artsNOW
Integrated learning solutions

PRINTMAKING ECOSYSTEMS: CARRYING CAPACITY AND BIODIVERSITY
Grade Band: 9-12
Content Focus: Visual Arts & Science



LEARNING DESCRIPTION

In this lesson, students will explore how biotic and abiotic factors influence ecosystems, species distribution, and carrying capacity. Through printmaking, students will create a visual representation of species interactions in a chosen biome, considering competition, predation, and resource availability. Each print will contribute to a collaborative class ecosystem model, showing how species coexist and how environmental changes impact populations.

LEARNING TARGETS

Essential Questions	"I Can" Statements
How do biotic and abiotic factors affect the distribution of species in an ecosystem?	I can explain how biotic and abiotic factors influence species distribution and biodiversity.
What is carrying capacity, and how does it influence populations?	I can describe the carrying capacity of an ecosystem and how it limits populations.
How do species interact within an ecosystem (competition, predation, resource availability)?	I can create a print that represents species interactions in an ecosystem.
How can printmaking be used to visually represent complex scientific concepts?	I can analyze how competition and resource availability affect populations.
What happens when an ecosystem's carrying capacity is exceeded?	I can collaborate with my peers to create a visual model of an ecosystem.

GEORGIA STANDARDS

Curriculum Standards	Arts Standards
Ecology: SEC1 Obtain, evaluate, and communicate information on how biotic and abiotic factors interact to influence the distribution of species and the diversity of life on Earth. a. Develop a model describing the organizational structure of a habitat within an ecosystem. Ask questions to gather and synthesize information from multiple sources to differentiate between Earth's major terrestrial biomes (i.e., tropical rainforest, savanna, temperate forest, desert, grassland, taiga, and tundra) and aquatic ecosystems (i.e., freshwater, estuaries, and marine). **Biology:** SB5 Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. **Environmental Science:** SEV1.a Develop and use a model to compare and analyze the levels of biological organization including organisms, populations, communities, ecosystems, and biosphere.	VAHSVA.CR.1.a Generate and conceptualize artistic ideas and work. VAHSVA.CR.1.b Consider multiple options, weighing consequences, and assessing results.

SOUTH CAROLINA STANDARDS

Curriculum Standards	Arts Standards
Biology: B-LS2-1. Use mathematical and/or computational representations to support explanations of biotic and abiotic factors that affect carrying capacity of ecosystems at different scales. B-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.	**Anchor Standard 1:** I can use the elements and principles of art to create artwork. **Anchor Standard 2:** I can use different materials, techniques, and processes to make art. **Anchor Standard 7:** I can relate visual arts ideas to other arts disciplines, content areas, and careers.

KEY VOCABULARY

Content Vocabulary	Arts Vocabulary
• Carrying capacity – The maximum number of organisms an ecosystem	• Printmaking – The art or technique of making prints, especially as practiced in

can support • Biotic factors – Living components of an ecosystem (plants, animals, fungi) • Abiotic factors – Nonliving components of an ecosystem (water, temperature, soil) • Biodiversity – The variety of life in an ecosystem • Predation – A biological interaction where one organism feeds on another • Competition – Organisms competing for limited resources	engraving, etching, dry point, woodcut or serigraphy • Relief print – A printmaking technique in which a design is carved into a material and inked for printing • Brayer – A small roller for inking type by hand, usually for making a proof • Composition – How an artist arranges the Elements of Art (line, shape, form, value, color, space, texture) to create an artwork • Contrast – The arrangement of opposite elements in a composition (light vs. dark, rough vs. smooth, etc.) Similar to **variety**, which refers to the differences in a work, achieved by using different shapes, textures, colors and values

MATERIALS

- Sketchbooks or STEAM journals/pencils
- Styrofoam sheets
- Dull pencils or ball point pens
- Brayers
- Water based printing ink
- Printing paper (white, colored, textured; mixed media paper works well)
- Colored pencils or art sticks
- Drying racks or designated drying space
- Paper towels to wipe ink off of styrofoam plates
- Colored index cards
- Trays for ink
- Optional: Colored pencils. art sticks, watercolors and paint brushes, etc.

INSTRUCTIONAL DESIGN

Opening/Activating Strategy

Activator: The "Survival Game"

- Objective: Help students understand carrying capacity and competition for resources.
- Activity instructions:
  - Set the scene:
    - Tell students they are deer living in a forest. The classroom represents their habitat.
    - They must "find food" (colored index cards scattered around the room).
  - Rules:
    - When the teacher says "Go", students must pick up only one card at a time and bring it back to their seat.
    - After each round, some students will be "eliminated" (didn't find food).
    - Increase competition by adding/removing "food" cards in each round.

        - Introduce a "predator" (teacher or student) who can "tag" students (eliminating them from the population).
    - Reflection: Discuss what happens to the population when resources become scarce or competition increases.
- Connect to lesson: This game simulates carrying capacity—when resources run out, populations decline.
    - Ask students, “How does this apply to real ecosystems?”. Transition into a class discussion about biotic and abiotic factors that influence populations.

Discussion Questions:

1. What factors determine how many organisms an ecosystem can support?
2. How do species interact in ecosystems (predation, competition, symbiosis)?
3. What happens when a species population grows too large?

Work Session

Research & Brainstorm:

- As a class, students will choose one of Earth’s major biomes or aquatic ecosystems:
    - Tropical Rainforest
    - Desert
    - Grassland
    - Taiga
    - Tundra
    - Freshwater
    - Estuary
    - Marine
- Students will research the biotic and abiotic factors in their chosen biome.
- Students will then sketch a food web/chain with at least:
    - One producer (plant)
    - Two primary consumers (herbivores)
    - One predator
    - One decomposer
- Before students begin their printmaking, they will complete a short written response:
    - What biome did you choose?
    - Which biotic and abiotic factors did you include?
    - How will your print show interactions in the ecosystem?

Give students the following instructions to create their prints:

- **Create a Printing Plate:**
    - Choose one species from your ecosystem and sketch it on paper.
    - Use a dull pencil or ballpoint pen to carve design into the foam—press firmly but avoid puncturing all the way through.
    - Encourage students to sketch lightly first before carving to avoid mistakes.
    - Add textural details to represent how the species interacts with the ecosystem.
- **Carving Techniques:**
    - Keep lines simple and bold for clear prints; intricate details may not transfer well.
    - Reverse letters or numbers if including text, as prints will be a mirror image.
    - Vary line thickness for added depth—thicker lines hold more ink, while thinner lines create subtle details.
- **Inking the Plate:**
    - Roll out a thin, even layer of ink on a tray before applying to the styrofoam plate with a brayer.

- Roll the inked brayer over the styrofoam plate. Make sure ink covers the entire design, but avoid excessive ink, which can cause smudging.
- Test prints on scrap paper before making the final print.

- **Printing Process:**
  - Place the inked plate face down on the final paper and press evenly with hands or a clean brayer.
  - Avoid shifting or sliding the plate while printing to prevent smudging.
  - Lift the plate carefully to reveal the design.
  - Encourage students to appreciate the imperfections as part of the artistic process!
- **Creative Enhancements:**
  - Try different colors – Experiment with layering multiple prints in different colors.
  - Overlap prints – Print the same design multiple times on one page to create patterns.
  - Use mixed media – Combine printmaking with drawing, collage, or watercolor backgrounds for unique effects.

Collaborative Ecosystem Model:

- Assemble a class biome display:
  - Each student's print represents one species in the biome.
  - Arrange prints based on interactions (e.g., predator near prey, plants near decomposers, etc.).
  - Use labels or speech bubbles to explain each species' role in the ecosystem.

Closing/Reflection

- Facilitate a discussion around the following questions:
  - How does your species interact with others in the ecosystem?
  - What factors affect the ecosystem's population size (predation, competition, disease, etc.)?
  - How does your print visually represent the species' role?
  - What happens when the carrying capacity is exceeded in this biome?
- Students will complete a short reflection (written or through video) explaining:
  - What biotic and abiotic factors are represented in your collaborative ecosystem model?
  - How does your print demonstrate carrying capacity, competition, or species interactions?
  - What challenges did you face in printmaking, and how did you overcome them?

ASSESSMENTS

Formative

Think-Pair-Share (during brainstorming)

- After students sketch their food web or ecosystem interactions, students will pair up and explain their choices.
- Teacher circulates to assess understanding of content and the printmaking process.

Mini-Checkpoint Questions (before printing)

- Before students carve their print, they must complete a short written response:
  - What biome did you choose?
  - Which biotic and abiotic factors did you include?
  - How will your print show interactions in the ecosystem?

Summative

Final Print and Reflection (Written or Video)

- Students will create a short reflection explaining:
    - What biotic and abiotic factors are represented in your collaborative ecosystem model?
    - How does your print demonstrate carrying capacity, competition, or species interactions?
    - What challenges did you face in printmaking, and how did you overcome them?

DIFFERENTIATION

Accelerated:

- Create multi-layered prints with multiple species interacting.
- Research and add how climate change affects the chosen biome.
- Create a digital ecosystem infographic.
    - Using Canva, Google Slides, or Adobe Express, students can create a digital infographic explaining the ecosystem they represented.
    - It must include:
        - Their print
        - Key species and roles
        - A description of carrying capacity

Remedial:

- Provide visual examples for reference.
- Allow students to present their reflections orally.

ADDITIONAL RESOURCES

Virtual Field Trip

- Use Google Earth or National Geographic's Explorer Classroom to explore different biomes. Students can take notes on species and environmental factors.
- What Is Printmaking? The Met
- Printmaking - Tate Museum

This integrated lesson provides differentiated ideas and activities for educators that are aligned to a sampling of standards. Standards referenced at the time of publishing may differ based on each state's adoption of new standards.

Ideas contributed by: Shannon Green

Revised and copyright: May 2025 @ ArtsNOW