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# Making the Academic Case for Schoolyard Forests

## A National 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 content frameworks in Science, Math, English Language Arts, Social Studies, Career Technical Education, Arts, and Health.

### Introduction

Schoolyard forests are groves of climate-adapted tree species that include large trees and high tree diversity. 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 can provide an immersive and engaging learning environment that can help students learn and apply content standards in various subjects. A forest system can also foster a sense of stewardship and responsibility among students. While learning outdoors is a natural fit for science, a 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 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.

## Science

According to A Framework for K-12 Science Education (2012), “... the insights gained and interests provoked from studying and engaging in the practices of science and engineering during their K-12 schooling should help students see how science and engineering are instrumental in addressing major challenges that confront society today, such as ... solving the problems of global environmental change.” In addition, the authors point out that “the actual doing of science or engineering can also pique students’ curiosity, capture their interest, and motivate their continued study...” At every stage, the development of a schoolyard forest system provides an excellent opportunity for hands-on scientific exploration, investigation, and problem solving. Students can engage in three-dimensional science learning while engaging with natural phenomena 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 different microclimates; examine the relationships among different species of plants, animals, and fungi in the forest; and explore biodiversity on site.



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### 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.

### Structure, Function, and Information Processing

Students can explore the forest system to 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 leaves are arranged to capture sunlight or how seeds are dispersed. Students can also observe the forest’s animal species and learn how different animal structures help them obtain food or evade predators.

### Growth, Development, and Reproduction of Organisms

Students can explore the forest system and diverse plants and animals as they learn about their growth and development. Growth rates, pollination syndromes, and seed dispersal methods can be investigated first hand. Setting up a photo monitoring project can also help track changes in the growth of the forest over many years.



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## Earth's Systems

Understanding the processes that drive Earth's systems can be studied at the school forest scale. For example, the carbon cycle and climate literacy can be directly connected to photosynthesis and the role of trees in carbon sequestration. Similarly, investigating transpiration by trees can elucidate part of the water cycle, while soil studies can add to inquiries about the geosphere.

## Human Impacts

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 schoolyard trees, and they can see the results of their own stewardship activities. They can also learn how actions in the broader ecosystem, such as pollution and climate change, have resulted in the need for tree canopy and how such actions 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.

## Engineering Design

Students can engage in design challenges to plan and implement a schoolyard forest and to address other environmental challenges on campus, such as reducing erosion, controlling invasive species, and 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, and community members.

## Cultural Responsiveness

The science framework encourages educators to consider students' 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.



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## Math

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. Working with this real-world context can help them build the “habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy.” (Common Core State Standards for Mathematics). 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.



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## English Language Arts

The schoolyard forest system can be 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. As pointed out in [The Common Core State Standards](#), “several standards can be addressed by a single rich task.” 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 climate resilience, green space access, conservation, 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

According to the [College, Career & Civic Life C3 Framework for Social Studies State Standards \(2013\)](#), “social studies is the ideal staging ground for taking informed action because of its unique role in preparing students for civic life.” Taking informed action (Dimension 4) encourages students to address local and global problems. Through schoolyard forests, students can address the problems of urban heat islands, lack of shade, tree canopy inequity, and the need to mitigate climate change’s effects in the community. The framework further states that, “active and responsible citizens identify and analyze public problems; deliberate with other people about how to define and address issues; take constructive, collaborative action; reflect on their actions; create and sustain groups; and influence institutions both large and small.” Engaging students in all phases of a schoolyard forest, from the initial design to follow-up studies, gives them an opportunity to apply a range of social studies skills.





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Furthermore, understanding the interconnectedness and interdependence between human societies and the natural world is a relevant goal of the framework, outlined under the learning goals of Human-Environment Interaction and Global Interconnections within the discipline of Geography. 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. 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 climate change 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.

Below are a few examples of how students can learn in each of the social studies disciplines:

## Civics

As students design, plan, build, and maintain 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 as their schoolyard forest is designed and planted.

## Economics

As students design and maintain a schoolyard forest, they can learn about economic decision-making and scarcity of resources (such as water, equipment, and labor) while exploring the benefits and costs of decisions. As they explore the benefits of schoolyard forests, they can learn how 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.

## Geography

The schoolyard forest provides a rich and engaging location for exploring geographic knowledge and reasoning. Students can observe, map, and analyze the different land uses within their own school environment. They can also analyze how the forest contributes to the broader natural landscape and compare the forest to other types of land use they encounter in their community. 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 and understand their own role in modifying the school environment. They can also explore their own relationship with the forest and its contribution to their physical and mental health.

## History

Chronological reasoning can be applied to an outdoor, natural context as students 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 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 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.

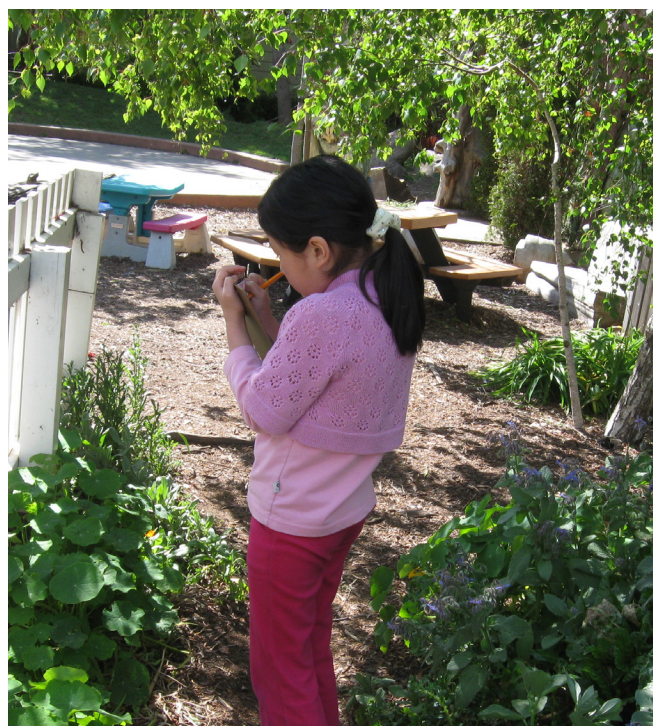
## Psychology

According to the Psychology Companion Document for the C3 Framework (Appendix B), students are asked to “use psychological knowledge to promote healthy lifestyle choices.” Students can investigate the significant amount of research that is available on nature’s benefits for mental health as well as conduct their own research. The schoolyard forest can be a calming and peaceful environment that can help students experience their own mental and emotional health. Teachers can also use the forest as a space for nature connection, meditation, and mindfulness exercises.



## Social Studies Skills

In addition to the grade-level content standards, schoolyard forest systems can help students develop the overarching skills important to informed decision making. The following are some examples of how these skills can be explored. For example, when applying the skills of Developing Questions and Planning Inquiries (Dimension 1), students can use the schoolyard forest as a primary source for research, whether it is gathering information about how different parts of the school community use the space or the roles of different students and adults in stewardship. 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. When Evaluating Sources and Using Evidence (Dimension 3), students can assess the credibility of primary and secondary sources related to the history of the land in their community or region, including maps, photographs, and oral histories. As students use the skills of Communicating Conclusions and Taking Informed Action (Dimension 4), they can apply what they have learned about urban heat islands, lack of shade, tree canopy inequity, and the need to mitigate climate change’s effects in the community and take action to create, sustain, or expand a schoolyard forest.



## Career Technical Education

Schoolyard forests support the Common Career Technical Core standards and the creation of green jobs and training opportunities in a wide range of industry sectors. According to the Standards for Career Ready Practices in the Common Career Technical Core (2012), students should “Consider 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 and/or mitigate negative impact on other people, organizations and the environment.” 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, Food, and Natural Resources

A schoolyard forest can provide opportunities for stewardship as well as 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. They can also analyze the environmental services provided by the forest.

### Architecture and Construction

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

### Government and Public Administration

Students can be involved in the planning of the forest and 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 as their schoolyard forest is designed and planted. They can also formulate policies to shape the use of the forest by the broader community.

### Hospitality and Tourism

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

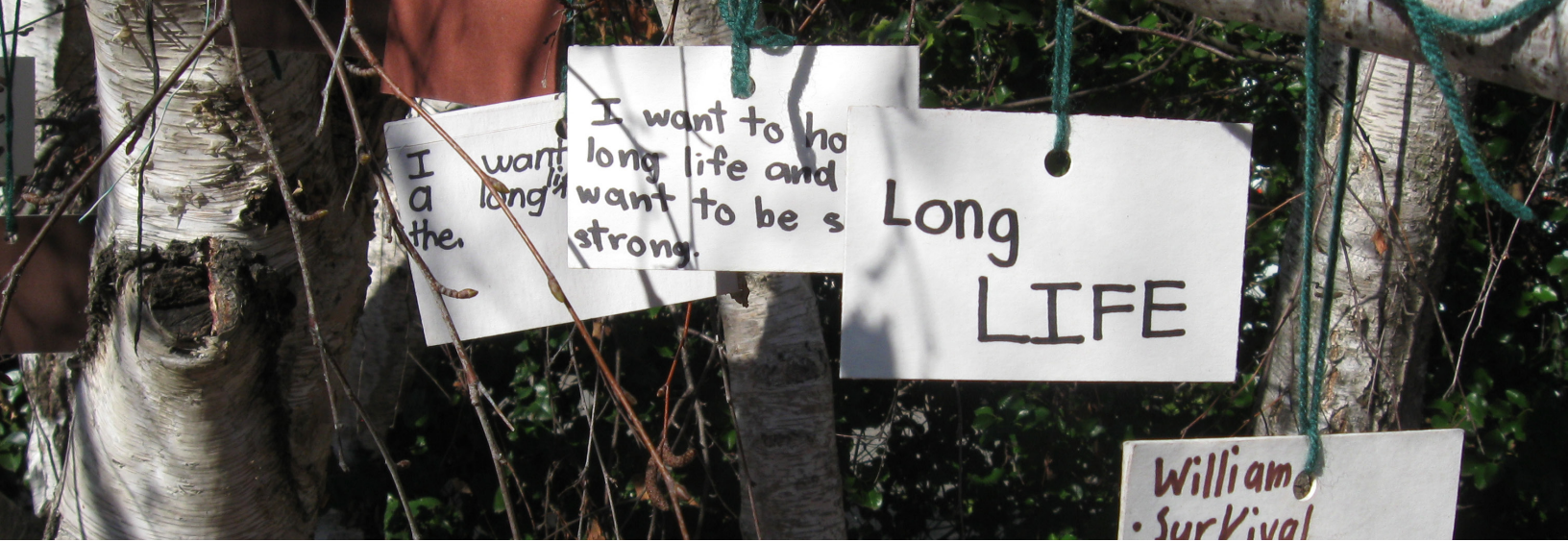
### Information Technology

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 use existing software or develop programs such as tree inventory software. Students can also use apps to participate in existing citizen science projects or develop their own projects and associated apps.

### Manufacturing

Students can investigate alternative product processes and procedures in sustainable product design by creating products using natural materials found in the schoolyard forest, such as wood, leaves, flowers, or seeds.





## Science, Technology, Engineering, and Mathematics

Students can apply the design process to designing the schoolyard forest. This can include investigations of water flow, soil composition, schoolyard surface temperatures, sun direction, wildlife habitat, and plant selection.

## Arts

A schoolyard forest system can play a significant role in supporting arts education and fostering creativity among students by providing inspiration, materials, and/or a setting. In addition, according to the [National Core Arts Standards \(2016\)](#), students are expected to “relate artistic ideas and works with societal, cultural, and historical context to deepen understanding.” 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, and 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 dance routines. They can also learn about the movements of different animals and plants in the forest and use them as inspiration for 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.

## Health

Schoolyard forest systems make a school campus a healthier environment and provide a positive example and living laboratory for improving individual and public health. According to the [National Health Education Standards \(2022\)](#), educating students about health includes students learning “advocacy skills to encourage others to adopt health enhancing norms, beliefs, and behaviors as well as to implement policies, programs, and environments that support health.”

## Functional Health Knowledge

As students learn about the interrelationships among physical, social, emotional, and intellectual health, they can investigate the effect of tree canopy–moderated temperatures on physical health as well as the mental and emotional health benefits of spending time in nature. The schoolyard forest can be a calming and peaceful environment for teachers to use as a space for meditation and mindfulness exercises as well as for students to access on their own time. Forests with fruit trees and medicinal plants can also be used to teach students about healthy eating habits, the importance of nutrition, and traditional plant-derived medicines. Teachers can organize lessons on plant identification and use the forest as a source of fresh fruit, seeds, and leaves.

## Health and Safety Practices

Students involved in stewardship have the opportunity to develop and model a suite of health and safety practices as they work with teams, tools, and weather preparation.

## Student Advocacy for Health

Students can apply advocacy skills to promote the health benefits of time spent in the schoolyard forest and take action to improve conditions for themselves and others in the community.

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### NATIONAL SCHOOLYARD FOREST SYSTEM

The National Schoolyard Forest System™ seeks to create schoolyard forests on PreK-12 public school grounds across the country to directly shade and protect students from extreme heat and rising temperatures due to climate change. This initiative was founded by Green Schoolyards America, and launched with California as the first state 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/schoolyard-forest-system](https://greenschoolyards.org/schoolyard-forest-system)



## 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. 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. Forest systems also offer a fertile ground for exploring history, social studies, and civic engagement, empowering students' active participation in democratic processes and addressing real-world issues. Such forests also 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.



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