The Living Soil–The Living Plant: We Are All Interconnected and Related
Theme 2: Scope and Sequence - Grades K–8

Strand	Topic	K–2		3–5		6–8	
		Learning Outcomes	Garden Activities	Learning Outcomes	Garden Activities	Learning Outcomes	Garden Activities
Scientific Inquiry	Ability to make observations, inquiry, collect and interpret data, make conclusions	Make Observations. Ask questions. Collect data. Interpret data. Make conclusions.	What is soil made of? Observe garden soil. Ask questions. Explore and classify the parts of soil. Where do these soil parts come from? Can we recombine them to make soil?		Set up a garden experiment to test the effect of soil types on plant growth.		6th grade: Guided two minutes of silent observation. “I notice_____. I wonder_____. “ From this come up with a testable question. Students share out.
	Engineering design	Design, build, and test various solutions to simple garden problems in infrastructure.	Design a solution to a problem identified in the garden. Discuss possibilities, create a small model, build the best solution, test.		Identify problems in the garden, (e.g., drainage, irrigation) and design solutions to the problem (e.g., divert water).		
The Living Soil	Describe characteristics and components of living soil	Explain how soil is created. Describe differences among soil samples. Identify living and nonliving components of soil.	Collect soil samples from five different areas of the school garden. Describe the different types of soil using all five senses. Compare soil samples to each other. Sort and classify living and nonliving soil components. Create a list of words that describe collected soils. Illustrate, in words or drawings, findings of soil exploration activity. Recombine samples to make soil.	Investigate and identify general components of living soil. Analyse and classify various types of soil found in Hawaii.	Observe compost pile and identify moisture level, temperature, (brown) carbon:nitrogen (green) ratio. Sort, classify, identify, and represent components of soils from different garden beds. Include particle size, clay, silt, loam, and living things. Perform and analyse mason jar soil test. Create soil forms such as balls, ribbons, snakes, etc. to understand soil components, texture, and properties. Introduce basic soil chemistry: Use soil test	Compare and contrast the abiotic and biotic factors of the soil. Explain how abiotic and biotic factors relate to other systems. Recognize and classify sand, silt, clay, and loam. Justify and describe the proportional relationships of soil components.	Using a quadrat, hand lens, and/or magiscope describe and draw soils from different areas of school grounds. Make qualitative and quantitative observations of collected samples. Perform soil percolation and absorption test to analyze porosity and components of soil. Introduce basic soil chemistry: Use soil test kit or Vernier probes to analyze nitrogen, phosphorus, potassium (K), and pH of soil samples from school garden. Analyze soils using the clump test.

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					kit or Vernier probes to analyze nitrogen, phosphorus, potassium (K), and pH of soil samples from school garden. Discuss that there are minerals in the soil. Investigate how plants show deficiencies (lack) of the mineral (e.g., iron-deficient plants have younger leaves yellowing, calcium-deficient plants have blossom end rot, etc.).		Create optimum garden soil health using test results and amendments. Construct loamy soil necessary for optimum plant growth.
	Identify organisms in the soils and their functions and interrelationships	Describe soil as a living medium. Describe how living organisms and organic matter contribute to soil health. Recognize and draw or explain the difference between vertebrates and invertebrates.	Investigate worms living in soil and compost systems. Create and maintain a worm bin to investigate the role worms play in soil fertility. Sift finished compost (or garden soil) and explore, draw, and describe the organisms found in the soil. Appendix: Banana Slug String Band, *The FBI is on the Scene.*	Identify and illustrate fungi, bacteria, and invertebrates. Describe, compare, and contrast the roles fungi, bacteria, and invertebrates play as decomposers, recyclers, and contributors of soil nutrients. Illustrate fungi, bacteria, and invertebrates found in soil samples.	Observe compost pile and identify living (biotic) and nonliving (abiotic) factors. Collect and record data. Observe compost pile over time, identify presence of living organisms throughout the compost cycle. Collect and record data. Sift finished compost or garden soil. Use hand lens to identify various decomposers such as shredders, predators, bacteria, and fungi. Collect and record data. Use visual material such as a field guides or videos to show fungi, bacteria, and invertebrates.	Cite specific evidence for how microbes affect plant growth and overall health of the soil.	Design an experiment to compare plants grown in sterilized soil and compost-enriched soil. Apply medium rich in microorganisms such as worm castings or EM Bokashi to garden beds and observe plants' response. Collect and culture microbe samples using an agar petri dish. Using a microscope, analyze growth to distinguish between "threads" (mycelium) of fungus and the circular "clumps" (colonies) of bacteria. Construct a Berlese funnel to identify macroorganisms in the

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					Describe the soil organisms fungi, bacteria, and invertebrates in terms of the relationship of their structure to their function (e.g., mandibles - shredding leaves, burrowing in soil - opens soils for oxygen, etc.). Draw, act, sing, or play a guessing game about the structure and function. Appendix: Banana Slug String Band, *The FBI is on the Scene.*		soil.
	Explain how soils are created	Identify and be able to classify living and nonliving components of soil. Describe how living and nonliving components of soil became part of the soil.	Collect soil samples from various places around school. Sort and classify the components of the soil samples into living and nonliving. Discuss their origins. Experiment with combining individual soil components to create soil. Investigate origins of Hawai‘i’s soils through the story of the ‘ōhi‘a. See Appendix (story of ‘ōhi‘a)	Understand that weather, geologic forces, and human activity create different soil types.	Create a shake jar test (soil column) and identify components of soil (e.g., rocks, clay, sand, silt, humus). Observe and identify signs of erosion caused by water or wind in the garden. Use quadrats to compare and contrast a compost pile in the garden with a decomposing area in a forest, woods, beach, etc. Design a model to demonstrate a solution to erosion. Ahupua‘a field trip to	Summarize how weather transforms rock (the parent material) into soil. Categorize the inorganic and organic components of soil.	Measure, compare, and contrast the layers in soil horizons in different areas of the garden. Use quadrats to carefully observe the topsoil and identify its component. Collect and record data. Identify an area of erosion. Measure the length, width, and depth of the identified area and calculate the volume of topsoil lost. Design, implement, and test a solution to prevent erosion. Monitor and report

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					identify signs of erosion and weathering, identify composting in nature. Write a legend or story about the origin of Hawai‘i’s soil.		intervention tactics over time. Evaluate efficacy of erosion intervention tactics.
	Understand how to make a soil mixture for nursery and seed starting	Recognize characteristics of potting mixes.	Observe potting mix and garden soil. Germinate seeds in garden soil and potting mix. Collect and record data. Compare and contrast collected data. Summarize observations. Create a soil mixture made of ½ compost and ½ potting soil. Transplant seedlings into soil mixture. Discuss and explain why transplants need compost. Describe the differences between soils located beneath a tree and in a vegetable garden bed.	Understand components of healthy soil for use in plant propagation.	Create nutrient-rich soil: Add soil amendments on hand such as crushed coral, worm castings, etc. to compost or potting soil. Create an experiment to investigate soil fertility: Start seeds in or transplant seedlings into amended soil, straight compost, and potting Observe and collect data. Compare and contrast collected data. Create a soil recipe book of soil mixtures for school and home gardening.	Distinguish between different planting mediums for use in seed starting, propagation, and transplanting. Create different planting mediums for use in seed starting, propagation, and transplanting out of materials on hand.	Create nutrient-rich soil: Add soil amendments on hand such as crushed coral, worm castings, etc. to compost or potting soil. Create an experiment to investigate soil fertility: Start seeds in or transplant seedlings into amended soil, straight compost, and potting soil. Observe and collect data. Compare and contrast collected data. Construct a healthy growing environment for seedlings and plants. Prepare and amend garden beds for planting crops. Prepare and amend areas for planting perennials such as fruit trees.

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							Compare and contrast practices for preparing soils for annuals vs. perennials.
	Know and describe the oxygen, nitrogen, and carbon cycles in the soil (e.g., biogeochemical) (Also in Theme 4)	Identify and describe green (nitrogen), brown (carbon), oxygen, and moisture in the soil cycle.	Build a compost pile: Identify green material (nitrogen) and brown material (carbon), oxygen, and moisture. Describe and explain how carbon, nitrogen, oxygen, and moisture make compost. Apply finished compost to garden beds and observe the results. Appendix: Video: *Dirt Made My Lunch* by The Banana Slug String Band.	Record observations about oxygen and carbon in healthy soil. Hypothesize and prove the presence of oxygen and carbon in healthy soil. Compare and describe carbon and oxygen levels in various soil types.	Build, maintain, and employ aerobic (with oxygen) compost systems and identify browns (carbon) and greens (nitrogen) sources. Over span of time, collect and record qualitative and quantitative data from compost systems, including temperature and moisture levels, and senses. Perform a shake jar test. Identify humus and bubbles as evidence of oxygen in soil.	Demonstrate or explain how soil aeration and organic material impact plant growth.	Build anaerobic (without oxygen) and aerobic (with oxygen) compost systems, collect temperature data, and observe change over time, using visual and olfactory cues. Compare and contrast compost piles using different ratios of carbon, nitrogen, moisture, and oxygen. Aerate garden beds to add oxygen for the health of fungi, bacteria, and insects. Add water, carbon, and nitrogen (stable organic material) to improve plant health and support micro and macroorganisms.
Living Plants	Explain the relationship between weeds and soil Identify local weeds Explain pioneer plant species	Identify and give examples of common weeds in the garden or school environment. Describe the advantages and disadvantages of common weeds. Explain the role weeds	Go on a weed identification walk in the garden. Locate common weeds in the garden. Learn the names of and illustrate common garden weeds.	Identify and employ various soil building strategies such as mulching and cover cropping in the garden.	Conduct a weed identification walk to learn the names of common garden weeds. Set up a cover crop prior to summer break to restore nutrients. Assess cover cropping as an effective method of weed	Classify weed vs. non-weed in specific environments. Explain how weeds can be used as a garden resource. Design a use for weeds as a garden resource.	Conduct a weed identification walk. Locate and learn the names of common garden weeds. Use weeds as resources for compost nitrogen enrichment. Recognize and identify

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		play in soil health.	Investigate the role of weeds in soil health (e.g., identify where weeds grow to cover bare soil). Sort and classify common weeds by variety, leaf size, etc. Chop and drop weeds, add to compost, or make tea from weeds. See Appendix.		control/prevention. Locate volunteer weed plants in the garden. Explain their impact, role, and function in the garden. Explain how weeds impact surrounding plants. Describe advantages and disadvantages of weeds. Find and use weeds that are not seeding as a green (nitrogen) layer in the compost pile.		noxious weeds, such as weed seeds, in the garden that would contaminate compost. Design and test strategies for managing noxious weeds in your garden.
	Describe the life cycle of a plant Explain structure and function of plant parts	Identify and draw the structure and function of the six plant parts. Identify and describe what plants and animals need to survive.	Grow a plant from seed to seed: observe, measure, collect, record, or graph growth. Identify and describe the stages of the life cycle. Identify and describe or draw six plant parts. Learn the Six Plant Part Song (See Appendix). Grow and prepare a salad using each of the six plant parts. Use the United States Department of Agriculture's Fresh Fruit and Vegetable Program's weekly snack to identify and explain the edible parts of fruits and vegetables.	Predict and perform seed germination, seed collection, and seed saving.	Grow a plant from seed to seed: observe, measure, collect, record, or graph growth. Design and conduct an experiment about seed germination in different conditions. Harvest a variety of seeds and compare structure and function of different seeds. Create a written or drawn journal that explains the life cycle of a plant and describes a plant's parts and structures. Grow ipu or pumpkin. Identify male and female aspects of reproductive parts.	Identify and describe plants based on their characteristics. Recognize and identify which life cycle stage the plant is in based on its structures.	Categorize seeds and plants into monocots and dicots. Identify the six plant parts (roots, stems, leaves, flowers, fruits, and seeds). Describe the role plant parts play in plant growth and reproduction. Identify reproductive parts of plants. Explain the reproductive cycle of plants. Create a design brief for a plant: select a parent plant for specific qualities, and state specific argument for selection. Conduct a seed exchange with the plant's

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					Dissect a bean seed. Identify various parts of the seed. Dissect a corn seed. Identify various parts of the seed.		seeds. Compare and contrast plant adaptations and methods of seed dispersal.
	Understand and explain photosynthesis	Explain the role the sun plays in a plant's ability to make its own food.	Stand in the garden and feel the sun. Discuss, observe, and identify the energy (sunlight) that plants. Play Photosynthesis Tag (see Appendix). Design an experiment that demonstrates the effect of sunlight on plants. Comparing plants grown with and without sunlight. Introduce photosynthesis through story.	Develop a model to describe and summarize photosynthesis. Explain or prove through experiment design how plant parts enable photosynthesis.	Cover up a plant part to prevent sunlight from reaching the leaf. Observe what happens. Conduct a seed germination experiment in light vs. dark. Make predictions about what seeds need during germination. Make predictions about what plants need to grow. Draw a picture or create a model to explain photosynthesis. Introduce chlorophyll.	Categorize the inputs and outputs of photosynthesis.	Recognize seasonality in the garden and how it affects the plant's ability to photosynthesize. Design an experiment to demonstrate the effect different quantities of light have on the growth and development of seedlings. Set up and observe transpiration bags. Measure the volume of water collected from different plants and correlate to surface area of a leaf.
	Understand how to propagate and grow plants	Explain germination, propagation, and transplanting as elements of plant growth.	Experiment sowing seeds directly into garden soil and into pots. Observe, compare, and chart days to germination, flowering, and fruiting. Transplant potted seedlings into garden soil. Plant via vegetative	Classify plants not propagated by seed. Apply propagation strategies to a variety of plants.	Read a seed packet and apply information to practices. Propagate a variety of plants using different methods, such as germination, vegetative (asexual) propagation, grafting, and air layering. Observe how different plants in the garden or nature reproduce.	Design optimal conditions for germinating and growing plants.	Read a seed packet and apply information to practices. Design and conduct an experiment about resource availability (water, sun, nutrients, etc.) and its effect on the germination rate of seeds (sexual reproduction). Design and conduct an experiment about

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			propagation (kalo, banana, sugar cane, sweet potato, or pineapple). Explore resprouting plants from pieces (celery stalk, green onion bottoms, carrot top, sweet potato).		Identify and discuss how plants have adapted to conditions by utilizing appropriate propagation strategies. Identify propagation structures exhibited by plants under various conditions (e.g., stress induces flower/seed production, ‘uala stem in contact with soil and water will produce roots). Prepare cuttings to share with community members.		resource availability (water, sun, nutrients, etc.) and its effect on the growth rate of cuttings (asexual propagation). Propagate a variety of plants using different methods, such as germination, vegetative (asexual) propagation, grafting, air layering.
	Recognize and identify the differences among Polynesian-introduced, endemic, and indigenous plants	Identify and name main forest trees (koa, ‘ōhi‘a) and canoe crops (banana, kalo, ‘uala, kō, ‘ulu, ‘olena, ti leaf) Recognize that plants have arrived at different times in different ways (e.g., waves, wind, and wings).	Define introduced, endemic, and indigenous in terms of plants. Conduct a guided garden walk and identify introduced, endemic, and indigenous plants within the school environment. Conduct a biodiversity scavenger hunt. See Appendix. Introduce how seeds are dispersed through wind, water, wings, and animals. Draw or explain seed shapes. Investigate how plants arrived in Hawai‘i. Harvest and prepare native plants for a craft,	Identify and classify endemic, indigenous, and Polynesian-introduced plants. Explain how various plants have different practical uses and applications.	Observe and identify how plants travel, specifically how plants arrived in Hawai‘i, an isolated place, by wind, water, or animal. Explain how Hawai‘i is the endemic species capital of the world. Conduct a guided garden walk; identify introduced, endemic and indigenous plants on campus, discuss how the plant got to Hawai‘i (wind, water, wings). Create signage to distinguish native plants on campus; create a map of native plants on campus.	Identify a minimum of five of each: Polynesian-introduced, indigenous, and endemic plants	Conduct a guided garden walk; identify introduced, endemic, and indigenous plants. Plant and propagate Polynesian-introduced, indigenous, and endemic plants in the garden. Harvest and prepare native plants for a craft, cordage, food, medicine, or beverage (e.g., kapa, lei, etc.).

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			cordage, food, medicine or beverage (e.g, kapa, lei, etc.).		Define terms endemic, indigenous, and Polynesian-introduced. Create a meal with Polynesian-introduced food crop. Harvest and prepare native plants for a craft, cordage, food, medicine or beverage (e.g., kapa, lei, etc.).		
	Understand inheritance, genetic variation, and biodiversity in plants	Observe differential traits of varieties of a plant species.	Sort, classify, and count different traits among multiple varieties within a particular plant species (e.g., beans, lettuce). Generate questions about the variations in the garden. Hypothesize explanations of why variations happen. Observe how a young plant is like, but not exactly like, the parent plant. Locate plants in the garden that can be divided off the parent plant and harvest keiki. Describe or draw how these plants resemble their parents.	Distinguish genetic and inherited differences in plants. Compare and classify how biodiversity influences survival.	Identify examples of genetic variation in the garden (e.g., pigeon pea, corn, lettuce, beans, kalo). Sort, classify, and count different traits among multiple varieties within a particular plant species (e.g., beans, lettuce, or tomatoes). Discuss how and why the variation happens. Compare and contrast color, leaf shape, and taste of several kalo and/or sweet potato varieties.	Investigate the different methods of plant propagation (e.g., seeds, cuttings, air layering, etc.)	Sort, classify, and count different traits among multiple varieties within a particular plant species (e.g., beans, lettuce, or tomatoes). Discuss how and why the variation happens. Develop testable questions from these observations. Compare color, leaf shape, and taste of different taro (kalo) varieties and/or sweet potato (‘uala) varieties. Identify examples of genetic variation in the garden (e.g., pigeon pea, corn). Propagate plants asexually and sexually.

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Soil Fertility	Understand, build, and use compost systems	Describe the components of composting (green and brown, decomposers, air, water, time).	Identify and collect green (nitrogen) and brown (carbon) materials for compost pile. Build, tend, and record observations of a compost pile over time. Observe nature's composting (e.g., a rotting apple, leaves decomposing under a tree). Build and tend a classroom or garden worm bin. See Appendix: How to Compost Guide.	Construct, retrieve, and layer green (nitrogen) and brown (carbon) in composting systems. Explain how green (nitrogen) and brown (carbon) provide various nutritional elements for optimal fungi, bacteria, and invertebrate activity. Connect vermiculture, soil amendments, and healthy layering to soil creation and plant nutrition uptake.	Build a compost pile with green (nitrogen) and brown (carbon) layers in the proper ratios. Build and maintain several different compost systems such as aerobic, anaerobic, compost bins, compost pallets. Observe a compost pile. Turn and record moisture, temperature, and pH changes over time. Use a compost log to record data. Determine when a compost pile is finished and ready for use (i.e., temperature is stable, abundance of macro- and microorganisms). Discuss the importance of compost and create a drawing, poem, play,or song about compost and its creation.	Construct and maintain healthy compost systems and apply to the garden (e.g., vermiculture, aerobic, anaerobic).	Using proper ratios of nitrogen to carbon and water to air-build an aerobic compost pile. Observe a compost pile. Turn and record moisture, temperature and pH changes over time. Use a compost log to record data. Determine when a compost pile is finished and ready for use (i.e., temperature is stable). Determine when a compost pile is finished and ready for use (i.e., temperature is stable, abundance of macro- and microorganisms) Use compost in the garden. Estimate, using buckets, the volume of compost and/or mulch required to create balanced soil. Build and tend a classroom or garden worm bin.
	Investigate, analyze, and apply natural soil fertility systems	Explain how compost enriches the soil and feeds plants. Explain that mulch protects, cools, and retains moisture in the soil.	Apply finished compost and/or vermicompost to the garden. Make observations and discuss process. Investigate, identify, and gather different materials from the nearby environment and use to mulch around garden	Construct, retrieve, and layer green (nitrogen) and brown (carbon) in composting systems. Explain how green and brown provide various nutritional elements for optimal fungi, bacteria, and invertebrate activity.	Sift finished compost and make observations. Sort vermicast from red wigglers and/or Indian blue worms. Apply compost created from the different compost systems to garden beds.	Recognize and integrate soil fertility systems for optimal plant growth. Explain how/why to apply amendments in plant growing cycles.	Sift finished compost and make observations. Sort vermicast from red wigglers and/or Indian blue worms Use ratios to make correct dilutions of worm/compost teas, ash, etc. as a soil amendment.

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			plants. Identify and grow plants that make good mulch sources. Observe and record temperature of mulched and un-mulched soil. Grow a plant in amended (with compost) and non-amended soils; record observations and formulate questions based on observations.	Connect vermiculture, soil amendments, and healthy layering to soil creation and plant nutrition uptake.	Grow the same crop in the garden beds. Compare and contrast the plants' growth in the different media. Identify mulch (brown/carbon) sources on campus. Identify human discards appropriate for mulch, weed cover, and/or brown (carbon) layer in compost (e.g., newspaper, cardboard, shredded paper). Compare and contrast the condition of trees with and without mulch. Mulch on and between beds to conserve water and prevent weeds. Use ratios to make correct dilutions of worm/compost teas, ash, etc. as a soil amendment.		Use compost and amendments as a part of bed prep. Mulch on and between beds to conserve water and prevent weeds.
	Understand decomposition	Explain that decomposition includes organic materials, air, water, organisms, and time.	Build, turn, and sift a compost pile and observe decomposition. Use eyes and magnifying glass to conduct a visual investigation of fungi, bacteria, and invertebrates in compost. Create a story in which the compost pile is the ultimate resort getaway (ideal habitat) for fungi,	Understand that decomposition is one way that Nature cycles matter and energy.	Compare and contrast the volume of a compost pile that is turned and a pile that is not turned. Compare and contrast the temperature of a compost pile that is watered and a pile that is dry. Conduct a visual investigation of fungi, bacteria, and	Observe decaying organic matter and explain its role within the garden ecosystem.	Build and maintain a compost system to demonstrate the cycling of matter and apply to the garden. Measure the change in volume of a compost pile over time. Measure the temperature changes in a compost pile over time.

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			bacteria, and invertebrates. Design the resort (habitat) to include the inhabitants' favorite foods, enough air, water, etc. The Banana Slug String Band video "The F.B.I. is on the Scene." Decomposition song (see Appendix). Observe decomposition of mulch on the soil over time. Experiment: Bury and dig up, to observe over time, the decomposition of organic and inorganic materials.		invertebrates in the wet/dry or turned/unturned compost using sight and a magnifying glass. Observe decomposition of mulch on the soil over time. Record data. Research decomposition rates, create a decomposition timeline (e.g., slippers, apple, styrofoam, glass, etc.) http://techalive.mtu.edu/meec/module10/EnergyFlow.htm		Collect and culture microbe samples using an agar petri dish. Using a microscope, analyze growth to distinguish between "threads" (mycelium) of fungus and the circular "clumps" (colonies) of bacteria. Construct a Berlese funnel to identify macroorganisms in the soil.
Biodiversity and interdependence	Understand and describe how weather shapes the Earth and affects soil and plants	Explain how sun, rain, and clouds affect soil and plants.	Observe changes in the garden after a weather event (rainfall, heavy wind, cloudy day). Investigate how air and soil temperatures changes with clouds and rainfall. Observe and discuss how plants are affected by rain, sun, drought, and temperature.	Examine and summarize how weather and climate affects soil creation and shapes land formations.	Observe geographical features at school. Create a model to replicate geographical features. Explain how weather shaped the geographical features.	Explain the effects of plants and weather on soil erosion. Explain the relationship between soil erosion and biodiversity. Explain how topsoil is necessary for supporting life on the planet.	Create a model using an apple to represent the Earth and show the relationship of topsoil to planet. Explain findings. Create a decomposition timeline using organic and inorganic items found in the garden and on school campus. Display in the garden. Identify areas in the garden that model the effects of water and wind on areas of soil with and without plants. Compare and contrast the areas in writing, orally,l or through illustrations.

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	Explain the importance of biodiversity within the garden environment	Explain biodiversity in the context of a garden environment. Give examples of plant and animal biodiversity in the garden. Describe biodiversity in terms of plant and animal interdependence.	Define biodiversity. Conduct a nature walk on the school campus. Identify trees and plants and discuss them in terms of biodiversity. Draw or describe different types of seeds or leaves. Categorize seeds/leaves based on observations. Count and name the different types of trees students can see from the garden. Expand understanding of biodiversity: survey the garden and identify who/what lives in the garden. List and count discoveries. See Appendix. Describe biodiversity in the garden and on campus. Compare and contrast the two sites.	Identify and distinguish biodiversity in a variety of natural contexts.	Identify evidence of pests in the garden (e.g., holes in leaves, egg, etc.) and determine which organisms are responsible using a field guide (see Appendix for field guide). Classify organisms as pests or beneficial insects. Name beneficial insects based on their function (e.g, decomposers, pollinators, predators, shredders). Cultivate plants that attract beneficial insects. Research plant types that attract beneficial insects or deter pests.	Identify the components of a biodiverse system. Explain how biodiversity supports the overall health of the garden environment in terms of specific species and overall environmental resilience.	Practice Integrated Pest Management to maintain maximum biodiversity in the garden ecosystem. Identify evidence of pests in the garden (e.g., holes in leaves, egg, etc.). Determine which organisms are responsible. Using a field guide, investigate the life cycle of the pest and use this information to experiment with methods of control. (e.g., cabbage moth, little fire ant). Identify garden pollinators and beneficial insects and their host plants. Propagate, plant, and maintain these host plants in the garden. Use a quadrat, measure and record abundance and diversity of insects on “host” plants vs. grass or path. Build and apply healthy compost to garden beds.
	Identify the function that beneficial organisms and pests play in the garden	Describe the roles of pests, pollinators, and predators in the garden system.	Identify and draw common garden insects. Identify evidence of pests in the garden (e.g., holes in leaves, aphids on leaves). Identify garden pollinators	Identify beneficial insects and pests. Identify invasive species. Explain the importance of pollinators, predators, pests, and their relationship to companion planting.	Experiment with companion planting. Identify the benefits of companion planting to maximize space, provide habitats, increase fertility, etc.	Know the basic tenets of Integrated Pest Management and the importance of pollinators.	Practice Integrated Pest Management to maintain maximum biodiversity in the garden ecosystem. Use techniques such as companion planting and planting for beneficial insects to increase the

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			and beneficial insects. Identify plants that attract pollinators and beneficial insects. Observe and ask questions about the roles of pests, pollinators, and predators in the garden system. Play the Pest-Pollinators and Predators Tag Game. See Appendix.	Define food web.	Observe the activity of birds, mammals, and invertebrates in the garden. Research and report on companion plants and how they function. Identify the producers, consumers, and decomposers in your garden. Illustrate the food web in the school's garden to demonstrate key relationships.		biodiversity of the garden. Recognize plant stages and link to diversity of living organisms in the garden. Define and identify trophic levels within the garden ecosystem. Include producers (sun/soil/water/air); primary consumers (herbivores); secondary consumers; and tertiary consumers.
	Demonstrate an understanding of the interrelationships between soil, plants, animals, humans, and the environment	Describe the ways in which living things are connected. Describe the environments living things inhabit.	Explore plant relationships with companion planting. See Appendix. Investigate, observe, and identify plant/animal relationships in the garden. Draw a picture or describe with words one relationship. Observe and discuss the activity and interaction of birds, mammals, and invertebrates in the garden. Use the garden as a model to observe and identify how soil, plants, animals, insects, and humans interact; draw or describe one of these	Develop a model to describe the movement of matter and energy between compost, healthy soils, and optimal human health.	Conduct nature walk to identify and survey biodiversity on campus and in the garden; compare and contrast two sites. Compare a monocrop (e.g., a lawn or playing field) to the diverse environment in a garden through observations of the surrounding ecosystem. Use quadrats to survey abundance and diversity of organisms.	Know the role insects play as pollinators for food crops. Recognize the interrelationship between insects, plants, and other factors in the garden. Appraise the impacts of pesticide, herbicide, and commercial fertilizer use.	Compare and contrast transgenic, hybrid, and open-pollinated crops. Apply principles of seed saving to maintain biodiversity in your garden. Compare a monocrop to the diverse environment in a garden.

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		Learning Outcomes	Garden Activities	Learning Outcomes	Garden Activities	Learning Outcomes	Garden Activities
			relationships.				
Garden Practices	Know how to prepare different planting areas for a variety of plant types	Demonstrate how to prepare a garden bed or a pot for planting a seed or plant.	Prepare a bed for planting. Remove weeds, add amendments, smooth the soil with a rake. Add amendments. Fill pots with potting mix and plant seeds.	Demonstrate how to transplant and direct seed with optimal soil amendments and conditions.		Explain how to prepare a hole for tree planting. Use a soil profile to model positive and negative integers when planting a tree, on a vertical axis with ground level being zero. Explain how to prepare a planting bed: cultivate, amend, aerate, and shape. Demonstrate how to transplant crops into a prepared garden bed using best practices such as depth, root handling, time of day, and appropriate amounts of water. Read and follow directions on a seed packet. Demonstrate knowledge of vocabulary and concepts by planting seeds into a prepared garden bed at correct depth and spacing. Design an experiment to compare and contrast till/no till or monocrop/diversified crop planting. Evaluate the results.	Transplant crops into a prepared garden bed using best practices such as depth, root handling, time of day, and appropriate amounts of water. Read and follow directions on a seed packet. Demonstrate knowledge of vocabulary and concepts by planting seeds into a prepared garden bed at correct depth and spacing. Design and conduct an experiment to compare and contrast till/no till and/or monocrop/diversified crop planting. Evaluate the results.

Strand	Topic	K–2		3–5		6–8	
		Learning Outcomes	Garden Activities	Learning Outcomes	Garden Activities	Learning Outcomes	Garden Activities
	Demonstrate how to safely use, maintain, store and repair garden tools	Identify and name garden tools. Demonstrate proper use, safety, and care of garden tools.	Learn the names of tools, how to use them safely and when to use them, how to clean them and put them away. Identify age-appropriate tools.	Demonstrate safe and competent use of shovels, hand trowels, clippers, and picks. Explain proper tool maintenance.		Demonstrate safe and competent use of shovels, hand trowels, clippers, and picks. Explain proper tool maintenance.	