Creating Sustainable School and Home Gardens: **Wildlife Monitoring Using Bioacoustics**

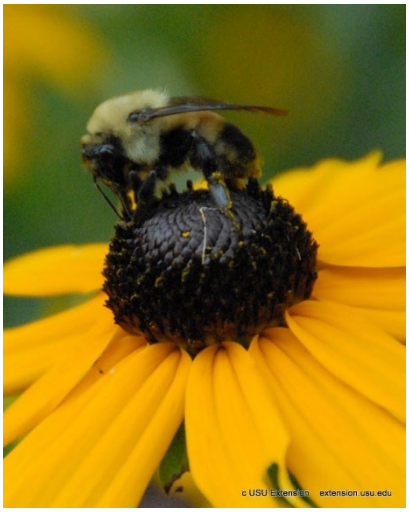
Kaitlin Campbell, Rita Hagevik, and Kathy Cabe Trundle

How It Works

Chirps, cheeps, and croaks! Animals use sounds to communicate with each other, just like humans. Humans can listen in on animals by using a **bioacoustic monitoring device**, a passive device that quietly records surrounding sounds. Bioacoustic monitoring devices blend in with the environment, allowing us to know what types of animals appear when we're gone. The device collects and stores data and allows us to visualize, analyze, and identify animals from the sounds they make.

Selecting a Device

- **Frequencies.** Consider the frequencies required for the animals you want to hear. If you can hear it with your ear, then an acoustic recorder is fine for you. If you want to hear bats, for example, or anything above 20 kHz, then you will need an ultrasonic recorder.
- **Microphone.** Check the microphone on the device. Consider how loud the animal vocalizes. For quieter sounds like bees, for example, place the device closer to where you expect to observe them. If you are recording ultrasonic sounds, be sure noisy objects are not around blocking sound to your device.
- **Environment.** Are you recording in a rainy, humid environment? Ensure your device is waterproof. Remember that rainy, foggy, and humid conditions may affect your ability to detect sounds at a distance.



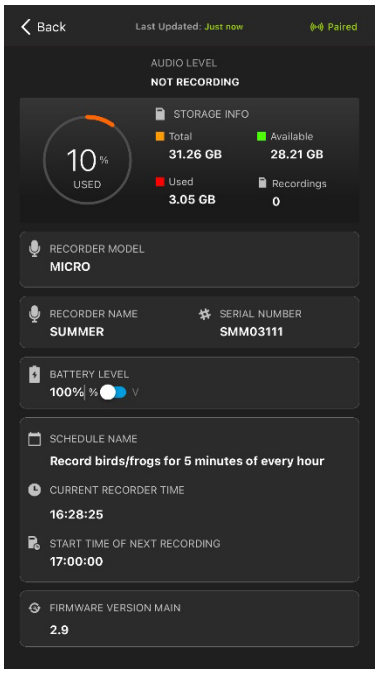
Imagine listening to the sounds of a bee gathering nectar!

How and Where to Install a Device

Select a bioacoustics device with needed frequencies for wildlife in your area and carefully place it in your garden.

Locate your bioacoustics device in the shade and away from busy roads or wind.

- Configure your bioacoustics device to record shorter or longer sound clips, depending on your needs. Many devices allow options for recording every hour for a few minutes. This is a good option to sample various sounds in the ecosystem.
- Keep in mind that some birds and insects only sing during particular times of day. If you want to document wide diversity, set your system to recording intervals throughout the day rather than just once a day.
- Tie your device with a rope or use screws to secure it where you desire, though not too tightly. The plastic is fragile and tightening it too much can cause damage.
- Be careful not to place it near a building or noisy human-made objects like a heating and air unit or busy road. Remember, louder noises will drown out softer sounds.
- If it is windy where you are recording, place your device downwind or try to block the wind using a windscreen.
- Ultraviolet (UV) light and heat can affect audio recorders, so try not to place them in direct sunlight, especially in warm temperatures. In colder temperatures, consider placing them where they will warm up or bring them inside if it will be especially cold. Most recorders are fine in below-zero weather to a certain point. Check your device for its temperature range.
- Set up your bioacoustic device and run a trial first to make sure you are recording what you want to hear! Consider running some initial pilot surveys.



This image shows an example of setting your bioacoustic device's recording schedule.

After Collecting Data

- After collecting the desired data, transfer the SD card to a computer and copy the data to the computer.
- Most monitoring systems collect data as **.wav** files that can be reviewed on most computer systems. If the file size is too big, convert the data to MP3 files for optimal storage.
- Data can be further analyzed using the software that accompanies the device or other online programs. These programs analyze spectrograms (visualizations of sound). See the Resources section for links to examples.
- Sound graphs can be used when teaching about physics, math, biodiversity, and nature observations.

Maintenance

- Replace the batteries when needed, which is at around 180 hours (unless it's being used constantly).
- Insert a silica gel desiccant packet (included) to reduce moisture inside the case.
- Avoid contact with insect repellants; the DEET chemical corrodes the rubber ring protecting the inside contents.

Remember to change the batteries when they run low.

Fun Facts

- Our human ears are so limited to what we can hear and discern, but with bioacoustics monitoring, we can hear so much more!
- Bioacoustics allow us to discover the diversity of insects and animals in areas we would like to know more about.
- With bioacoustics we can see different animal sound frequencies without being able to hear them; it's like x-ray vision, but for sounds.
- Not only can bioacoustics be used in woods and gardens, but when used underwater, you can listen to the sounds of the ocean.
- Many birds look almost identical to us, but they have distinct songs, allowing them to find their own species.
- The snowy tree cricket's song changes depending on the temperature. Counting the number of chirps in 13 seconds and then adding 40 will yield the temperature in Fahrenheit. For more information, see Snowy Tree Cricket from the Songs of Insects website.

Resources

Cornell Lab of Ornithology, Cornell University

- K. Lisa Yang Center for Conservation Bioacoustics
- Merlin, a free app that identifies birds and their songs using artificial intelligence.
- eBird, a citizen science project that documents birds around the world and maintains a birdsong database.

Research

- NOAA Fisheries (2024, September 3). *Ocean noise.* https://www.fisheries.noaa.gov/national/science-data/ocean-noise.
  Humans produce significant noise that can affect wildlife, including those living in the ocean.
- Welz, A. (2019, November 5). *Listening to nature: The emerging field of bioacoustics*. Yale Environment 360. https://e360.yale.edu/features/listening-to-nature-the-emerging-field-of-bioacoustics.
  This online magazine covers global environmental issues.

The goldfinch lives in forests, plains, backyards, and parks across North America.

- Bioacoustics – the International Journal of Animal Sound and Its Recording.
  This scientific journal focuses on bioacoustics.

Insect Sounds and Spectrograms

- Songs of Insects, a great resource for insect sounds (crickets, katydids, cicadas etc.).
- Avian Vocal Behavior- Sound Visualizations, showing videos from the Cornell Lab Bird Academy showing examples of birdsong frequencies.
- Spectrogram examples handout, Colleen McLinn, Cornell Lab's Celebrate Urban Birds (CUBS) program.

References

- Madhusudhana, S., Pavan, G., Miller. L. A., Gannon, W. L., Hawkins, A., Erbe, C., Hamel, J. A., & Thomas, J. A. (2022). Choosing equipment for animal bioacoustic research. In Erbe, C., Thomas, J.A. (Eds.), Exploring animal behavior through sound: Volume 1 (pp. 37–85). Springer. https://doi.org/10.1007/978-3-030-97540-1_2
- Morgan, E., & Ansberry, K. (2014, February). Teaching through trade books: The science and technology of sound. *Science and Children.*

Acknowledgments

Smart Foodscapes (usu.edu/smart-foodscapes)
Learn more by scanning the QR code.

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