④ ANALYZING A BLACK BEAR'S MOVEMENT

Through a story, maps, and biologist Joseph Guthrie's explanations in short videos, students track the path of a black bear known as "M34." Students develop an argument explaining the factors affecting M34's movement through different environments and provide supporting evidence for their claim. Students then present, defend, and evaluate one another's arguments. Throughout the activity, students gain insights into technologies and techniques that researchers like Guthrie use to track bears and other wildlife.

ESTIMATED TOTAL TIME

100 minutes

► **Grades 6–8 Life Science**
► **Geography and Technology Connections**

KEY TERMS
► **deforestation**
► **ecosystem**
► **limiting factor**
► **migration**
► **urbanization**

See the glossary on page 44 for definitions.

BACKGROUND

The story of black bear M34 became an inspiration for land and habitat conservation in Florida. This bear's story also reveals how biologists answer questions of black bear movement and the factors affecting that movement. **Limiting factors** in ecology are elements that restrain the growth, distribution, or abundance of an organism's population within an **ecosystem**. The availability of food, water, and space can all impact wildlife populations, as can disease, predation, or parasitism. With the story of the tracking of M34, biologists were

able to illustrate how human actions including deforestation and urbanization impacted one black bear over several months in Florida. The study of M34 provided insights into wildlife behavior and the need for land conservation.

When shelter, food, or water is scarce, black bears may need to roam far and wide to find these resources. Land development, however, has changed and fragmented the space in which these and other animals can safely roam. **Wildlife corridors**, such as the Florida Wildlife

Corridor, can help animals more safely move across large landscapes to access the resources they need. Wildlife corridors directly address and mitigate many of the factors impacting black bear movement. By providing continuous pathways between fragmented habitats, these corridors offer black bears the opportunity to access food, space, mates, suitable habitats, and safe migration routes, supporting their movement and, ultimately, overall population health.

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OBJECTIVES

Students will:
- analyze the movement over time and space of a black bear; and
- develop, find evidence for, and justify a claim about the factors influencing the bear's movement.

PREPARATION

Gather and/or print materials:
- Video: Exploring with GIS: Tracking Black Bears (7:54)
- Handout: A Black Bear's Movement: Develop an Argument (1 per small group)
- Online Resource: Bear Necessities StoryMap, or Handout: Story Line for Path of a Black Bear
- Handout: Evaluation: Black Bear M34 Arguments (1 per student)
- Large chart paper
- Markers

Set up technology:
- Ideally, students in small groups will be able to access the Bear Necessities StoryMap online. If computer access is limited, students can use the Path of a Black Bear handout, reading independently or in small groups. Preview the StoryMap or the reading to determine whether or not students will need vocabulary support.
- Plan whether students will present Part 2 as a slide presentation or as a poster on large chart paper.

PART 1: 50 MIN

15 MIN   INTRODUCE THE TASK

1. Give students a few minutes to talk about what they know about black bears, including whether they have ever seen a black bear in a zoo or in the wild. Have them describe behaviors they observed and anything surprising.

2. Tell students that they will be following the path of a Florida black bear to analyze its movement and the **limiting factors** affecting its movement. Discuss with students how limited resources can impact the movement of an animal, while a limiting factor is anything that constrains a **population's size** and slows or stops it from growing.

3. Students will also learn about techniques biologists use to track wildlife. Introduce Dr. Rae Wynn-Grant—one scientist who has made a career studying black bears—through a video about her work. Preview these questions to answer as they watch:

   - *What is a GPS collar? Why does Dr. Wynn-Grant use GPS collars to study black bears?* (She can track a bear's movement every couple of hours for 1–2 years.)

   - *What has her research revealed about bear movement?* (Some bears range widely, while others stay mostly in one small area.)

   - *What is the main reason Dr. Wynn-Grant believes bears are getting closer to cities rather than staying in areas without people?* (They are looking for food.)

   Show the video "Exploring with GIS: Tracking Black Bears" and discuss students' answers to the questions.

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4. Explain that students will explore the path of a 2.5 year old black bear known as "M34" who was tracked for nine months by different scientists as it moved around central Florida. Help students shift their thinking from the human perspective to the bear's perspective by asking for students' ideas:

   • *What do you think a black bear needs to survive?*

   • *What might have prompted M34 to move around?*

   • *Why might movement from place to place in Florida be a challenge for black bear M34?*

   Explain that these questions are similar to the research questions of the team of biologists, including Joe Guthrie, that tracked M34. (Students will see Joe Guthrie in videos.) Guide students to consider the impacts humans have had on wildlife habitats (through, for example, **deforestation** and **urbanization**) that would impact the movement of a bear. Explain to students that they will follow the path of this one bear scientists tracked with a GPS collar, so they may better understand how human activities have impacted bear populations and the availability of resources that bears need to survive and thrive.

35 MIN EXPLORE THE PATH OF A BLACK BEAR AND DEVELOP A CLAIM

5. Divide the class into small groups and distribute one A Black Bear's Movement: Develop an Argument handout per small group. Review the task and guiding question.

6. Show students how to navigate through the Bear Necessities StoryMap—reading the text, looking at the maps, and taking notes as they go in Step 1 of the handout. Consider having students pause as they reach each video; you may want to watch those together as a class before moving on.

7. Before students begin, point out the first example in the data table in Step 1. Note that the first row has been completed based on the first section of the StoryMap.

8. To help students consider the importance of the notes they take, explain that they will use these notes as evidence in Step 3. Also, preview together Step 2, where students will select one factor impacting M34's movement that they are able to support with evidence. Review these definitions if needed:

   • **Claim:** their answer to the guiding question

   • **Evidence:** data (measurements or observations) they collected; an analysis of the data

   • **Justification:** reasoning that involves a rule or scientific principle that describes why the evidence supports the claim

9. Have students begin navigating the StoryMap and completing Step 1 as they go, pausing to watch each video together as a class. Provide ample time for students to complete Steps 2–4 where they develop their claim, use evidence from Step 3 to support their claim, and justify it. Note that as students consider a scientific concept as part of their justification, you can refer them back to what they have learned about limiting factors. (They may come to this conclusion without prompting.)

MORE TO EXPLORE

BEAR SAFETY
Talk about human encounters with American black bears. Ask: *What should you do if you encounter a black bear?* Invite volunteers to share their ideas and record them on the board. These bear safety guidelines from the National Park Service will help with clarifying or expanding responses. Explain that black bears generally prefer to avoid human contact. Understanding their behavior and these guidelines can help to ensure a safe experience for both humans and bears.

GET CREATIVE
Incorporate creative writing to reinforce and deepen students' understanding of what they've learned about bear range and movement. Give students an opportunity to reflect on M34's travels and then write poetry or a short story, such as "If I Were a Black Bear…"

MAKE CONNECTIONS
Exploring animal migrations is an ideal way for students to discover intersections of geography, ecology, and biology, as well as human interactions, impacts, and interventions. Have students research the movement or migration patterns of a variety of terrestrial and marine animals and compare these with what they learned about the path of M34. Find more ideas from National Geographic here.

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PART 2: 50 MIN

10 MIN **CREATE A PRESENTATION**

1. Have small groups create a presentation slide(s) or a poster on chart paper of their argument, including the guiding question, claim, evidence, and justification of evidence.

2. Have small groups practice presenting within their group.

25 MIN **PREPARE AND PRESENT**

3. Give small groups 5 minutes to meet with their group and prepare to present. Distribute copies of the Evaluation: Black Bear M34 Arguments handout to each student. Assign each group a number and have them mark it at the top left of their presentation slide or poster, so that students can include it in their group evaluations.

4. Give each small group about 3 minutes to present, followed by brief time for students to independently complete the Evaluation: Black Bear M34 Arguments handout before the next presentation.

15 MIN **HAVE A WHOLE-CLASS DISCUSSION**

5. Have students return to their small group to discuss their insights from the other presentations. Explain to students that scientific knowledge can change when new evidence is introduced. Ask: *Based on the new information, has anyone changed their opinion? Invite volunteers to explain what caused them to change.* Then ask: *Is it possible that there are multiple answers?* If students say yes, have them give evidence that supports this claim. They should realize that there isn't one answer, as multiple factors have influenced the black bears' movements, and new research over time may also change scientists' understanding.

6. Help students synthesize new learning about limiting factors and human actions. Ask: *How might limiting factors impact a population's movement patterns? What can humans do to reduce the effects of some of these limiting factors?*