SOUND SCIENCE: BASICS OF BIOACOUSTICS - LESSON PLAN

Please visit www.conservationnation.org/lessons for complete lesson materials including the lesson video, worksheets, and vocabulary list.

GRADES

5-8

TIME REQUIRED

One 45-minute class period. Lesson can be expanded to two class periods with increased discussion time and utilization of the optional activities.

SUMMARY

In this lesson, students are introduced to bioacoustics, the science of using sound to study the living world. Through engaging video content and guided discussion, students learn how animals use sound to communicate and how scientists use those sounds to understand behavior, monitor wildlife, and protect ecosystems.

Students apply these concepts through a hands-on Sound Map activity, where they listen closely in two different environments, such as their classroom and an outdoor space, to identify and map both natural and human-made sounds. By comparing their sound maps, students analyze patterns, consider how sound reveals information about a place, and begin to think like scientists collecting real-world data. The experience builds observation skills, critical thinking, and a deeper appreciation for how listening can unlock insights about the natural world and support conservation.

OBJECTIVES

Students will be able to:

- Explain what bioacoustics is and how scientists use sound to study animals
- Describe how animals use sound to communicate, including what information vocalizations can convey
- Identify tools scientists use to collect sound data, such as Autonomous Recording Units (ARUs)
- Analyze how studying animal sounds can reveal patterns in behavior and ecosystems
- Describe how bioacoustics supports conservation efforts and helps protect wildlife

- Connect scientific research to real-world careers, including how scientists use technology and fieldwork together
- Practice active listening and observation, and distinguish between natural and human made sounds

MATERIALS

Available at www.conservationnation.org/lessons

- Pre-read article: Bioacoustics: What Nature's Sounds Can Tell Us About The Health of Our World (available at the link or to print in the lesson materials)
- Sound Science: Basics of Bioacoustics video (available at www.conservationnation.org/lessons)
- Vocabulary list
- Nature soundscape recording for Sound Map activity: https://youtu.be/E7byvKAJHGU?si=qFEYsmMpNYcN91jU
- A blank piece of paper or index card
- Student worksheet
    - Sound Map Activity Worksheet
    - Dream Big Career Reflection Worksheet (Optional)

NEXT GENERATION SCIENCE STANDARDS

- **MS-LSI-4:** Use argument based on empirical evidence to support an explanation for how characteristic animal behaviors increase the probability of survival and reproduction.
- **MS-LS2-1:** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations.
- **MS-LS2-2:** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- M**S-ETS1-2:** Evaluate competing design solutions using a systematic process to determine how well they meet criteria and constraints.
- **MS-ETS1-4:** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process.

INSTRUCTIONS

1. **Introduction – 1 minute**
    a. Briefly explain that the lesson will provide students with the opportunity to explore bioacoustics, the science of using sound to understand how animals communicate and survive, and how scientists use those sounds to study and protect the natural world. You'll then step into the role of a scientist by creating your own sound maps, listening closely to your environment to uncover patterns and hidden information in the sounds around you.

2. **Watch the video – 15 minutes (including discussion and reflection)**
    a. Play the *Sound Science: Basics of Bioacoustics* video. Stop at the time of codes listed below to conduct brief class discussions and answer questions on screen.
    b. **03.15**: Group discussion question – If certain sounds or 'instruments' disappear from a natural soundscape, what might that tell scientists about what's happening in that ecosystem?
    c. **05.45:** Pair or small group discussion –If whales have to change how they communicate because of noise, how might that affect their behavior over time?
    d. **07.33:** Group discussion – Why might animals communicate less in disturbed environments? What does this tell us about these ecosystems?
    e. **08.56:** Pair or small group discussion –Why would it be important for animals like elephants that travel long distances to use low-frequency sounds instead of high-frequency ones?
    f. **10.50:** Group discussion – If you collected sound data in your neighborhood over time, what patterns might you expect to see — and what could cause those patterns to change?
    g. **11.33:** Additional footage: More information about Dr. Joanna Lambert

3. **Class Discussion – 5 minutes**
    a. **Ask**: What do you think a sound map is?
    b. After taking a few answers, Introduce the idea of a **sound map** and write the definition on the board: *"A sound map is a simple way of noticing and documenting sounds in a local area by drawing or labelling them on a blank card."* Note that scientists use sound maps to visualize, analyze, and monitor environments by mapping acoustic data, often for ocean floor mapping, wildlife monitoring, and assessing human-induced noise

levels.

4. **Sound Map Activity – 20 minutes**
   a. Distribute printed worksheets or project the worksheet for students to work on individually (see Sound Map worksheet).
   b. Students will need a blank sheet of paper, a notebook, or an index card for the activity.
   c. Review the instructions with students.
      - Students will create two sound maps. The idea is to sit quietly and concentrate for 3-4 minutes and record the sounds you hear. Be as creative as you'd like, but there are a few requirements.
        - Include yourself in the center of the sound map
        - Write or draw the things making the sounds you hear (car, bird, person, etc.)
        - Indicate through size, arrows, or distance from you (or another way), how loud/quiet and near/far the sound is
        - Indicate if the sound is natural or man made

   d. NOTE: There are two options to complete the worksheet. In both options, students must create a sound map in two locations.
   e. Option 1 has students create one sound map in the classroom and one sound map outside. Option 2 allows students to stay indoors for both sound maps. The first can be created in or around the classroom. The second will be when the students listen to an audio recording played in the classroom. Found here: https://youtu.be/E7byvKAJHGU?si=qFEYsmMpNYcN91jU
   f. After students complete both sound maps, ask a few volunteers to share their sound maps with the class.
   g. Discuss the following questions as a class or divide students into small groups to discuss and report back to the larger class.
      - How were your two sound maps different?
      - What clues would tell you you're in a different environment?
      - Where did you hear more natural sounds? Why?
      - Where did you hear more human-made sounds?
      - Which environment was **louder? quieter? more complex?**
      - What might these sound differences tell scientists about each place?

END OF MAIN LESSON WITH ADDITIONAL ACTIVITIES ON THE NEXT PAGE

ADDITIONAL ACTIVITIES

Select one or more activities below to conduct in a separate class period to explore the social, emotional learning around "Sound Science: Basics of Bioacoustics."

5. **Reflection – 20 minutes**
    a. What sounds do you notice in your everyday environment that you normally ignore? Why do you think we often stop paying attention to the world around us?
    b. Dr. Lambert says, "The question is whether we are listening closely enough to understand." What does being a good listener mean to you—not just in nature, but in your relationships with others?
    c. Why is it important to recognize that animals communicate, form relationships, and respond emotionally to their environments?
    d. Chimpanzees become quieter when their habitats are disturbed. What does this teach us about how stress or change can affect communication in both animals and humans?
    e. How can listening carefully—to people, communities, and nature—make someone a better leader?
    f. What is one action you could take to become more aware of the natural world around you?
    g. If you were a bioacoustics scientist, what sounds or animals would you want to study and why?

6. **Dream Big – Exploring Your Future – 15 minutes**
    In the "Sound Science: Basics of Bioacoustics" video, students meet two people who found their passion working in nature. This worksheet helps students connect what they learned in the video to real conservation careers. By reflecting on the work of Taylor and Joanna, and even the videographer, students identify the skills used in green careers, imagine themselves in similar roles, and explore their own future career possibilities. Complete the worksheet (or use a notebook to record answers to worksheet questions) to explore self-reflection, creativity, and goal setting while showing how passion for wildlife can grow into meaningful work.

LEARN MORE

If you would like to dive deeper into the world of bioacoustics and what we've learned from studying animal communication, check out some of the following resources:

- Picking Up Good Vibrations for Elephant Conservation. Cornell University. This article on Cornell's Elephant Listening Project shows how researchers are using sound recorders to monitor and learn more about the behavior of forest elephants in Central Africa.
- Global Library of Underwater Biological Sounds (GLUBS): This open-access platform, initiated by the International Quiet Ocean Experiment (IQOE), acts as a central hub for identifying and documenting underwater sounds to aid in marine conservation and biodiversity research.
- NPR: Sperm Whales Make Sounds Like Human Vowels: (2 mins) Researchers analyzed 3,948 codas and found that sperm whales produce vowel-like structures ("a-codas" and "i-codas") within their coda clicks. The clicks are not random and exhibit a structure similar to humans.
- How Noise Pollution Threatens Ocean Life. (10 mins) The Economist. Noise pollution has led to multiple whale-strandings and poses a threat to thousands of ocean creatures. Meet the scientist who is mapping ocean noise in a bid to dial down the volume

MEET YOUR HOSTS

Taylor Rabe is a former fellow and now Education and Engagement Facilitator with the Washington DC-based non-profit, Conservation Nation. She is also a wildlife technician with the Yellowstone Wolf Project. She spends her days radio tracking and observing radio-collared wolves, while also sharing her knowledge, spotting scope, and sightings with the millions of visitors to Yellow National Park. Her main priority is education and helping inspire the next generation of conservationists.

Dr. Joanna Lambert is a professor in the Department of Environmental Studies at the University of Colorado – Boulder (CU). Joanna has spent her career publishing and teaching about evolution, ecology, and the critical conservation issues impacting wildlife interactions and adaptation. Previous to her position at CU, Joanna was a professor at University of Texas, a visiting professor at Duke University, an associate professor at the University of Wisconsin – Madison, an assistant professor at the University of Oregon, and Program Director at the *National Science Foundation*. She is also a Master Instructor at the Yellowstone Institute, teaching field seminars at the historical Lamar Buffalo Ranch in Yellowstone National Park.

We hope you enjoyed this lesson!
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www.conservationnation.org