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### Unit 3.4: How can we plan gardens for our community to grow plants for food?

**Enduring Understanding** – *Students apply the following ideas to explain phenomena or design solutions to problems they experience in their environment:* Plants have characteristics, including traits, and a life cycle that can be influenced by the environment. Environmental conditions, such as weather and climate, affect where and when particular plants can grow and survive. Weather patterns in an area can be used to predict the weather, which can affect the traits and life cycles of plants growing in that area. Weather-related hazards—such as strong storms, drought, and flooding—can harm plants. Some plants have traits that are well adapted to surviving hazardous weather conditions (e.g., waxy coating on leaves), but people can also design solutions to reduce the impacts of hazardous weather on plants. Climate describes patterns in an area’s typical weather conditions over many years. Particular plants are well adapted to growing in particular climates because of what they need from the environment to survive (e.g., certain plants can only survive in tropical climates).

#### Final Artifact

The final artifact for this unit is planning and planting a school garden and designing, testing, revising, and making claims about a solution (tool or process) to protect the garden plants from weather-related hazards or changes in the environment.

#### In Unit 3.4, students build toward these Primary PEs

- 3-ESS2-1** Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- 3-ESS2-2** Obtain and combine information to describe climates in different regions of the world.
- 3-ESS3-1** Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.
- 3-LS3-2** Use evidence to support the explanation that traits can be influenced by the environment.
- 3-LS1-1** Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

#### In Unit 3.4, students build toward these Secondary PEs

- 3-LS3-1** Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.
- 3-LS4-3** Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 3-LS4-4** Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- 3-5-ETS1-1** Define a simple design problem reflecting a need or a want that includes specific criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.



### **LS1 How can we plan a garden where different types of plants can grow and survive?**

Students ask questions, make observations and take measurements, and obtain information from text about how similarities and differences in plants' traits affect how well they survive in particular environments.

In Learning Set 1, students investigate the traits of plants, making models of plants' life cycles. Students use these investigations and models to think about how to design gardens where different types of plants can grow and survive.

#### **L1.1 How do people grow plants for food?**

Students visit a local garden or share the kinds of plants grown for food they've seen in their community. Students view brief videos that illustrate the work of the Gangsta Gardener as well as gardens in Detroit and South Carolina. The teacher introduces the Driving Question, and students generate questions they must ask to plant their own garden to grow food.

#### **L1.2 What different types of plants can we grow in our garden?**

Students choose the plants they will investigate for the garden. They record observations on plants' seeds and produce and develop a class plants chart comparing similarities and differences in structures to plan their garden.

#### **L1.3 How can we help different types of plants grow and survive in our garden?**

Students use a plants chart and information from seed packets to develop a plan for planting their garden and for data collection related to the growth of their plants. They then plant their seeds.

#### **L1.4 What environmental conditions around our school may affect our plant's survival?**

Students examine an aerial map of their school. They identify two areas to observe and collect environmental data from each area. Students draw and label pictures of the areas and share their data to create a class chart comparing the conditions in each area.

#### **L1.5 How can we plan our garden to help plants survive as they grow and change?**

Students use data from the plants chart to develop a class life cycle interactions model of mung beans and to figure out how plants interact with the environment as they grow. Students revisit their observations of their plants' structures from the chart developed in the previous lesson to develop initial models of how their plants' structures will change over time.

#### **L1.6 What location around our school has the best environmental conditions for the survival of plants in our garden?**

Students participate in an interactive read aloud of the book *In the Garden with Dr. Carver* and ask questions about features of the environment that would affect plants' survival around their school. Students use previously collected data and drawings to develop arguments for why their plants would grow well in one location and not others (defining problems).

### **LS2 How can we figure out when to plant our garden?**

Students collect and analyze data to make claims about the influence of changing environmental conditions on the traits and health of plants (*cause and effect*).

In Learning Set 2, students investigate how changes in environmental conditions influence the traits of mung beans. Students analyze the data they collect to identify patterns in the growth and health of plants in different conditions.

#### **L2.1 How can changes in the environment affect the traits and health of our plants?**

Students collaboratively plan an investigation to figure out how changes in the environment (more or less water, warmer or colder temperatures) affect the traits and health of mung beans, while keeping other variables constant. Students test mung beans in different conditions and make initial observations.



**L2.2 How does the environment around our school change during the year?**

Students compare changes in daily temperature data with average temperature data by analyzing bar graphs and comparing patterns. They determine which set of data would be more useful for planning their garden. Students use average seasonal weather data to create bar graphs of typical high and low temperatures in certain months in their community. They compare their graphs with those of a partner in their groups and describe patterns they notice in the data.

**L2.3 How does the weather at different times of year affect how and when we should plan to plant our garden?**

Students analyze and interpret the temperature graphs they created in L2.2 as well as precipitation and sunlight graphs. They use patterns in the data to develop claims about seasonal patterns in temperature and precipitation where they live and when to move their plants to an outdoor garden in their community.

**L2.4 How do the traits of our mung beans change when the environment changes?**

Students identify patterns in the traits of mung beans across different environmental conditions (changes in water and temperature). They make claims about how changing one part of the environment caused changes in the traits and health of mung beans. Students discuss how to add their findings from this investigation to their claims from the previous lesson about when to move their plants outdoors.

**LS3 Why do our plants grow at different times of year in some places and not at all in other places?**

Students obtain information from text, analyze data, and construct arguments from evidence to design solutions to problems that develop because particular plants have traits that allow them to grow well in particular climates (*patterns and cause and effect*).

In Learning Set 3, students investigate different climatic regions and explore how certain plant traits may support survival in particular climates. They analyze data to construct claims about traits that allow particular plants to survive.

**L3.1 When can we harvest plants for food in our community?**

Students revisit the Gangsta Gardener video and compare the plant structures and time of year (December) observed in the video with the structures/time of year for their community gardens. They use observations of their class plants to revise their plant life cycle models and compare the times of year for harvesting food from their plants in different climates.

**L3.2 Why can't communities all grow the same plants at the same time of year?**

Students compare the plants that were in the Gangsta Gardener's gardens with plants grown around their own community. They develop claims supported by evidence from temperature, precipitation, and sunlight data maps that certain plants grow well in particular areas of the United States because of similar environmental conditions.

**L3.3 How does climate affect how people plan gardens to grow plants?**

Students revisit the temperature and precipitation data and graphs created and analyzed in LS2. They jigsaw text and average weather graphs from different climates in the United States. Groups create posters to describe weather patterns in different climates and share the information with other groups.

**L3.4 Why do some plants survive in some climates but not in others?**

Students analyze climate graphs from a location (Hawaii) that has a tropical climate. They participate in an interactive read aloud of the book *No Monkeys, No Chocolate*. Students model how the cacao tree interacts with organisms and non-living parts of the environment (e.g., soil, temperature, precipitation) during each stage of its life cycle to figure out how a tropical climate supports the survival of the plant.

**L3.5 How can plants survive in sunny, warm, dry climates?**

Students record observations of waxy and non-waxy leaves, then heat the leaves and observe differences in the



interactions with a warm, dry environment or climate. They investigate this trait using leaves made of paper and wax paper to simulate a waxy coating. Students analyze climate graphs from a location (Texas) that has a desert or dry climate. They then obtain information from text regarding how different varieties of wheat are more or less able to grow and thrive in dry climates based on their traits and how these traits enable these plants to survive in particular environmental conditions.

**L3.6** *How will our plants survive in hazardous weather conditions related to the climate where we live?*

Students revise their plant life cycle interaction models by adding identified traits and possible plant development stages that might be affected by hazardous weather related to their local climate. Students work with their groups to define problems and develop solutions to make sure that their plants' needs are met in the garden.

**LS4** **How can we plan gardens that protect our plants and grow food in our community?**

Students use evidence from observations and information from text to compare and make claims about the merits of design solutions to protect plants from hazardous weather that can damage plants and affect the traits they develop at different points in their life cycle (*cause and effect*).

In Learning Set 4, students examine the effects of hazardous weather on plants and explore design solutions growers can use to protect their plants from hazardous weather and changing environmental conditions.

**L4.1** *How can we predict and prepare for hazardous weather that might harm our plants?*

Students ask questions about and record observations, using photographs, of weather events that can be hazardous to growing plants (e.g., freezing weather, thunderstorms, hurricanes, droughts, floods). Students watch a video of a weather forecaster predicting hazardous weather. They analyze weather data from weather radar to make their own predictions about the weather, especially hazardous weather.

**L4.2** *How can we design solutions to protect our plants from different kinds of weather hazards?*

Students analyze a map that shows how much average temperatures have increased where they live from 1988 to 2017. They listen to an article explaining how fruit crops in Michigan are being damaged by hazardous weather. Students choose one type of hazardous weather and a solution they want to learn more about to argue for the use of that solution in the class garden. They use evidence from observations of their growing plants and the criteria and constraints they have identified for their class garden design.

**L4.3** *Which solutions do we think are most likely to protect our garden plants and why?*

Students compare multiple solutions to address the problem identified in the previous lesson. They make claims about how well each solution will protect their garden plants from weather-related hazards. Students use evidence from their observations, weather data, and text to support their claims. The class comes to a consensus about which solutions might best protect their garden from weather hazards based on previously identified criteria and constraints.

**L4.4** *How can we design a garden to grow and protect our plants outside?*

Student groups share their plans for the garden with invited families or community members. Students and community members plant or move their garden outside (based on whether there is a usable garden plot at the school or whether planting a container garden would work better).

