses and on short walks in kids' own neighborhoods—is one of the most effective strategies for student engagement and achievement. Schoolyard forests are living ecosystems that showcase endless phenomena that illustrate the interconnectedness of various elements, including humans, plants, animals, soil, and climate. Students have the opportunity to interact with these real-world spaces and scenarios, fostering environmental literacy and becoming informed stewards of their hyper-local environments. The following page contains a few examples of how the EP&Cs might be explored.


Thomas Kuoh

Principle 1: People depend on natural systems

Students can observe and study the diverse ecosystems present in the schoolyard forest, understanding how these systems provide essential goods and ecosystem services, such as shade, oxygen, wildlife habitat, and carbon sequestration, just to name a few.

Principle 2: People influence natural systems

Students can explore the impact of their own stewardship activities on the school forest. They can also investigate how human activities, such as land use, resource extraction, and community development, influence the composition, biodiversity, and viability of natural systems.

Principle 3: Natural systems change in ways that people benefit from and can influence

Students can observe and analyze the cycles and processes that occur within the schoolyard forest, such as nutrient cycles, water cycles, and succession, as well as how their own actions can positively, neutrally, or negatively impact these cycles.

Principle 4: There are no permanent or impermeable boundaries that prevent matter from flowing between systems

Students can examine the exchange of matter between the schoolyard forest and human activities, such as nutrient cycles, waste management, pollution, and composting.

Principle 5: Decisions affecting resources and natural systems are complex

Students can engage in decision-making activities related to the schoolyard forest, including design, resource management, conservation strategies, and land-use planning within the context of the schoolyard forest.

Just as the EP&Cs are intended to infuse and connect multiple disciplines, a schoolyard forest is a space that students and educators alike can return to again and again, deepening their connection to nature, their curiosity about sustainable systems, and their sense of stewardship of healthy campus communities.

Science

According to California's Science Framework (2016), "Outdoor and environmental learning experiences are powerful tools for implementing key instructional shifts required by the CA [Next Generation Science Standards (NGSS)] and California's Environmental Principles and Concepts…Engaging students in relevant issues requires connecting to students' everyday experiences." This should be done in "student-centered learning environments [that] extend beyond the classroom to the schoolyard, the community, parks, outdoor schools, museums, zoos, aquariums, virtual platforms, and beyond" (Chapter 11: Instructional Strategies for CA NGSS Teaching and Learning in the Twenty-First Century, p. 1455).

At every stage, the development of a schoolyard forest system provides an excellent opportunity for hands-on scientific exploration and investigation. Students can engage in three-dimensional science learning in ongoing research projects on their own campus. The following are some examples of how the standards can be explored.

Ecosystems

Schoolyard forests provide a hands-on opportunity for students to study ecosystems and the interdependence of living organisms. They can observe and analyze the relationships between different species of plants, animals, and fungi in the forest, soil, and microclimates and develop an understanding of the importance of biodiversity.

Energy and Matter

Students can study the roles of photosynthesis, cellular respiration, and decomposition and investigate how energy and matter move through different trophic levels in the forest food web.

Earth and Human Activity

Students can investigate human impacts on the environment, starting with their own tree canopy. They can learn about the positive impacts of their school's tree canopy, such as shading and cooling, storing carbon, and providing wildlife habitat. They can investigate how student actions on their campus positively and negatively affect the schoolyard trees, and see the results of their own stewardship activities. They can also learn how actions in the broader ecosystem, such as pollution and climate change, can affect the health and sustainability of the schoolyard forest. Having their own forest will also enable students to be more engaged in researching global issues such as deforestation.

Structure and Function

Students can explore the forest system and observe the diverse structures of plants and animals. They can examine tree trunks, branches, leaves, stems, flowers, and seeds to understand how these structures relate to their functions, such as how different types of leaves capture sunlight. Students can also observe the forest's animal species and learn how different animal structures help them obtain food or evade predators.

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Engineering Design

Students can engage in design challenges to plan and implement a schoolyard forest and to address environmental challenges on campus, such as reducing erosion, controlling invasive species, or creating rainwater catchment systems.

Science and Engineering Practices

Schoolyard forests provide an opportunity and motivation for students to engage in scientific inquiry and engineering design practices. They can develop their own questions, collect data, make observations, and conduct experiments in the forest, while using evidence to support their claims and communicate their findings to classmates, school staff, or community members.

Indigenous Knowledge and Cultural Responsiveness

The science framework encourages educators to consider student's cultural backgrounds and local contexts when selecting phenomena and examples for teaching scientific concepts. Including native plants in the schoolyard forest provides an opportunity to address indigenous ways of knowing and tending and traditional ecological knowledge alongside Western science instruction. Intentionally including non-native yet other culturally familiar species also includes students with diverse heritages to draw on their own cultural experiences. By thoughtfully studying the schoolyard forest, educators can create a more inclusive and culturally responsive learning environment.

Math

According to California's Mathematics Framework (2013), "A fundamental goal is to promote higher-order mathematical thinking skills and interdisciplinary approaches that integrate the use of supportive technologies, inquiry, and problem-based learning to provide contexts for pupils to apply learning in relevant, real-world scenarios and that prepare all pupils for college, careers, and citizenship in the twenty-first century." Student outcomes consist of "twenty-first-century interdisciplinary themes, which include global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; and environmental literacy" (p. 7).

As students gather data from their own ever-changing schoolyard forest, they have a dynamic and practical context for applying their skills in measurement, modeling, and reasoning through statistical, geometric, and algebraic analyses. The following are a few examples of how the standards can be explored.

Measurement and Data

Students can use measurement and data analysis skills to study the forest ecosystem. For example, they can measure the diameter of tree trunks, the length of different types of leaves, the weight of organisms found there, and air and soil temperatures below the canopy. They can also collect data on factors that affect the health of the forest, such as the amount of sunlight or water available.

Statistics and Probability

Students can analyze data related to the forest ecosystem and use it to create graphs and charts and to calculate measures of central tendency and variability. Older students can analyze changing population dynamics over time.

Geometry

Schoolyard forests provide an opportunity for students to apply geometric concepts to the natural world. Younger students can explore the patterns and shapes found in different types of plants and animals. Later, they can use geometry to measure growing trees, analyze fractals and branching patterns, and calculate the area and volume of different parts of the forest.

Algebra

Students can use algebraic concepts to model and solve problems related to the forest ecosystem. For example, they can calculate the rate of change of different variables over time, such as the growth rate of trees or the population density of certain animal species.

Mathematical Practices

Schoolyard forests provide a context for students to develop mathematical practices, such as problem-solving, reasoning, and communication. Students can work in teams to design and conduct experiments, analyze data, and present their findings to others. They can use mathematical modeling to make predictions and solve real-world problems related to the forest ecosystem.


City of Vancouver, WA


Drew Kelly

English Language Arts

According to the English Language Arts/English Language Development Framework (2014), our students should "develop systems thinking, analyzing how various elements interact to produce complex outcomes" (p. 943). The schoolyard forest system becomes a fertile ground for interdisciplinary exploration, where students can integrate knowledge and ideas from multiple disciplines. Students are empowered to articulate their thoughts and ideas, drawing inspiration from the vibrant ecosystem that surrounds them. Their written expressions become a tapestry woven with scientific discoveries, literary insights, and personal reflections. The following are some examples of how the standards can be explored.

Speaking and Listening

Students can engage in discussions, debates, and presentations about environmental issues, such as conservation, green space access, climate resilience, and sustainability. They can also conduct interviews with local experts or community members about their expertise and perspectives on these issues.

Language

Students can learn and use specialized vocabulary related to ecology and biology. They can also analyze and interpret figurative language in nature-themed literature and poetry.

Writing

Students can write descriptive paragraphs, poetry, and essays about the natural world, using their observations and experiences in the schoolyard forest. They can also write scientific reports about their investigations and experiments related to ecology and the environment.

Reading

Students can read books and digital material related to the forest, animals, and ecology, including informational texts, such as field guides and scientific articles.

Social Studies and Civic Engagement

According to California's History-Social Science Framework (2016), a central goal of social studies is to foster students' comprehension of the interconnectedness and interdependence between human societies and the natural world. By integrating a schoolyard forest into the social studies curriculum, educators can provide students with firsthand experiences and tangible examples of the delicate balance between human societies and the environment and how they can take informed action individually and with others to build climate-resilient communities.

The framework provides numerous updated connection points between the Content Standards (1998) and California's Environmental Principles and Concepts (2004, revised 2018). For example, in Appendix B, Key Theme 6: is "Science, Technology, and the Environment." This section invites teachers to consider that "though humans are only one of millions of species, they may control up to 40 percent of all the energy that enters the biosphere from sunlight.... and global warming, which, if it continues, will have devastating effects on humankind's future."

With a schoolyard forest, students can investigate how humans harness and control energy resources, analyze the impacts of technological advancements on the environment, and critically examine the implications of global warming on our collective future. Students can observe how these forest ecosystems adapt to changing climate conditions, understand the significance of sustainable land use, and appreciate the vital role forests play in mitigating climate change.

Grade Level Standards and Questions

Grade level chapters in the History-Social Science Framework provide an updated context for understanding the Content Standards. As students explore their world from their campus, to their neighborhood, to the global community, a schoolyard forest system enhances learning at every grade level. A few brief examples are highlighted here:

2nd graders are asked to "demonstrate map skills" and "compare and contrast basic land use in urban, suburban, and rural environments in California" (Standard 2.2). By incorporating a schoolyard forest system into the curriculum, students can observe, map, and analyze the different land uses within their own school environment. They can explore how the forest system contributes to the natural landscape and compare it to other types of land use they encounter in their community.

4th graders focus on the study of California's geography and how it relates to the lives of plants, animals, and people. They explore the essential question: "How do natural resources, climate, and landforms affect how plants, animals, and people live?" (Standard 4.2.4). By implementing a schoolyard forest system, students can directly observe and interact with the natural environment, including plants, animals, and their habitats. They can explore how climate, landforms, and natural resources influence the living organisms within the schoolyard forest.

6th graders "discuss the climatic changes and human modifications of the physical environment that gave rise to the domestication of plants and animals and new sources of clothing and shelter" (Standard 6.1.3). By engaging with the schoolyard forest, students can witness firsthand how human modifications, such as irrigation, pruning, or soil management, interact with the natural environment to create favorable conditions for plant domestication. For campuses with food forests, students can have first-hand experience with domesticated fruit trees. As they think through how to keep a schoolyard forest system thriving in the context of impending climate change, they gain insight into how humans in the past may have adapted in response to changing conditions.

8th graders "discuss the influence of industrialization and technological developments on the region, including human modification of the landscape and how physical geography shaped human actions (e.g., growth of cities, deforestation, farming, mineral extraction)" (Standard 8.6.1). In a schoolyard forest, students can actively study the geography of their own school grounds, participate in reforestation efforts, learn about sustainable land management practices, and explore ways to mitigate the negative impacts of industrialization and technological development.

12th graders in Economics classes learn that "federal, state, and local governments have enacted a wide range of laws intended to protect the health of the environment...and build their knowledge about the considerations and processes involved in decisions related to the environment and natural resources." Through the schoolyard forest system, students can explore the laws and regulations that govern land use, conservation, and resource management. They can analyze how these laws are implemented in the design, creation, and maintenance of the schoolyard forest. Students can examine the role of government agencies, community organizations, and stakeholders in ensuring the health and sustainability of the forest ecosystem. This knowledge can help students take informed action through empowering civic engagement activities and can help students earn the State Seal of Civic Engagement (see next page).

Historical and Social Science Analysis Skills

In addition to the grade-level content standards, schoolyard forest systems can help students develop the overarching skills important to informed decision making. These skills also align with the College, Career and Civic Life (C3) Framework (2013). The following are some examples of how these skills can be explored.

CHRONOLOGICAL AND SPATIAL THINKING

Students can analyze the growth and development of the trees and other plant life in the schoolyard forest over time, using that as a starting point to understand chronology at different scales, from their forest to major events, like changes in climate or human impact. Students can create timelines of key events in the history of their community or region and compare them to the growth and development of the schoolyard forest over the same time period. Students can use maps to understand the physical and cultural features of their school and the area surrounding their school, and explore how those features have changed over time. Students can also set up data protocols, including photo monitoring, to set up a chronology of their young forest for future student cohorts.

RESEARCH, EVIDENCE, AND POINT OF VIEW

Students can use the schoolyard forest as a primary source for research, gathering information about the different plant and animal species that live there, their roles in the ecosystem, and how they have adapted to survive. Students can practice distinguishing fact from opinion by examining different perspectives on the importance of preserving natural habitats like the schoolyard forest, and the potential impact of human activities on those habitats. Students can assess the credibility of primary and secondary sources related to the history of their community or region, including maps, photographs, and oral histories.

HISTORICAL INTERPRETATION

Students can examine the history of the land where the schoolyard forest is located, including its use by indigenous peoples, the impact of colonization and settlement, and changes in land use over time. Students can explore the connections between historical events and environmental changes, and how those changes have affected the people and other living things in the area. Students can analyze economic and political issues related to the schoolyard forest, such as the costs and benefits of preserving it as a natural habitat or developing it for other uses.

Indigenous Ways of Knowing

Integrating the schoolyard forest system with the social studies framework, standards, and indigenous ways of knowing deepens students' understanding of their local community. The forest becomes a platform to explore indigenous land management practices, traditional ecological knowledge, and the cultural connection to the environment. By cultivating native plants within a schoolyard forest, students can work to restore damaged ecosystems and repair relations with other species in the region. Collaborating in growing a schoolyard forest with local indigenous communities enhances learning through interactions with elders, cultural leaders, and educators who share their knowledge and perspectives. It also allows for examination of environmental justice issues and the impact of historical events on indigenous peoples' relationship with the environment. By addressing diverse perspectives and social issues, students develop critical thinking and empathy, aligning with the California Social Studies Framework's goals of authentic representation and learning from local indigenous tribes and organizations (History-Social Science Framework).

City of Vancouver, WA

State Seal of Civic Engagement

California provides school districts the ability to award the State Seal of Civic Engagement to California students who demonstrate excellence in civics education and participation. As districts and schools prepare as early as elementary school to support students on their journey to the State Seal of Civic Engagement, schoolyard forest-related activities provide an excellent opportunity and context for students' learning and leadership activities. The following are some examples of how the criteria can be explored.

CRITERIA 1: BE ENGAGED IN ACADEMIC WORK IN A PRODUCTIVE WAY

Schoolyard forests become a highly engaging learning laboratory across the curriculum and grade levels, engaging students in standards-based hands-on research, design, planting, and stewardship of their schoolyard.

CRITERIA 2: DEMONSTRATE A COMPETENT UNDERSTANDING OF DEMOCRATIC PROCESSES

As students design, plan, build, maintain, and expand a schoolyard forest system, they can learn about the various branches and levels of government involved in funding, permitting, and supporting green space access on campus and in communities. Students can also learn about and participate in the decision-making processes in their schools and districts.

CRITERIA 3: PARTICIPATE IN INFORMED CIVIC ENGAGEMENT PROJECTS THAT ADDRESS REAL-WORLD PROBLEMS

Schoolyard forests empower students to take action by planting and caring for trees and creating schoolyard forests that directly shade and protect students from extreme heat and rising temperatures due to climate change.

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Career Technical Education

Schoolyard forests support the Career Technical Education Framework for California Public Schools and the creation of green jobs and training opportunities in a wide range of industry sectors. According to the Standards for Career Ready Practice in the California CTE Model Curriculum Standards, students should, "Understand the environmental, social, and economic impacts of decisions. Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact other people, organizations, the workplace, and the environment" (p. 12). Within the context of each school site and district, the campus may become a focal point for collaboration with local colleges, agencies, and businesses, providing endless opportunities for creativity and skill development. The following are some examples of how the standards can be explored.

Agriculture and Natural Resources

A schoolyard forest can provide hands-on learning opportunities for students to study different plant and animal species, their habitats, and their roles in the ecosystem. Students can also learn about sustainable practices such as organic pest management, conservation, soil health management, rainwater catchment, and fruit tree care.

Energy, Environment, and Utilities

Trees help reduce urban heat island effects, decrease energy consumption needed for cooling, support carbon capture, and reduce the use of high embodied energy/carbon materials.

Engineering and Architecture

Students can study how to integrate ecological principles into the design and evolution of the forest system. They can analyze factors such as soil composition, water flow, plant selection, and wildlife habitat to create an environmentally sustainable and resilient ecosystem.

Health Science and Medical Technology

A schoolyard forest can provide opportunities for students to study the health benefits of spending time in nature, such as reducing stress, improving mental health, and increasing physical activity.

Hospitality, Tourism, and Recreation

Students can learn about the hospitality and tourism industry by designing and promoting outdoor activities and events, such as nature walks, birdwatching tours, and climate education workshops.

Information and Communication Technologies

Students can use technology to document and share their experiences in the schoolyard forest, such as creating blogs, videos, or social media posts. They can also use technology to research and learn about different plant and animal species. Students can also use technology such as apps to participate in citizen science projects.

Manufacturing and Product Development

Students can learn about sustainable product design by creating products using natural materials found in the schoolyard forest, such as wood, leaves, flowers, or seeds.

Public Services

Students can learn about the role of parks and green spaces in their communities and the importance of preserving them for future generations.

Arts

A schoolyard forest system can play a significant role in supporting arts education and fostering creativity among students. For example, the Arts Education Framework (2019) describes an exemplar interdisciplinary standards-based project in which "students work in collaborative groups to plan how to most effectively engage decision-makers and the community at large to explain and encourage through media arts works the use of the environmental solution they developed with their science and health teachers" (p. 653). Many such opportunities for effective expression around solutions will arise from the schoolyard forest system. The following are some examples of how the arts can be explored.

Visual Arts

A schoolyard forest can provide inspiration and materials for students to create visual art projects such as landscape paintings, nature journaling, sketches of plants and animals, or nature-themed collages. Students can use the forest as a subject for their artwork while learning techniques for creating texture, color, and depth.

Music

A schoolyard forest can be a natural setting for students to learn about music theory and composition. Students can learn about the sounds of the forest and use them as inspiration for creating musical compositions. They can also use found objects in the forest to create their own musical instruments and experiment with sound production.

Dance

Students can learn about the natural rhythms of the forest and incorporate them into their dance routines. They can also learn about the movements of different animals and plants in the forest and use them as inspiration for their dance routines.

Theater

A schoolyard forest can be a stage for students to learn about theater and performance. Students can create plays or skits that incorporate the natural setting of the forest and the animals and plants that live there. They can also learn about different types of theater productions, such as outdoor theater or environmental theater, and create their own productions that showcase the natural beauty of the forest.

World Languages

A schoolyard forest system supports the goals of the World Languages Framework (2019) by providing an immersive and authentic environment for students to engage with the target language and culture. Through activities like nature walks, observations, and collaborative projects, students can develop their language skills while exploring ecological concepts and developing environmental literacy. The hands-on experiences in the schoolyard forest enhance students' understanding of sustainability, biodiversity, and the interdependence of ecosystems. By connecting language learning with real-world contexts, the schoolyard forest system fosters a deeper appreciation for the environment and promotes cross-cultural understanding.

Health

According to the Health Education Framework (2019), "Educating students about environmental health, from both a personal and community health perspective, is a strand in the standards that continues from kindergarten through high school where students are expected to learn, among other issues, about the impacts of air and water pollution on health. These topics tie directly to California's Environmental Principles and Concepts" (pp. 4–5). Schoolyard forest systems make a school campus a healthier place and provide a positive example and living laboratory for improving individual and public health. The following are some examples of how the standards can be explored.

Physical Activity and Fitness

The schoolyard forest can provide opportunities for students to engage in physical activity and exercise, which is crucial for their overall health and well-being. Teachers can incorporate physical education lessons into the forest environment, such as yoga or nature walks, and include forest stewardship tasks as part of the physical education program.

Nutrition and Healthy Eating

The schoolyard forest can be used to teach students about healthy eating habits and the importance of nutrition. Teachers can organize lessons on plant identification and use the forest as a source of fresh fruit, seeds, or leaves for cooking and nutrition lessons.

Mental and Emotional Health

The schoolyard forest can be a calming and peaceful environment that can help students learn about mental and emotional health. Teachers can use the forest as a space for meditation and mindfulness exercises and teach students about the benefits of spending time in nature for mental health.

Environmental Health

The schoolyard forest can be used to teach students about environmental health and the importance of sustainability. Teachers can organize lessons on conservation and the impact of human actions on the environment, and students can participate in projects to maintain and care for the forest.

Rita Hurault

Conclusion

Schoolyard forests offer a transformative learning environment that engages students in hands-on exploration, fosters environmental literacy, and promotes academic achievement and growth. These climate-adapted ecosystems provide a rich setting for interdisciplinary learning, allowing students to delve into subjects like science, math, English language arts, social studies, and more. By integrating California's Environmental Principles and Concepts, students develop a deep understanding of the interconnectedness between humans and the natural world. The forest becomes a living classroom where students can investigate ecosystems, study energy and matter flow, analyze human impacts, explore structures and functions, and even participate in engineering design challenges. It also offers a fertile ground for exploring history, social studies, and civic engagement, empowering and providing a pathway to the State Seal of Civic Engagement, fostering students' active participation in democratic processes and addressing real-world issues. These forests prepare students for future green jobs and provide opportunities for collaboration with local colleges, agencies, and businesses. In summary, schoolyard forests empower students, foster environmental stewardship, and create a dynamic learning environment that nurtures their academic growth and prepares them for a sustainable future.

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

CALIFORNIA Schoolyard Forest System℠

green schoolyards america

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