Schoolyard Habitat Correlations

to Virginia Science SOL and Other Subject Area Content

A schoolyard habitat is an outdoor classroom that can be used across ALL grade levels and subject areas. For example, planting a habitat requires measuring the dimensions and area of plant beds (math); researching and writing about the plants and animals that can live there (technology, language arts); and understanding the interactions between plants, animals, and their environment (science).

This document is broken into two parts:

Part 1: A table that includes K-12 Science SOL concepts that can be taught while planning, implementing, and maintaining a schoolyard habitat. This table includes 2018/2025 Science SOL strands correlated to a possible activity or concept that connects to the schoolyard habitat. This is not a comprehensive list, and we encourage you to think of ways to incorporate your schoolyard habitat into as many Science SOL strands as possible. **Virginia's Prince William County Public Schools contributed much of the science related information in this document through their Environmental Literacy Plan.*

- ★ The Science SOL 1 strand (Scientific and Engineering Practices) is not included below but can absolutely be filled when planning, implementing, maintaining, and monitoring a schoolyard habitat and nature journals are a great way for students to record observations of their habitat.
- ★ Consider how the planning, implementation, and maintenance of the schoolyard habitat can be used for Project Based Learning. What driving questions do students have about the habitat that they can investigate?

Part 2: Lists of potential connections to your schoolyard habitat for Math, Language Arts, History, CTE, Visual Arts, Health and PE courses, and Social Emotional Learning. Again, this will not be a comprehensive list and we encourage each subject area expert to connect their content to the schoolyard habitat.

Part 1: Connecting the 2018 Science SOL to Your Schoolyard Habitat

Elementary Science

Kindergarten		
Content Area	**SOL**	**Potential Activities/Concepts**
Science	K. 4 The student will investigate and understand that water is important in our daily lives and has properties. a) water had many uses b) water can be found in many places c) water flows downhill	Water is essential for plant survival. Track the flow of water in the schoolyard, are there places where the water naturally pools after a rainstorm, etc.

Science	K.6 The student will investigate and understand that there are differences between living organisms and nonliving objects. Key ideas include: a) all things can be classified as living or nonliving; and b) living organisms have certain characteristics that distinguish them from nonliving objects.	Investigate your habitat for its living/nonliving components. Investigate that plants have parts by using a plant from the habitat
Science	K.7 The student will investigate and understand that plants and animals have basic needs and life processes. Key ideas include: a) living things need adequate food, water, shelter, air, and space to survive; b) plants and animals have life cycles; c) offspring of plants are similar but not identical to their parents or to one another	Brainstorm a list of what plants and animals need to survive in your habitat. Use annual native plants to show plant reproduction and how plants may be similar but not identical
Science	K.8 The student will investigate and understand that light influences temperature on Earth's surfaces and can cause shadows. Key ideas include: a) the sun provides light and warms Earth's surface; b) shadows can be produced when sunlight or artificial light is blocked by an object; and c) objects in shadows and objects in sunlight have different temperatures.	Measure the temperature among various locations, grass, asphalt, mulch, shade, full sun, etc.
Science	K.9 The student will investigate and understand that there are patterns in nature. Key patterns include: a) daily weather; b) seasonal changes; and c) day and night.	Observe how seasonal changes affect plants and animals in your habitat
Science	K.10 The student will investigate and understand that change occurs over time. Key ideas include: a) natural and human-made things change over time; b) living and nonliving things change over time; c) changes can be observed and measured; and d) changes may be fast or slow.	Long term repeated observation of your habitat
Science	K.11 The student will investigate and understand that humans use resources. Key ideas include: a) some materials and objects can be used over and over again; b) materials can be recycled; and c) choices we make affect the air, water, land and living things.	Discuss the resources used in the habitat and how they can impact air, water, land, and other living things. Use recycled items in the habitat instead of new as possible
First grade		
Content Area	**SOL**	**Potential Activities/Concepts**

Science	1.4 The student will investigate and understand that plants have basic life needs and functional parts that allow them to survive. Key ideas include: a) plants need nutrients, air, water, light, and a place to grow; b) structure of plants perform specific functions; and c) plants can be classified based on a variety of characteristics	Observe what plants in your habitat need to survive. Dissect plants from your habitat to observe their structures. As a class create a very simple dichotomous key using some of the flowers in your habitat
Science	1.5 The student will investigate and understand that animals, including humans, have basic life needs that allow them to survive. Key ideas include: a) animals need air, food, water, shelter, and space (habitat); b) animals have different physical characteristics that perform specific functions; and c) animals can be classified based on a variety of characteristics	Observe what animals use your habitat for food, shelter, water, etc. and what characteristics (wings, feathers, legs, exoskeleton, etc.) they have that make them all different. Students can make their own list then combine to make a class list.
Science	1.6 The student will investigate and understand that there is a relationship between the sun and Earth. Key ideas include: a) the sun is the source of energy and light that warms the Earth's land, air, and water; and b) the sun's relative position changes in the Earth's sky throughout the day.	Take temperature readings in your habitat throughout the day to show how the land/water temperature changes and observe how these temperature changes may affect the plants and animals in your habitat
Science	1.7 The student will investigate and understand that there are weather and seasonal changes. Key ideas include: a) changes in temperature, light, and precipitation occur over time; b) there are relationships between daily weather and the season; and c) changes in temperature, light, and precipitation affect plants and animals, including humans.	Observe the plants in your habitat throughout the seasons. Connect spring with the time of budding an flowers and late summer/fall with losing leaves, recognize that plants go dormant throughout late spring and fall depending on the plant. Observe any changes that occur to the animal populations that use the habitat.
Science	1.8 The student will investigate and understand that natural resources can be used responsibly. Key ideas include: a) most natural resources are limited; b) human actions can affect the availability of natural resources; and c) reducing, reusing, and recycling are ways to conserve natural resources.	Investigate how you could incorporate the recycling/collecting of rainwater into your habitat to provide water in times of drought? Look at maps of the area before the school was built, were there any water sources or types of habitats that are not there now due to the construction of the school?
Second grade		
Content Area	**SOL**	**Potential Activities/Concepts**

Science	2.5 The student will investigate and understand that living things are part of a system. Key ideas include: a) plants and animals are interdependent with their living and nonliving surroundings; b) an animal's habitat provides all its basic needs; and c) habitats change over time due to many influences.	Predict natural changes that will occur in your habitat and the effects on plants and animals. Track observable changes in your habitat throughout the school year. Describe the changes in your habitat due to various influences- do they match with the predictions?
Science	2.6 The student will investigate and understand that there are different types of weather on Earth. Key ideas include: b) measuring, recording, and interpreting weather data allows for identification of weather patterns; and	Incorporate a rain gauge or weather gauge into your habitat. Track the data and compare what was happening with the weather over time to observable changes in your habitat. (less rainfall = plants wilt or turn brown, etc.)
Science	2.7 The student will investigate and understand that weather patterns and seasonal changes affect plants, animals, and their surroundings. Key ideas include: a) weather and seasonal changes affect the growth and behavior of living things; b) wind and weather can change the land; and c) changes can happen quickly or slowly over time.	Incorporate a rain gauge or weather gauge into your habitat. Track the data and compare what was happening with the weather over time to observable changes in your habitat. (less rainfall = plants wilt or turn brown, etc.) Observe how the behavior of animals change over seasons. Observe the habitat after a particularly windy day, did the habitat change at all?
Science	2.8 The student will investigate and understand that plants are important natural resources. Key ideas include: a) the availability of plant products affects the development of a geographic area; b) plants provide oxygen, homes, and food for many animals; and c) plants can help reduce the effect of wind and water.	Investigate, using experimentation and modeling, how plants might reduce the impact of wind and water (erosion) and allow this to inform what plants you may include in your habitat. Observe how organisms use the plants in your habitat as shelter and food.
Third grade		
Content Area	**SOL**	**Potential Activities/Concepts**
Science	3.5 The student will investigate and understand that aquatic and terrestrial ecosystems support a diversity of organisms. Key ideas include: a) ecosystems are made of living and nonliving components of the environment; and b) relationships exist among organisms in an ecosystem.	List the living and nonliving components of your habitat. Observe and explain the relationship between plants and pollinators in your habitat. Examine the relationship between organisms in the soil, the health of soil, and the health of plants.

		If possible, create a simple food chain using organisms you have observe or have evidence of occurring (tracks/scat) in your habitat
Science	3.6 The student will investigate and understand that soil is important in ecosystems. Key ideas include: a) soil, with its different components, is important to organisms; and b) soil provides support and nutrients necessary for plant growth.	Use soil samples/data to compare locations and decide on the best location for your habitat. Use soil data to improve the soil of your habitat. Experiment with growing native plant seeds in different soil types (different mixtures of sand, silt, clay) and then planting the ones that survive in your habitat.
Science	3.7 The student will investigate and understand that there is a water cycle and water is important to life on Earth. Key ideas include: b) the energy from the sun drives the water cycle; and c) the water cycle involves specific processes.	If your habitat has a water feature, use this feature to investigate the water cycle; example: measure the water level or volume to investigate evaporation.
Science	3.8 The student will investigate and understand that natural events and humans influence ecosystems. Key ideas include: a) human activity affects the quality of air, water, and habitats; b) water is limited and needs to be conserved; c) fire, flood, disease, and erosion affect ecosystems; and d) soil is a natural resource and should be conserved.	Experiment with why soil is so important for plants and humans. Try growing plants in just water over a long period of time with no added nutrients vs soil. If possible, start a compost to observe how long it takes to turn green and brown organic materials into soil. Investigate how you could incorporate the recycling/collecting of rainwater into your habitat to provide water in times of drought? Conduct a schoolyard investigation for soil erosion and develop a plan to reduce it using native habitat or construction methods.
Fourth grade		
Content Area	**SOL**	**Potential Activities/Concepts**
Science	4.2 The student will investigate and understand that plants and animals have structures that distinguish them from one another and play vital roles in their ability to survive. Key ideas include: a) the survival of plants and animals depends on photosynthesis; b) plants and animals have different structures and processes for obtaining energy; and c) plants and animals have different structures and processes for creating offspring.	Examine the plants in your habitat for adaptations they have for attracting pollinators. Examine a leaf from your habitat under a microscope for the organelle where photosynthesis takes place (chloroplast). Collect and examine the various seeds of plants from your habitat (a sock over the hand is great at collecting seeds as children run their hand over the plants) magnifying glasses/outdoor

		plastic microscopes can help children see the various hooks seeds use to attach themselves to animals for transport).
Science	4.3 The student will investigate and understand that organisms, including humans, interact with one another and with the nonliving components in the ecosystem. Key ideas include: a) interrelationships exist in populations, communities, and ecosystems; b) food webs show the transfer of energy within an ecosystem; c) changes in an organism's niche and habitat may occur at various stages in its life cycle; and d) classification can be used to identify organisms.	Students make a list of organisms (correctly identified) found in their schoolyard and how they may interact with other organisms and nonliving features. Students find organisms within their schoolyard and construct a food web. Students hypothesize the effect on the organism if one of its needs was reduces or removed from the habitat.
Science	4.4 The student will investigate and understand that weather conditions and phenomena affect ecosystems and can be predicted. Key ideas include: a) weather measurements create a record that can be used to make weather predictions; b) common and extreme weather events affect ecosystems; and c) long-term seasonal weather trends determine the climate of a region.	Add a weather station to your habitat and use it to monitor weather and analyze the data over time. Make habitat observations before and after predicted severe weather events to monitor their effect.
Science	4.8 The student will investigate and understand that Virginia has important natural resources. Key resources include: a) watersheds and water; b) plants and animals; c) minerals, rocks, and ores; and d) forests, soil, and land.	Investigate the school yard to identify questions, problems or issues that affect a natural resource in that area and determine a possible solution to an identified problem. Identify the watershed that your habitat is a part of and what role your habitat plays in a healthy (or unhealthy) watershed.
Fifth grade		
Content Area	**SOL**	**Potential Activities/Concepts**
Science	5.8 The student will investigate and understand that Earth constantly changes. Key ideas include: d) processes such as weathering, erosion, and deposition change the surface of the Earth	Schoolyard investigation of weathering and erosion. Could the schoolyard benefit from a habitat to help prevent erosion, runoff, etc.?
Science	5.9 The student will investigate and understand that the conservation of energy resources is important. Key ideas include: a) some sources of energy are considered renewable and others are not;	Explore the renewable and nonrenewable resources of your schoolyard habitat. Conduct an energy and water audit of your schoolyard habitat, explore ways to conserve.

	b) individuals and communities have means of conserving both energy and matter; and c) advances in technology improve the ability to transfer and transform energy.	

Middle School Science

Sixth grade		
Content Area	**SOL**	**Potential Activities/Concepts**
Science	6.4 The student will investigate and understand that there are basic sources of energy and that energy can be transformed. Key ideas include: a) the sun is important in the formation of most energy sources on Earth; b) Earth's energy budget relates to living systems and Earth's processes; d) energy transformations are important in energy usage.	If your habitat is equipped with any type of solar panels, use them to investigate how solar energy can be transformed into other forms of energy.
Science	6.6 The student will investigate and understand that water has unique physical properties and has a role in the natural and human-made environment. Key ideas include: a) water is referred to as the universal solvent; b) water has specific properties; d) water has a role in weathering; f) water is important for agriculture, power generation, and public health.	On a school yard walk/habitat investigation, chart, record, and describe evidence of chemical and physical weathering in the local environment. Reinforce the water property concepts of osmosis and capillary action to describe how tall plants (with xylem and phloem) found in your habitat obtain water from the soil. Examine leaves from your habitat plants under a microscope and perform an osmosis lab.
Science	6.8 The student will investigate and understand that land and water have roles in watershed systems. Key ideas include: a) a watershed is composed of the land that drains into a body of water; b) Virginia is composed of multiple watershed systems which have specific features; c) the Chesapeake Bay is an estuary that has many important functions; and d) natural processes, human activities, and biotic and abiotic factors influence the health of a watershed system.	Examine the school's watershed address then explore your schoolyard habitat to identify what factors may influence the health of the watershed the school is a part of.
Science	6.9 The student will investigate and understand that humans affect the environment and individuals can influence public policy decisions	Investigate practices that can reduce environmental hazards or improve land use in the schoolyard. Examine the quality of water

	related to energy and the environment. Key ideas include: a) natural resources are important to protect and maintain; b) renewable and nonrenewable resources can be managed; c) major health and safety issues are associated with air and water quality; e) preventive measures can protect land-use and reduce environmental hazards; and f) there are cost/benefit tradeoffs in conservation policies.	from water that runoffs from your habitat area vs the parking lot.
Seventh grade		
Content Area	**SOL**	**Potential Activities/Concepts**
Life Science	LS.4 The student will investigate and understand that there are chemical processes of energy transfer which are important for life. Key ideas include: a) photosynthesis is the foundation of virtually all food webs; and b) photosynthesis and cellular respiration support life processes.	Examine leaves of various plants from the habitat under a microscope, note the chloroplasts in each. (also covers LS 2 cell structures between plant and animals). Explore ways to use O2 sensors if available at your school to measure respiration and photosynthesis of the plants in your habitat.
Life Science	LS.5 The student will investigate and understand that biotic and abiotic factors affect an ecosystem. Key ideas include: a) matter moves through ecosystems via the carbon, water, and nitrogen cycles; b) energy transfer is represented by food webs and energy pyramids; and c) relationships exist among producers, consumers, and decomposers.	On a schoolyard/habitat walk: - analyze local aquatic and/or terrestrial ecosystems - identify biotic and abiotic components, and describe their roles in the cycling of matter and flow of energy - recognize examples of common producers, consumers, and decomposers and explain the role of each in the flow of energy and cycling of matter through an ecosystem -look for examples of the effects of human activity on the activity of producers, consumers, and decomposers in the school yard such as mowing, students walking on grass, and presence of invasive species. Use the native plants in your habitat as the produce level of a food web and continue to build the web using observations of organisms you see in your habitat or guidebooks/internet.
Life Science	LS.6 The student will investigate and understand that populations in a biological community	See food web activity above.

	interact and are interdependent. Key ideas include: a) relationships exist between predators and prey and these relationships are modeled in food webs; b) the availability and use of resources may lead to competition and cooperation; c) symbiotic relationships support the survival of different species; and d) the niche of each organism supports survival.	Your schoolyard habitat should provide a community of organisms, predict what would happen if resources became limited in your habitat. Explain the effects on an organism, population, and community level. Identify or cultivate symbiotic relationships that occur in your schoolyard habitat.
Life Science	LS.7 The student will investigate and understand that adaptations support an organism's survival in an ecosystem. Key ideas include: a) biotic and abiotic factors define land, marine, and freshwater ecosystems; and b) physical and behavioral characteristics enable organisms to survive within a specific ecosystem.	Observe and sketch various leaves from the habitat with a diverse array of adaptations. Investigate how structural adaptations among populations allow organisms to survive with ecosystems; examples include thorns, spikes, pointed tips, waxy coatings, etc.
Life Science	LS.8 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time. Key ideas include: a) organisms respond to daily, seasonal, and long-term changes; b) changes in the environment may increase or decrease population size; and c) large-scale changes such as eutrophication, climate changes, and catastrophic disturbances affect ecosystems.	Record daily changes in your habitat throughout various seasons and long-term. Analyze these changes occurring in your habitat for an increase or decrease in population sizes, the effect of weather or large-scale changes on your habitat.
Life Science	LS 9: The student will investigate and understand that relationships exist between ecosystem dynamics and human activity. Key ideas include: a) changes in habitat can disturb populations; b) disruptions in ecosystems can change species competition; and c) variations in biotic and abiotic factors can change ecosystems.	Use evidence from the school yard to describe the impact of human activity on the biotic and abiotic factors within an ecosystem. Plan an investigation examining relationships between ecosystem dynamics and human activity on school grounds. Use your recorded daily changes among seasons and long-term to determine how changes in the habitat (for example an introduction of an invasive species or an accidently mowing of the habitat) can disturb populations.
Life Science	LS 11: The student will investigate and understand that populations of organisms can change over time. Key ideas include: a) mutation, adaptation, natural selection, and extinction change populations; b) the fossil record, genetic information, and anatomical comparisons provide evidence for evolution; and	Have students construct an evidence-based explanation about how environmental factors such as climate change and genetic variation can influence a species' in the habitat. Using your recorded daily changes among seasons and long-term, examine your habitat for any plant mutations or changes in flower color over time (for perennial native plants) (can also

	c) environmental factors and genetic variation, influence survivability and diversity of organisms.	bring in LS 10 here). How has the habitat changed over time regarding the abundance of plant populations originally planted?
Eighth grade		
Content Area	**SOL**	**Potential Activities/Concepts**
Physical Science	PS.3 The student will investigate and understand that matter has properties and is conserved in chemical and physical processes. Key ideas include: a) pure substances can be identified based on their chemical and physical properties; b) pure substances can undergo physical and chemical changes that may result in a change of properties; c) compounds form through ionic and covalent bonding; and d) balanced chemical equations model the conservation of matter.	Explore the role of soil nutrients to plant health; specifically carbon, hydrogen, oxygen, nitrogen, phosphorous, potassium. Explore the various ways plants obtain these elements for survival. Test the habitat soil for pH, N, P, K.

High School Science

Biology		
Content Area	**SOL/Content Guidelines**	**Potential Activities/Concepts**
Biology	BIO.4The student will investigate and understand that bacteria and viruses have an effect on living systems. Key ideas include: a) viruses depend on a host for metabolic processes; b) the modes of reproduction/replication can be compared; c) the structures and functions can be compared; d) bacteria and viruses have a role in other organisms and the environment	Have student research bacterial and viruses that can infect schoolyard habitat plants and ways to reduce the impact.
Biology	BIO.8 The student will investigate and understand that there are dynamic equilibria within populations, communities, and ecosystems. Key ideas include:	Investigate the limiting factors of your schoolyard habitat: soil nutrients, water, space, etc. Explore the role of soil nutrients to plant health; specifically carbon, hydrogen, oxygen, nitrogen,

	a) interactions within and among populations include carrying capacities, limiting factors, and growth curves; b) nutrients cycle with energy transfer through ecosystems; c) ecosystems have succession patterns; and d) natural events and human activities influence local and global ecosystems and may affect the flora and fauna of Virginia.	phosphorous, potassium. Explore the various ways plants obtain these elements for survival and how these nutrients are cycled in the environment. Test the habitat soil for pH, N, P, K.
Chemistry		
Content Area	**SOL/Content Guidelines**	**Potential Activities/Concepts**
Chemistry	CH.3 The student will investigate and understand that atoms are conserved in chemical reactions. Knowledge of chemical properties of the elements can be used to describe and predict chemical interactions. Key ideas include: a) chemical formulas are models used to represent the number of each type of atom in a substance; b) balanced chemical equations model rearrangement of atoms in chemical reactions; c) atoms bond based on electron interactions; d) molecular geometry is predictive of physical and chemical properties; e) reaction types can be predicted and classified. CH.5 The student will investigate and understand that solutions behave in predictable and quantifiable ways. Key ideas include: b) changes in temperature can affect solubility; c) extent of dissociation defines types of electrolytes; d) pH and pOH quantify acid and base dissociation; e) colligative properties depend on the extent of dissociation	Explore the role of soil nutrients to plant health; specifically carbon, hydrogen, oxygen, nitrogen, phosphorous, potassium. Explore the various ways plants obtain these elements in their various forms for survival and how these nutrients are cycled in the environment. Explore the of the various ways of nitrogen fixation.
Ecology		
Ecology	EC.2 The student will investigate and understand that biotic and abiotic factors affect the distribution of species and the diversity of life on Earth. Demonstration of the essential knowledge and practices includes:	Students can use their schoolyard and schoolyard habitat as a living laboratory to study many of these concepts. Concepts that cannot directly be studied in the habitat, the habitat or organisms that live in the habitat should be used as the example:

	a) Compare the biotic and abiotic characteristics of Earth's principal terrestrial and aquatic biomes. b) Make, support, and evaluate a claim about how characteristics of biomes affect biodiversity. c) Plan and conduct a biosurvey to assess the health and condition of a circumscribed natural area. d) Research a natural or anthropogenic threat, the issues that are causing the threat, and describe potential remediation strategies. g) Compare benefits and limitations of methods used to increase resilience and sustainability in a local ecosystem. EC.3 The student will investigate and understand that energy is transferred through ecosystems. Demonstration of the essential knowledge and practices includes: d) Make, support, and evaluate a claim about how nutrient cycling by decomposers affects energy transfer in ecosystems. EC.4 The student will investigate and understand that matter flows through ecosystems. Demonstration of the essential knowledge and practices includes: c) Analyze and interpret data to predict how changes in the availability of resources will affect species' success in ecosystems. d) Make, support, and evaluate a claim about how a disruption in a biogeochemical cycle affects an ecosystem. e) Make, support, and evaluate a claim about how changes in resource availability affect the biodiversity of an ecosystem. EC.5 The student will investigate and understand that growth within populations is influenced by biotic and abiotic factors. Demonstration of the essential knowledge and practices includes: a) Explain how population growth and resource availability affect population dispersion. b) Analyze data to determine the relationship between population density and resource availability.	- Student can create various plots of land with different variables within the habitat to study over time. - Soil study: nutrients, pH, temperature, moisture, and other physical properties - Model the population growth of certain habitat plants based on various conditions. - Document how the habitat changes over time: daily, seasonally, and over the long-term then analyze the data for patterns and succession. - Start a composting system for soil nutrients and study decomposition. - Create multiple plots to study human influence on the schoolyard: schoolyard habitat, area that is left alone-no mowing, area that gets mowed. Study the biodiversity in each. - Investigate pollution sources, runoff? Air pollution monitoring? - Create a field guide to go along with each species (plant, animal, fungi, etc) that discuss their role in the habitat and greater ecosystem. Consider how the schoolyard habitat can be used for Project Based Learning. What driving questions do students have about the habitat that they can investigate?

	d) Analyze a local ecosystem and categorize limiting factors EC.7 The student will investigate and understand that natural and anthropogenic events affect ecosystems. Demonstration of the essential knowledge and practices includes: b) Develop and use a model to explain ecological succession for a local ecosystem and predict the effect of natural and anthropogenic events on natural succession processes. c) Make, support, and evaluate a claim about the effect of an invasive species on the stability of a local ecosystem. d) Make, support, and evaluate a claim about how natural and anthropogenic events affect ecosystem resilience.	
Environmental Science		
Content Area	**SOL/Content Guidelines**	**Potential Activities/Concepts**
Environmental Science	ENV.3 The student will investigate and understand that processes and systems lead to changes on Earth's surface. Demonstration of the essential knowledge and practices includes: a) Plan and conduct an investigation on the effect of processes on Earth's surface. c) Make, support, and evaluate a claim about how natural processes and human activities have changed Earth's surface. ENV.4 The student will investigate and understand that ecosystems are in a state of dynamic equilibrium that is affected by complex biotic and abiotic interactions. Demonstration of the essential knowledge and practices includes: a) Compare biotic and abiotic factors in terrestrial and aquatic ecosystems. b) Describe the ecological role that an organism plays in supporting the overall sustainability of the ecosystem. c) Make, support, and evaluate a claim about the ecological roles of different categories of species in maintaining or disrupting ecosystem equilibrium.	Students can use their schoolyard and schoolyard habitat as a living laboratory to study many of these concepts. Concepts that cannot directly be studied in the habitat, the habitat or organisms that live in the habitat should be used as the example: - Student can create various plots of land with different variables within the habitat to study over time. - Soil study: nutrients, pH, temperature, moisture, and other physical properties - Model the population growth of certain habitat plants based on various conditions. - Document how the habitat changes over time: daily, seasonally, and over the long-term then analyze the data for patterns and succession. - Create multiple plots to study human influence on the schoolyard: schoolyard habitat, area that is left alone-no mowing, area that gets mowed. Study the biodiversity in each. - Investigate pollution sources, runoff? Air pollution monitoring? - Create a field guide to go along with each species (plant, animal, fungi, etc.)

	d) Predict the effect caused by the introduction of an invasive species on the equilibrium of an ecosystem. h) Explain how ecosystems change over time through succession and how this affects ecosystem dynamics. ENV.7 The student will investigate and understand that pollutants have physical, chemical, and biological consequences at the local, regional, and global level. Demonstration of the essential knowledge and practices includes: a) Use data to identify a land, water, or atmospheric pollutant in the local community and determine possible sources and effects on the environment. b) Debate advantages and disadvantages of solutions to safely reduce, eliminate, or remediate a land, water, or atmospheric pollutant. c) Compare the benefits and limitations of remediation methods used with land, water, and atmospheric pollutants.	that discuss their role in the habitat and greater ecosystem. Consider how the schoolyard habitat can be used for Project Based Learning. What driving questions do students have about the habitat that they can investigate?

Part 2: Connecting Your Schoolyard Habitat to Other Content Areas

Schools should look for opportunities to incorporate schoolyard habitats across their curricula and grade levels. Below are additional ideas related to Math, Language Arts, History, Visual Arts, CTE, Health and Physical Education, and Social Emotional Learning:

Mathematics	
Content Area	**Potential Activities/Concepts**
Math	★ Many Math SOL strands can be enhanced by using your schoolyard habitat; many of the ideas in the list below can be scaled for your grade level. ○ Identify, analyze, compose, and compare shapes- students can look for triangular shapes in the habitat. ○ Have students count and record how many seeds they plant for each type of plant. Then have them count have many grew and turn it into a subtraction math problem. "If 50 seeds were planted and 35 grew. How many seeds did not grow?"

	○ Sort and count objects such as types of flowers, flower color, leaves ○ Have students go on a symmetry hunt in the habitat. ○ Draw a map of the habitat using scale. ○ Find the area and perimeter of the habitat. This could also be done with various shaped leaves for irregular objects. ○ When learning fractions, you can divide the habitat with string into a small grid and have students plant their plants in 2 of the 25 squares of the grid until there is a plant in each grid. ○ Measure the height of a group of the same plants- determine mean, median, and mode. ○ Record data and graph ▪ Plant growth over time ▪ Number of flowers with various colors ▪ Number of pollinators ○ Record the number of pollinators observed/10 minutes. Based on this data, calculate how many pollinators students may see in 60 minutes. ○ Use algebraic formulas to compute a variable such as the amount of fertilizer to add per quart of water (the directions are normally in gallons) ○ Plant a variety of seeds. Research the seed producers suggested number of days until germination. Record the number of days it takes most of the seeds to germinate in the habitat. Compare the actual time vs the suggested germination time. Discuss the accuracy of the research information and what variables may have affect the results (reasoning and proofing). ▪ A similar lesson would be to research how many petals a particular species of flower "should" have. Then collect 5-10 sample flowers from the habitat and count the petal numbers; graph the data. Compare this to the research. ○ Calculate the germination rate by recording the number of seedlings that emerged divided by the total number of seeds planted. ○ Measure plant height using standard (ruler) and nonstandard (pencil length) means. Compare the results. ○ If you need to bring in soil or mulch, determine the volume of material you will need. ○ Using geometry, estimate how many plants of each variety can fit in an area given that each species of plant potentially has different recommended spacing between plants. ○ Measure and compare temperature of the air and various surfaces (concrete, metal, soil, etc.). ○ Incorporate aspects of the habitat into math word problems. ▪ An example for younger students, there are 10 native coneflower plants growing in the habitat. Jack and Jill want to add an equal number of native goldenrod and native mint to the habitat. After they are done planting, how many total plants will be in the habitat? ▪ An example for older students, you are purchasing seeds for your schoolyard habitat. The seeds for the habitat originally priced at $240 are on sale for 15% off. Then there is the 4.8% sales tax. Find the total price of the seeds after including the discount and sales tax. ○ Create and manage a budget for the schoolyard habitat project. ○ Track and graph weather conditions over time.

	○ For older students, have then count the number of plants of a particular species in the habitat and create an equation for a classmate solve for the number of that species in the habitat. For example, if there are 6 native coneflower plants, a students could create the equation 2x + 4 = 16, where X is equal to the number of native coneflower plants in the habitat.

Language Arts	
Content Area	**Potential Activities/Concepts**
Language Arts	★ Many communication, reading, writing, and research SOLs can be achieved while planning, implementing, maintaining, and monitoring a schoolyard habitat. Many of the ideas in the list below can be scaled for your grade level, the idea is to not only use the schoolyard habitat as a beautiful teaching space but to integrate it as much as possible into the curriculum. ○ Have students research the best native plants for the schoolyard habitat space then have students present on the best planting methods for that plant (step by step directions) and defend their reasoning behind their plant choice. ○ While maintaining your schoolyard habitat, nonnatives or undesirable plants may grow from time to time, research these undesirable plants and the best methods for removal. Have students write a protocol for identifying these undesirable plants and the methods of removing them that fellow students can follow. ○ Integrate books that connect to the habitat plants, pollination, pollinators, or other wildlife in the habitat. ○ Maybe there is a passage in a book, a poem, etc. that talks about a particular plant, would the experience of reading that passage be heightened for your students by being near those plants in the habitat at the time of reading the passage? ○ Maybe a children's book is all about pollinator and pollination, read the book in the classroom, then go out and investigate examples of pollinators and pollination in your habitat, then have the students write about this experience connecting what they read with their real-life experience. ○ Does a book you read year after year with students incorporate a particular plant of significance? Be sure to plant the *native* version of that plant in the habitat so that students can make a larger connection between the reading and real-life. ○ Can you create a native sensory habitat centered around sensory words learned in the classroom? ○ Walk through the habitat and write down words that describe your sensory observations to assemble your own haiku. ○ When discussing vocabulary terms, try to incorporate age-appropriate terms connected to the habitat plants, pollination, pollinators, or other wildlife in the habitat. ○ Nature Journals can be a great place for students to practice writing. Give the students writing prompts that incorporate the habitat observations. Schoolyard habitats can also be a great place for writing inspiration.

History/Geography/Social Science	
Content Area	**Potential Activities/Concepts**

History/ Geography/ Social Science/ Economics	★ Many of the ideas in the list below can be scaled for your grade level. Geography: ○ Provide an aerial map of the school and surrounding areas. Use the map to predict potential locations of a schoolyard habitat and then use the map to walk the schoolgrounds and confirm the locations. ♦ can be used in conjunction with the tracking the flow of water science activity for Kindergarten. ○ Have the students document the how the vegetation in the habitat changes in regard to the change in seasons. ○ Discuss how human interaction with the environment has changed our local schoolyard environment and geography through the building of the school grounds, roads, housing, etc. Social Science and Economics: ○ Take a tour of your schoolyard and list the natural resources and manmade resources. ○ When having your students analyze how they fit into their community on a smaller and larger scale: for example, have students volunteer their time helping to maintain the schoolyard habitat. Leverage this schoolyard volunteerism into something larger by inviting community volunteers and representatives of volunteer organizations to share opportunities for students to become actively engaged in sustainability related volunteerism in their community. ○ Use planning your schoolyard habitat (i.e., budget and materials) as a real-life example of supply and demand and inflation; using costs of items for the habitat as an example. Have students research the business near you that could supply materials for your habitat and classify them. Have students interview the small business owners you find about their experience with entrepreneurship.

Visual Arts	
Content Area	**Potential Activities/Concepts**
Visual Arts	★ Teachers can connect many aspects of the Visual Arts Progression Charts to the schoolyard habitat. ○ photography, drawing, painting, or simply using the habitat as a source of inspiration can all be incorporated. ○ Objects from the habitat, like flower petals, could be used to create a piece of art or possibly even natural paints or dyes. ○ Create an art installation using plants or rocks placed in a particular pattern in the habitat or an art project using materials gathered in the habitat. ○ Use the habitat to look for real world example of elements of art and art principles.

CTE	
Content Area	**Potential Activities/Concepts**
CTE	★ CTE Courses: there is ample opportunity to connect multiple CTE courses to your schoolyard habitat. Here are a few examples below based on some middle school CTE standards. ○ Involved in the planning and creation process, creating computer generated landscape plans, prepping the land, building signage, etc.

	○ When discussing resources used in technology and engineering consider an outdoor scavenger hunt for natural resources and methods to sustainably manage those resources or planting school habitats to preserve resources such as native plants, water, incorporating crop rotation, utilizing fewer chemicals, upcycling materials, alternative energy, etc. ○ For career clusters: Invite local flower growers or other agricultural personnel or natural resource personnel to share their career experience and expertise. ○ To demonstrate reasonability for living environments: Perform regular maintenance at the schoolyard habitat. ○ Should you incorporate technological systems into your habitat: for example, if implementing technology into your schoolyard habitat space (ex: solar panel lighting), have students conduct an environmental cost/benefit analysis. Have students survey the schoolyard and attempt to address an erosion, runoff, invasive species, etc. through habitat work or other technological solutions. ○ When having your students analyze how they fit into their community on a smaller and larger scale: for example, have students volunteer their time helping to maintain the schoolyard habitat. Leverage this schoolyard volunteerism into something larger by inviting community volunteers and representatives of volunteer organizations to share opportunities for students to become actively engaged in sustainability related volunteerism in their community. ○ Manufacturing of habitat items from recycled materials (upcycling); for example, a discarded milk jug turned into a watering can.

Health/PE	
Content Area	**Potential Activities/Concepts**
Health/PE	★ Health and Physical Education: research shows that it is beneficial for humans to be outside for stress reduction, exercise, rest, and play. ○ Discuss with students the benefit of being outdoors to mental health and stress reduction and then utilize the schoolyard habitat for a portion of class, such as yoga in the habitat, nature walk, or perform maintenance in the habitat.

Social Emotional Learning	
Content Area	**Potential Activities/Concepts**
SEL	★ Planning, building, and maintaining a schoolyard habitat involves teamwork and seamlessly integrates the Virginia Profile of a Graduate 5 C's (Collaboration, Critical Thinking, Communication, Citizenship, and Creativity). Students can also work on the SEL competencies of self-awareness, self-management, social awareness, relationship skills, and decision-making. Throughout the process of creating and maintaining a schoolyard habitat, students also create something they feel connected to and feel, at least some, ownership over. The following ideas were adapted from Big Green Garden-Based SEL Lessons.

	○ With your students, brainstorm ways that students can show respect to the schoolyard habitat, those organisms that inhabit it, and those who have worked to create and maintain it. Then take a quiet walk through the habitat with your students, maybe even have students pick a spot and sit silently for 5 minutes, have the students focus on what they notice through their senses, then comeback together as a group and add any additional ways to your list. ▪ Respect for the habitat can help students reflect on how they respect themselves and others. ○ With your students, brainstorm how we can integrate caring (self-care, caring for other people, caring for other organisms, caring for the habitat) when we are outdoors or in the habitat? ▪ Have students think about how they can work together to care for the habitat and develop a plan. ▪ Allow students to pick a spot in the habitat and sit quietly for a few minutes. Have them reflect on do you feel differently when you are sitting here in the habitat as opposed to scrolling on your phone or in the classroom, why? What part of the habitat brings you the most joy? If students are involved with caretaking for the habitat, ask them has the habitat responded to our care, if so, how? How would you feel if someone didn't care for this space? ○ With your students, explore the diversity of the habitat and how diversity provides for the needs of organisms that live in the habitat. Have the students reflect on what they have in common with each other, what they have that makes them unique, and how their similarities and differences impact how they work together. ○ Student words and actions have power, even if no one is around. Have students reflect on how their choices to act or not act influences their relationships and the environment. ▪ Caring for an environment, like a schoolyard habitat, means that students and staff must follow through on their commitment to the habitat or else it will accidently get mowed by facility staff, overgrown with weeds, etc. Have students imagine a scenario where they are responsible for watering plants in the habitat. Have them write down all the possible excuses they could think of for why they might not water the plants. Hold up a carboard milk carton, the carton represents a watering can (the relationship between the students and the habitat plants) for the habitat. Have students share out their excuses for not watering the habitat and each time an excuse is shared, cut, or remove a portion of the milk carton, to represent damage to the relationship. When we don't follow through with our commitment it can hurt the relationship we have with ourselves and others.