Butterfly Gardening with Trees

(2.LS1.c, 7LS3.b, ENV 5.c)

Time
2 45 minute classes

GSES Standard (# and text) Character Count: 1000

S2L1 Obtain, evaluate, and communicate information about the life cycles of different living organisms.

C. Construct an explanation of an animal's role in dispersing seeds or in the pollination of plants.

S7L3 Obtain, evaluate, and communicate information to explain how organisms reproduce either sexually or asexually and transfer genetic information to determine the traits of their offspring.

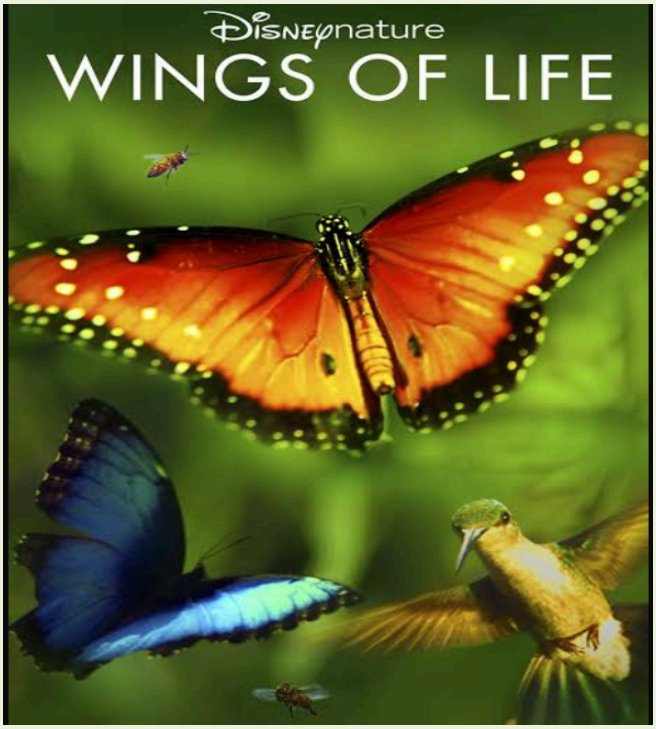
B. Develop and use a model to describe how asexual reproduction can result in offspring with identical genetic information while sexual reproduction results in genetic variation.

SEV5 Obtain, evaluate, and communicate information about the effects of human population growth on global ecosystems.

- C. Construct an argument from evidence regarding the ecological effects of human innovations (Agricultural, Industrial, Medical, and Technological Revolutions) on global ecosystems.

Phenomenon

The Beauty of Pollination - Wings of Life | Disney Video



Video: Louis Schwarzberg / DisneyNature The Beauty of Pollination / Wings of Life trailer (4 min 16 sec / no captions / no narration)

Lesson Overview Character Count: 1000

Students will observe trees when they are in bloom (producing pollen), being pollinated (by wind, water, or animals), or bearing fruit, and then investigate sexual and asexual reproduction in plants.

Engage Character Count: 900

Students will visit the schoolyard to observe the phenomenon of trees interacting with pollinators (birds, butterflies, moths, flies, bees, etc.) by providing food for larvae (caterpillars) or nectar for adults. Students will draft a tentative explanation for the process they observed and will later return to revise and clarify this explanation.

Elicit Questions Character Count: 900

Prompt students to ask what they wonder about trees and pollination; and then give them a chance to undertake research to answer their own questions.

Explore Character Count: 900

2nd Grade: Investigating Plant and Animal Interactions

2nd graders will observe pollination in the schoolyard; create a model of the pollination process; and imagine the missing ingredients from a meal that consists solely of foods that don't require animals for pollination or seed dispersal. These activities are derived from The Smithsonian Institute's lesson - "Plants and Animals: Partners in Pollination"

7th Grade: Investigating Sexual vs Asexual Reproduction in Trees and Other Plants

7th graders will use the Jigsaw Protocol to read and share articles about sexual and asexual reproduction in plants, gaining clues about morphology that they will use to analyze trees in the schoolyard.

- Pollen are Not Sperm because pollen (an entire living organism) can survive on its own without moisture, resulting in the phenomenon of alternating plant generations that sexually reproduce - video by MinuteEarth
- Pollinator-mediated selection is an evolutionary process that matches foraging behavior of certain animals to the shape of flowers they pollinate - Wikipedia
- Pollinator Syndromes are reflected in the mutualistic match-up of the actions of pollinating animals and the shape of flowers to which they are attracted - US Forest Service
- Dandelions: Holy Parachutes and Asexual Seeds - The Herb Society
- How Aspens Grow - US Forest Service
- Tree Gardening - NY Times
- Host Trees for Butterflies - Butterfly Lady
- Native Trees of GA - UGA Extension

Teams of students will observe trees in the schoolyard and - using their previous research about the shape and functions of flowers as evidence - each team will make a claim about how a selected tree in the schoolyard reproduces (sexually, asexually, or both ways) and, if it reproduces sexually: whether it is pollinated by wind, water, or animals. Each team will also identify at least one animal species that is likely to be found in the schoolyard (insect, bird or mammal) which assists a tree with pollination or seed dispersal. Then they will research the selected species to see if their argument was on target.

Students will select plants that they think may be able to reproduce asexually and design experiments to test their hypotheses. They may use cuttings from trees in the schoolyard, stump sprouts, or fruit and vegetable scraps from the kitchen (other than seeds), to try to propagate a plant asexually. Use this video: Truth or Fiction about Regrowing Kitchen Scraps, to debrief the activity.

High School: Investigating the impact of human population on global ecosystems, and ecological effects of agriculture

Students will use the Jigsaw protocol to research ways that agricultural practices affect pollinators:

- How Pollinators Benefit Agriculture - US Forest Service
- Contribution of Intensive Farming Practices to Loss of Floral Resources for Pollinators - Langlois, Alban, et.al.
- Threats to Pollinators - US Forest Service
- Asexual Reproduction May "Seed" New Agriculture Approach - HHMI
- Diversification in Agricultural Landscapes Affects Pollinators - Frontier
- Reducing Pesticides in Farming Benefits Pollinators - WWF
- How Monoculture Farms Harm Bees
- The Effects of Flower Strips and Hedgerows on Crop Yield and Pollinator Services
- Mounting Evidence that Managed and Introduced Bees Harm Wild Bees

Engineer Character Count: 900

Students will design and use a hand pollination tool that humans can use when the natural pollination process is unsuccessful for some reason (absence of pollinator animal species, lack of wind, etc). This engineering design challenge is described in the Teach Engineering activity: To Pollinate or Not to Pollinate.

Explain Character Count: 900

2nd graders should be able to label a diagram (or narrate a skit) to explain that

- Wind, water and animals assist trees (and other plants) by moving pollen so that it fertilizes flowers.
- Fertilized flowers grow into fruits (containing seeds) or nuts. Seeds and nuts are needed to grow new plants.

7th graders should be able to demonstrate their understanding that:

- Trees and other plants make pollen that is needed to fertilize a flower (or a female cone, in conifer species) in order to form fruits, nuts, and seeds
- Pollen has to be spread (moved) from the place where it is formed to a specific part of the flower, for fertilization
- Wind spreads the pollen of trees like pines and other conifers, as well as grassy plants like corn, barley and rice
- Water spreads the pollen of aquatic plants that live with their roots in water
- Pollinators such as insects, birds, and small animals spread pollen of hardwood trees and other plants with flowers
- Fertilized fruits, nuts, and seeds are needed to make new plants
- Some fruits, nuts, and seeds are eaten by humans or other animals before they have a chance to make new plants
- Animals typically eat entire fruits and poop out the seeds, dispersing (spreading) seeds far from the original location
- Some plants reproduce asexually, creating clones of themselves (and some sexually-reproducing plants can also reproduce vegetatively)

High school students should be able to explain ways in which humans depend on, support, and harm pollinators and the plants on which they depend - especially through agricultural practices.

Environmental Stewardship / PBL Character Count: 900

Annual flowers may come to mind when one thinks of leaves as food sources for caterpillars (butterfly larvae) and nectar sources for adult butterflies: Pollinator-Friendly Native Plant Lists by Region of the US - Xerces Society. But trees are the most prolific supporters of pollinator species. An oak tree alone can support as many as 500 species of pollinators. Students will research trees that support pollinator species before selecting a tree to plant in the schoolyard.

- Native Oaks of the Eastern US - USDA
- American Tulip Tree (Yellow Poplar or Tulip Poplar) - bplant
- Georgia Butterfly Host Plants - Environmental Education Alliance / Monarchs Across Georgia
- 10 Best Trees for Pollinators - video from A Garden for Birds
- Trees for Bees - Arbor Day Foundation
- Tree Gardening - NY Times
- Host Trees for Butterflies - Butterfly Lady
- Native Trees of GA - UGA Extension

Extend Character Count: 900

The 1 hr 20 min full length movie version of Wings of Life, can be streamed on Disney Plus or Apple TV, rented from Google Play for $3.99, or purchased for about $20.

Evaluate Character Count: 900

The student's final explanation should demonstrate growth in knowledge and understanding of trees as hosts for pollinators, pollinator syndrome (through which host plants and pollinators co-evolve to have compatible features), and pollination as a part of sexual reproduction in plants.

Re-Teach Character Count: 900

Students may participate in observing pollinator behavior and contributing data to a community science project. Those in Georgia and the Southeast can join the Great Southeastern Pollinator Census in August, or the Great Sunflower Project in other parts of the country (or on other dates)

How this Lesson incorporates "Gather / Reason / Explain / Act / Teach" or "Obtain / Evaluate / Communicate" framework

Check relevant sections and add a line that describes specific, related lesson activities on the right. Character Count: 144

Gather / Obtain *includes any of the following:*	**Students will gather or obtain data and information by . . .**
☐ Obtaining Information	Answer Here or N/A
☐ Asking Questions/Defining Problems	Answer Here or N/A
☐ Planning & Carrying Out Investigations	Answer Here or N/A
☐ Using Models to Gather Data	Answer Here or N/A

☐ Using Mathematics / Computational Thinking	Answer Here or N/A
Reason / Evaluate *includes any of the following:*	**Students will reason and evaluate data or other info by . . .**
☐ Evaluating Information	Answer Here or N/A
☐ Analyzing Data	Answer Here or N/A
☐ Using Mathematics / Computational Thinking	Answer Here or N/A
☐ Developing Evidence	Answer Here or N/A
☐ Constructing Explanations / Solving Problems	Answer Here or N/A
☐ Using Models to Predict & Develop Evidence	Answer Here or N/A
Explain / Communicate *includes any of the following:*	**Students will explain and communicate by . . .**
☐ Communicating Information	Answer Here or N/A
☐ Arguing from Evidence (written & oral)	Answer Here or N/A
☐ Using Models to Explain or Communicate	Answer Here or N/A
Act	**Students will solve a real-world problem by . . .**
☐ Student-Directed Stewardship Project or Civic Action	Answer Here or N/A
Teach	**Students will share their findings and reflect by** . . .
☐ Presentation of Project to Stakeholders / Reflection	Answer Here or N/A

How this Learning Experience Integrates 3-D Science *The checked elements are integrated in this lesson:*

Science and Engineering Practice	**Crosscutting Concepts**

☐ Asking Questions and Defining Problems
☐ Developing and Using Models
☐ Planning and Carrying Out Investigations
☐ Analyzing and Interpreting Data
☐ Mathematical and Computational Thinking
☐ Constructing Explanations and Designing Solutions
☐ Engaging in Argumentation from Evidence
☐ Obtaining, Evaluating and Communicating Information

☐ Patterns
☐ Cause and Effect
☐ Scale, Proportion and Quantity
☐ Systems and System Models
☐ Energy and Matter
☐ Structure and Function
☐ Stability and Change

Core Ideas

Physical Science
☐ Matter and Its Interactions
☐ Motion and Stability / Forces and Interactions
☐ Energy
☐ Waves and their Applications in Info Transfer

Life Science
☐ Structure and Processes
☐ Ecosystem Interactions, Energy and Dynamics
☐ Heredity, Inheritance and Variations
☐ Biological Evolution, Unity and Diversity

Earth and Space Science
☐ Earth's Place in the Universe
☐ Earth's Systems
☐Earth and Human Activity

Engineering
☐ Engineering Design Process
☐ Links among Engineering, Technology, Science and Society

How this Learning Experience integrates STEM: Character Count: 900
Students engineer a hand pollination device.

What parts of this lesson are suited for Outdoor Learning and why?: Character Count: 900
Students observe trees and the process of pollination in the schoolyard in order to construct arguments from evidence about how specific trees reproduce.

Is there a project or series of which this Lesson is a part?
CoOL Schoolyards Lesson Collection

Is another version of this Lesson available?
Choose yes or no.
No

Lesson Name: Character Count: 144