



Overview

After spending 5 weeks in the Arctic learning about tundra vegetation and phenology, Alejandra Martinez wanted to have her students observe the growth of plants in their school. In this lesson, students will grow plants in multiple locations and track their growth to compare their phenology.

Objectives

Students will learn what phenology is and make observations about plant growth. At the completion of this lesson, they will see how different environments affect plant growth. Students will choose multiple locations to grow three of the same species of plant. For example, students might want to have one grow inside the classroom, one outside in a garden area, and one in an environmental chamber, if available. Students will record the date of the plants' emergence, the production of leaves, their first true leaves, their first bud, open flower, and when the flower wilts.

[Resource Details](#)

Region

Arctic

Completion Time

More than a week

Grade

Middle School and Up

Permission

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Expeditions

[Phenology and Vegetation in the Warming Arctic 2019](#)

Author(s)

Alejandra Martinez

Related Members

[Alejandra Martinez](#)

[Jeremy May](#)

[Steven Oberbauer](#)

Materials

Pots/garden area

Soil

Fast growing seeds (like mustard)

Watering cans

Rulers

Topic

Life Science

General Life Science

Tools and Methods

Ecology

Organisms and Their Environments

Climate Change

Lesson Preparation

Instructors will need to prepare multiple locations (2-3) for planting. I suggest an area inside and outside of the classroom, and an environmental chamber, if available. A familiarization of the stages of phenology for the chosen plant is helpful. Materials – pots/garden area, soil, fast-growing seeds (like mustard), watering cans, rulers

Procedure

Students should be familiar with phenology prior to this lesson and the stages of growth for their chosen species of plants.

1. Prep areas for planting
2. Students will plant their seeds in multiple locations
3. Students will record the plants' stages of growth on the Phenology Table provided. They will

enter the date that each plant reaches that stage in its growth.

4. Twice a week the students will use a ruler to measure the plant's growth in centimeters and record their data in the Plant Growth data table.

Extension

Instructors can choose to have the students use calendar dates in their tables or Julian days. The type of plant and its growth rate will determine how long the experiment will be.

Transferability

This lesson will be a long term activity that will span multiple weeks or months, depending on the chosen species.

Resources

Journals and Videos

<https://www.polartrec.com/expeditions/phenology-and-vegetation-in-the-warming-arctic-2019/journals/2019-06-16>

Phenology and Climate change



Mobile Instrumented Sensor Platform Tram



It's Not Easy Being Green... In the Tundra



Assessment

Students will be evaluated on their ability to record data, graph their data and answer the post-lab questions that require them to analyze their data.

Author/Credits

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Standards Other

Next Generation Science Standards

MS-LS1-4: Use argument based on empirical evidence and scientific reasoning to support an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively.

MS-LS1-4: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Texas Essential Knowledge and Skills

7th Grade Science

7.10(A) observe and describe how different environments, including microhabitats in schoolyards and biomes, support different varieties of organisms (B) describe how biodiversity contributes to the sustainability of an ecosystem

7.11 Examine organisms or their structures such as insects or leaves and use dichotomous keys for identification

(B) explain variation within a population or species by comparing external features, behaviors, or physiology of organisms that enhance their survival such as migration, hibernation, or storage of food in a bulb

7.13(B) describe and relate responses in organisms that may result from internal stimuli such as wilting in plants and fever or vomiting in animals that allow them to maintain balance.

Biology

2(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as data-collecting probes, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, balances, gel electrophoresis apparatuses, micropipettes, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;

(G) analyze, evaluate, make inferences, and predict trends from data

3(A) analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student

(C) draw inferences based on data related to promotional materials for products and services

12(E) describe how environmental change can impact ecosystem stability

Environmental Systems

4(B) assess the role of native plants and animals within a local ecosystem and compare them to plants and animals in ecosystems within four other biomes

(G) predict how species extinction may alter the food chain and affect existing populations in an ecosystem

(H) research and explain the causes of species diversity and predict changes that may occur in an ecosystem if species and genetic diversity is increased or reduced.

7(D) analyze and make predictions about the impact on populations of geographic locales due to diseases, birth and death rates, urbanization, and natural events such as migration and seasonal changes

8(B) explain how regional changes in the environment may have a global effect

(E) analyze the impact of temperature inversions on global warming, ice cap, and glacial melting, and changes in ocean currents and surface temperatures

9(D) describe the effect of pollution on global warming, glacial and ice cap melting, the greenhouse effect, the ozone layer, and aquatic viability

(H) analyze and evaluate different views on the existence of global warming

Earth and Space

Strand 6(C) Relevance. The interacting components of Earth's system change by both natural and human-influenced processes. Natural processes include hazards such as flooding, earthquakes, volcanoes, hurricanes, meteorite impacts, and climate change. Some human-influenced processes such as pollution and nonsustainable use of Earth's natural resources may damage Earth's system. Examples include climate change, soil erosion, air and water pollution, and biodiversity loss. The time scale of these changes and their impact on human society must be understood to make wise decisions concerning the use of the land, water, air, and natural resources. Proper stewardship of Earth will prevent unnecessary degradation and destruction of Earth's subsystems and diminish detrimental impacts on individuals and society.