Science Lesson Plan

Instructional Alignment to Three Dimensions of the *Framework*

Teacher: April Mitchell, Lin Xiang **Grade:** 6th **Science Discipline:** Life Science	**Title:** *Bark Beetles & Tree Mortality*

Utah SEEd Standard:

Standard 6.4.4 **Construct an argument supported by evidence** that the stability of populations is affected by changes to an ecosystem. [Emphasize how changes to living and nonliving components in an ecosystem affect populations in that ecosystem.]

Disciplinary Core Ideas:	**Featured Crosscutting Concept:**	**Featured Science Practice:**
LS2.C: Ecosystem Dynamics, Functioning, and Resilience	Stability and change	Engaging in argument from evidence

Performance Expectations: How can students *demonstrate mastery*?	Students will **ask questions** to define the system and identify variables that could affect the size of beetle populations. Students will **obtain and evaluate information** to generate claims about the cause of recent beetle outbreaks. Students will **develop and use a model** of the forest ecosystem to investigate the effects of rising temperatures on bark beetle populations over various time scales. Students will **construct a written argument** to support the claim that changes in climate have affected the stability of populations in the forest ecosystem, causing an increased number of beetle outbreaks in recent years.

5E Instructional Sequence

Engage

The teacher engages students with a phenomenon. Students generate questions and make a claim.

Phenomenon= Native bark beetle populations in a forest ecosystem can cause the death of many trees.

Students ask questions and generate claims about the role of bark beetles in a forest ecosystem (and how such a tiny insect can kill such a large tree).

Explore

Students explore the phenomenon and gather evidence to support or refute their claim.

Students observe bark beetles and beetle galleries in tree bark. Students read to obtain information on the bark beetle life cycle and how this tiny insect kills the tree it depends on for food and shelter. Students analyze data to determine the effect of temperature on beetle growth and reproduction. Students analyze patterns of tree growth to determine the number of beetle outbreaks that have occurred in the past several hundred years across regions with different climates.

Students develop and use an embodied model of the forest ecosystem to describe how a beetle outbreaks occur, resulting in large-scale tree mortality.

[Teacher Hint: Paired programming….]

Explain

Students explain the phenomenon using evidence and reasoning to support their claim. New vocabulary is introduced as needed.

Students construct an explanation for how beetle and tree populations remain stable over a large time scale in

a healthy forest ecosystem. Students use data from the computer model as evidence to support the claim that temperature is a factor that directly affects beetle populations.

Elaborate

Students apply knowledge to solve a problem, or explore and explain a new but related phenomenon.

Phenomenon= Bark beetle populations have been increasing in forested areas of the western United States and Canada in recent years, causing widespread tree mortality.

Students read to obtain information on the increased number of beetle outbreaks in the Western United States and Canada. Students analyze data to identify changes to the forest ecosystem that could impact beetle population size, including changes in temperature, rainfall, and forest management.

Students use a computer model of the forest ecosystem to collect data on how often beetle outbreaks occur in a healthy ecosystem and use the data to make predictions or assess the risk of future outbreaks.

Students use the computer model to investigate the effects of climate change (temperature, rainfall) on bark beetle population size. Students identify patterns in the data and use the data as evidence to make predictions about the number of outbreaks expected in the next century if global temperatures continue to rise.

Students develop a written argument for how changes in climate have affected the stability of populations in the forest ecosystem, causing an increased number of beetle outbreaks in recent years. The argument should be supported by evidence from scientific literature, students' own investigations, and data collected from the computer model.

[Teacher Hint: Invite students to create a systems map to identify relationships between the living and nonliving components of the ecosystem that affect bark beetle population size. Prompt students to identify and describe the given evidence needed to support the claim that rising temperatures are causing bark beetle populations to increase.]

Evaluate

The teacher administers formative assessments throughout.

Exemplar:

Claim= The increased number of beetle outbreaks in recent years has largely been caused by changes in climate (rising temperatures, drought).

Evidence= Increased temperatures (longer summers, warmer winters) result in increased survival and reproduction for the bark beetle. Warmer temperatures speed up the beetle life cycle, causing beetles to lay more eggs. Also, warmer winters mean more eggs survive and emerge from trees the following spring.

Data collected from the computer model shows that rising temperatures can increase the number of outbreaks over time. At zero temperature, average number of outbreaks is ____. At one degree temperature change, average number of outbreaks is _____.

Reasoning= Small changes in one component of an ecosystem can cause large changes in another component. When environments change, some organisms survive and reproduce while others die. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.

Materials: Laptops, copies of handouts, copies of readings, beetle specimens and bark galleries optional