beetles
Science and Teaching for Field Instructors

Ecosystems Theme Field Experience Script (2–3 Hours)

Note: This field experience write-up includes parts that are the same as the *Ecosystems and Matter Theme Field Experience Script (3–6Hours)*. Print this 2–3 hour script and carry it with you as you lead this field experience.

Note: For Ecosystems (and Matter): Introduction, Ecosystems (and Matter): Instructor Support, full write-up of *Ecosystems Theme Field Experience Script (2–3 Hours)*, and full write-up of *Ecosystems and Matter Theme Field Experience Script (3–6 Hours)*, see: http://beetlesproject.org/resources/for-field-instructors/ecosystems-matter-theme-field-experience

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

Ecosystems Theme Field Experience Script (2–3 Hours)

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MATERIALS AND PREPARATION

MATERIALS

For the instructor

- 1 manila folder, large sheet of paper, or portable whiteboard
- marker, large

For each student

- journal
- pen or pencil

PREPARATION

1. **Print this script to carry with you as you lead the field experience.**
2. **Prepare definition of *ecosystem*.** On a manila folder, large sheet of paper, or the whiteboard, write "ecosystem = all the living and nonliving things that interact with each other in a particular environment."
3. **Make a copy of the *Systems and System Models* crosscutting concept poster.** (Print a free copy at: https://johnmuirlaws.com/product/crosscutting-concept-poster)
4. **Read individual BEETLES activity write-ups, gather other materials you will need for these, and print the Field Cards.** Each BEETLES activity referenced in this theme field experience includes a list of materials and preparation steps, as well as an Instructor Support section that outlines key concepts and content knowledge. At the beginning of each section in this theme field experience, links to the activity write-ups are included. Read each individual activity write-up and print a copy of the Field Card from each activity to carry with you in the field.

Introduction (~25–40 minutes)

You are What You Eat Name Game (~5 minutes)

Note: See the BEETLES *You Are What You Eat* activity write-up to lead this activity (http://beetlesproject.org/resources/for-field-instructors/youarewhatyoueat/).

Thought Swap (formerly known as *Walk & Talk*) (~5 minutes)

Note: See the BEETLES *Thought Swap* (formerly known as *Walk & Talk*) activity write-up to lead this activity.(http://beetlesproject.org/resources/for-field-instructors/walk-and-talk/).

1. **Introduce the *Thought Swap* routine.** Introduce *Thought Swap* as described in the BEETLES student activity write-up.
2. **Lead *Thought Swap* as you move to your trailhead or first activity site.** Use some of the following questions as an Invitation to the field experience theme. This will help students access their prior knowledge about how organisms interact in an ecosystem.
   - *Find out as many ways as you can that you and your partner are connected. Are you connected through music, activities, interests, people you know?*
   - *Look around. What are the organisms (living things) you see? What about nonliving things?*
   - *How might those things be connected with one another?*
   - *Look at that [stump/tree/bush]. Discuss as many ways you can think of that other organisms might use that [stump/tree/bush] to survive.*
   - *What would different kinds of organisms need to survive in this ecosystem?*
   - *What organisms do you think live here that we can't see?*
   - *How do organisms interact with the human-made things that are here, such as the cars, buildings, viewing decks, garbage cans, etc.?*
   - *How do the human-built things here affect organisms—positively, negatively, or both? Do they affect all organisms the same way, or do they affect some organisms positively and some negatively? Explain why you think so.*

Introduction to Ecosystems Theme (~15 minutes)

1. **Explain that there are amazing, interesting things everywhere, if we pay attention.**
2. **Tell students to look around from where they're standing, notice the organisms (living things) that surround them everywhere, and describe one to a partner.**
   a. Look around! There are amazing, interesting things everywhere!
   b. Take a moment to notice some of those things with a partner and describe one thing to a partner.

TEACHING NOTES

Beginning your day. Begin the field experience with your preferred practices for tone-setting, checking in with students, and preparing logistically for the day.

Starting with *Thought Swap* (formerly known as *Walk & Talk*). Starting with this routine supports social engagement, teamwork, and inclusion and establishes a group learning culture of discussion. Once students know the structure, they can drop into the routine easily throughout the rest of the day (as is suggested in this write-up). If it's a very short walk between activity sites, though, just arrange students in pairs and tell them to discuss questions with that one partner. Younger students can struggle with the rotation procedure, so try just pairing them without the rotation.

Keep it moving. Keep this introduction to the theme fairly brief and fast-paced. The point is not to tell students everything about ecosystems, but to give them a frame for the activities to come.

TEACHING NOTES

3. **Tell students they will get to explore the surrounding area and ecosystem, much like scientists would.**

4. **Hold up the card with the definition of *ecosystem* and read it out loud to students.**

5. **Explain that the theme for the day is ecosystems and tell students that their goal is to learn as much as they can about how the ecosystem works:**
   a. We're going to learn as much as we can about this ecosystem.
   b. We'll do that by exploring and observing parts of the ecosystem and then thinking about how those parts interact with and impact one another.
   c. You'll get close up and make observations of organisms so we can figure out what lives here.
   d. It means that we're going to have to do some detective work, looking for evidence of organisms interacting with one another and with the environment.
   e. It also means that we're going to have to work as a team, sharing observations and ideas so we can all learn together.

Getting kids pumped. The idea of exploring and making discoveries about how things work can be exciting for students. Use it to get them pumped up to start the theme field experience.

6. **Explain that scientists have studied many ecosystems to learn about how nature works. Then, pump up students about their unique opportunity to explore *this* place:**
   a. You might be exploring an area scientists haven't studied yet!
   b. Try to be thorough and careful in making observations and learning about the ecosystem.

[Optional] *Mind Pie* (~7 minutes)

Note: See the BEETLES *Mind Pie* activity write-up to lead this activity (http://beetlesproject.org/resources/for-field-instructors/mind-pie-2/).

Keeping the momentum. If you do choose to do one of these optional activities as part of your initial phase of the theme field experience, keep it quick and connected to the theme to keep the momentum going and to keep students excited about exploring the ecosystem. An introduction is important to frame the experience and set the tone, but it's also important that students get a chance to do something in nature fairly soon.

Using *Mind Pie* to assess student understanding. This activity helps students access their prior knowledge on the topic, gives them an idea of what to expect during the field experience, and gives the instructor some information about the group that they can use to make instructional decisions.

1. **Introduce and lead the *Mind Pie* activity.** Introduce the activity as described in the BEETLES activity write-up, including statements from the NGSS Ecosystems, Matter, and Energy category in the *Mind Pie* write-up, as well as a few from the NGSS Science and Engineering Practices category.
   - Suggested prompts related to the ecosystems theme of the field experience:
     - I can explain how organisms in this environment interact with one another.
     - I can explain decomposition.
     - I can explain one or more of these:
       - what an ecosystem is
       - ecosystem models
       - systems
   - Suggested prompts related to Science and Engineering Practices:
     - I can participate in a scientific discussion.
     - I like exploring outside.
     - I can make an explanation based on evidence.

[Optional] *Systems Game* (~8 minutes)

1. **Introduce the game.**
   a. We're going to play a game to help us think about systems and ecosystems.

2. **Explain how to play the game:**
   a. Pick one person in the group who (just for the purposes of this game) is your "prey" and one person who is your "predator." Be sure to keep who you choose a secret from everyone.
   b. Prey is an animal that is hunted and eaten by another animal.
   c. Predator is an animal that hunts and eats another animal. (Give students time to silently choose their prey and predator.)
   d. When I say, "Go," your goal is to stay close to your prey and away from your predator without letting anyone know who your prey and predator are.

3. **Set boundaries, play the game, and notice any patterns that emerge.**
   a. Make sure students are aware of boundaries and are being careful not to crash into one another.
   b. The group might look a little chaotic initially, but patterns tend to emerge—a clump of students chasing one another, the group widening apart and then coming together, etc.

4. **After a few minutes, pause the game and ask students to *Turn & Share* and describe any patterns they noticed of how the group moved.**

5. **Share observations as a group.**
   a. Ask some students to share adjectives to describe what happened in the game.
   b. Ask other students to use whichever hand signal for agreeing that your group uses when they agree with an adjective that someone else mentions.

6. **Make generalized statements about the kinds of adjectives students used and the patterns they noticed.**
   a. For example: "It seemed like many of us described the group's movements as quick. It seemed like many of us turned a lot, and at times there was a pattern where there were some small circles of students moving around."

7. **Explain that as individuals, they were trying to achieve the goal of survival, not trying to play a role or help the system:**
   a. A system of how the whole group moved began to form—but it wasn't intentional.
   b. This is similar to how an ecosystem works.
   c. Each part of an ecosystem is just doing what it can to survive, not trying to make patterns happen and not trying to play a role or help out the ecosystem.
   d. We call some organisms **decomposers** and some organisms **producers**, but those are names assigned by humans. Sometimes, we forget that the organisms themselves have no idea that they are called that.

TEACHING NOTES

Deciding whether to play the *Systems Game*. The *Systems Game* is a way to get students thinking about some ideas related to systems (and to get students moving, too!). This game is a fairly lightweight introduction to systems thinking, but it does help debunk the common misconception that members of an ecosystem are aware of how they impact the ecosystem and want to help the ecosystem by fulfilling a role (e.g., decomposers *want* to break down dead things to help the ecosystem, or plants *want* to help by making food).

About educational games. Games are fun and can be energizing, but the learning that takes place during a game is often overestimated. Games can be used well in outdoor education, but they are often relied on too much to teach concepts and make learning fun, to the exclusion of letting students actually engage with nature and engage in a productive struggle with ideas. While the instructor may be thinking that students are learning about predator–prey interactions during a game, students are often thinking, *I'm playing tag!* Still, a well-designed and well-led game can give students a different perspective on a process in nature that they can't directly observe and can deepen students' understanding of something they're exploring. However, for this to happen, it must have a thoughtful introduction and debrief before and after.

Using difficult words. It takes about seven exposures to a word for it to become part of a learner's vocabulary. Ideally, students should hear, speak, read, and write the word. Define the word *ecosystem* the first few times you use it and hold up the card showing the definition. This will help students have a better chance of remembering the word and developing understanding of the concept.

TEACHING NOTES

Foundational tools for exploring nature. It's important to lead an activity such as *I Notice, I Wonder, It Reminds Me Of* toward the beginning of a field experience because it gives students tools to engage with and explore nature through wonder, curiosity, and a scientific mindset. Those are important and foundational attitudes that will make all the other activities on your field experience more successful. *NSI: Nature Scene Investigators* is another BEETLES activity that provides these tools. Students can keep using these tools to explore nature after they leave your program!

e. The organisms are just going about their lives, eating what they can digest in order to survive.
f. When we observe organisms interacting, or evidence of interacting, it may seem like the organism wants to help somehow, like a decomposer breaking down something dead, or plants making food. However, they are each just doing what they can to survive.
g. These organisms may play a role in the ecosystem, like what humans call a decomposer, but without intent.
h. Although some organisms depend on one another, they aren't actually trying to help or hurt one another or to form any of the patterns we observe.
i. To learn about this ecosystem, we're going to spend time looking at the parts of the ecosystem and how the parts interact.

[Optional] *I Notice, I Wonder, It Reminds Me Of* (~25 minutes)

Note: See the BEETLES *I Notice, I Wonder, It Reminds Me Of* activity write-up to lead this activity (http://beetlesproject.org/resources/for-field-instructors/notice-wonder-reminds/).

1. **If you haven't done so already, introduce *I Notice, I Wonder, It Reminds Me Of* and tell students they will learn observation skills that will help them learn about the ecosystem.**
2. **Lead the activity as described in the BEETLES activity write-up, without doing the Optional Extension: Focus on Asking Scientific Questions.**
3. **Afterward, explain to students that the observation tools they've learned will help them better understand parts of the ecosystem.**
4. **Remind students to use tools from the activity throughout the field experience.**
   a. For example, when you come across something interesting, remind students to use the prompts out loud in pairs: "Call out what you notice." or "Use your observation tools."
   b. Or, during an Exploration phase of one of the activities, remind students to use these tools during their explorations before you send them out to observe.

What Lives Here? (Parts 1 and 2) (~40 minutes)

Note: See the BEETLES *What Lives Here?* activity write-up to lead this activity (http://beetlesproject.org/resources/for-field-instructors/what-lives-here/).

1. **Explain to students that they will start to learn about the ecosystem they are in by working together as a team to figure out what lives there:**
   a. You get to do something exciting—exploring together as a team, trying to figure out what lives in this ecosystem.
   b. You'll be recording what you find, like scientists might do.
2. **Lead the first two parts of *What Lives Here?* as described in the BEETLES activity write-up.** For now, just lead the first two parts of *What Lives Here?*:

   a. Searching for Organisms and Evidence of Organisms
   b. Discussing Organisms and Evidence

3. **After the activity, continue with your field experience, telling students they can keep adding organisms to their lists as they hike and giving them opportunities to do so. Explain:**
   a. Keep observing organisms and evidence of organisms during the field experience.
   b. You'll use the lists for something else later.
   c. The more you have recorded, the better.

4. **[Optional] If students used field guides to identify organisms, occasionally ask students who you know have identified a plant to identify it for the group as you hike.**
   a. Consider occasionally pointing at a plant that you know someone in the group learned to identify and asking that person to identify it for the group.
   b. Ask that student to show the group the features that helped them identify it.

5. **When students see new organisms to add to their lists, briefly brainstorm ways those organisms might be connected with other living and nonliving things in the area.**

[Optional] Additional BEETLES Activities to Explore Parts of the Ecosystem (~40–120 minutes)

1. **Lead one or more additional BEETLES activities to focus on and further explore parts of the ecosystem.** If you have more time and want your students to explore the ecosystem by focusing in on one specific organism or group of organisms (or one or a few parts of the system), lead one of the following activities:
   - ***Discovery Swap*** (~60 minutes). To engage students in a continued search for organisms and then an in-depth study of one particular organism, lead *Discovery Swap* as written in the activity write-up. Integrate the crosscutting concept of *Systems and System Models* into the activity to better support the group's understanding of ecosystems. See the sidebars and Instructor Support section to help integrate this crosscutting concept (http://beetlesproject.org/resources/for-field-instructors/discovery-swap-2/).
   - ***Lichen Exploration*** (~45 minutes). To engage students in studying lichen and discussing the unique relationship between the two organisms that make up lichen (fungi and algae), lead *Lichen Exploration* as written in the activity write-up (http://beetlesproject.org/resources/for-field-instructors/lichen-exploration-2).
   - ***Fungi Exploration*** (~60 minutes). To engage students in investigating fungi and discussing the impact of fungi on ecosystems, lead *Fungi Exploration* as written in the activity write-up (http://beetlesproject.org/resources/for-field-instructors/fungi-exploration/).

TEACHING NOTES

Skipping some Invitation questions. Some of the Invitation questions in the *Thought Swap* (formerly known as *Walk & Talk*) at the beginning of *What Lives Here?* are the same as those listed at the beginning of this field experience. Skip any you've already asked, ask the other questions, and then jump straight into the rest of the activity.

Students making mental notes to record later. Instead of having students stop to record organisms throughout the field experience, you could have them put their journals away and make mental notes of evidence of other organisms and nonliving things in the ecosystem they find throughout the field experience. When the group continues with the second half of *What Lives Here?*, give the group some time to add what they've seen to their lists in their journals.

Students teaching students. Giving students a chance to identify organisms and teach others how to do it both solidifies their skills and empowers them to rely on themselves and on one another instead of always turning to you for information.

Choose one or two activities. All these activities help students focus on one part of the ecosystem, which helps them deepen their understanding of the ecosystem as a whole. Do one, or at most two, of these activities before continuing on to the rest of the field experience.

Don't do both *Discovery Swap* and *Interview an Organism*. Both *Discovery Swap* and *Interview an Organism* engage students in close observation of a single organism. If you choose to do one of these activities, then don't do the other activity during this field experience.

TEACHING NOTES

Don't overdo it with discussion. There's already a fair amount of discussion in this field experience, both in the "*What Lives Here?,* Part 2" and the "Wrapping Up" sections. There are also optional rich and worthwhile ecosystem discussions in the *Bark Beetle Exploration* and *Fungi Exploration* activities, but it might be best to skip those dicussions if you choose to do them in this field experience. Pay attention to how your group is doing. Mixing activities that are exploration-based and movement-based between discussions can be helpful.

NGSS crosscutting concept: *Systems and System Models*. To help your students understand and use this thinking tool, explain that scientists use models to isolate one system, or parts of it, to learn about the larger systems that make up our world. Scientists decide what parts of the system to focus on and which to leave out in order to better understand something. They pay attention to interactions between parts of a system. They also notice things outside the system that affect it. It's important that students interpret their models and use them to answer questions in order to use their models in a scientific manner.

Abbreviated and less structured *Thought Swap*. If it's just a short distance, tell students to quickly find a partner and discuss the questions with that partner as they walk toward where you will do the activity.

- ***Bark Beetle Exploration*** (~50 minutes)**.** To engage students in examining and making explanations about the evidence that bark beetles leave behind as they interact with trees, lead *Bark Beetle Exploration* as written in the activity write-up (http://beetlesproject.org/resources/for-field-instructors/bark-beetles-2/).
- ***Interview an Organism*** (~40 minutes)**.** To focus students on deep observations of a single organism and how it interacts with living and nonliving things in its surroundings, lead *Interview an Organism* as written in the activity write-up (http://beetlesproject.org/resources/for-field-instructors/interview-an-organism/).

2. **When introducing any of these activities, make connections to the theme and point out that studying one part of the ecosystem in depth will help students better understand the ecosystem as a whole.**

3. **Hold up the *Systems and System Models* poster and explain:**
   a. When looking at a system, it can be helpful to study one part of it in depth.
   b. Looking at systems is a way of thinking that scientists often use to understand things.
   c. Knowing how [bark beetles, spiders, macroinvertebrates, etc.] interact with other parts of the ecosystem to get what they need to survive can give us a deeper understanding of this whole ecosystem and how the parts of the ecosystem affect one another.

4. **As you wrap up any of these activities, help students connect what they learned to the theme by asking them to reflect on their understanding and have them add any organisms or interactions they've seen to the lists in their journals. Explain:**
   a. Take some time to add the names of any new organisms you've seen to your journals.
   b. By focusing on _____, we went in depth and learned about one of many parts of the system.
   c. *Turn & Share* (or *Thought Swap*) with a partner about some of the following questions after doing the optional activities:
      - *What are parts of the ecosystem we observed during that activity?*
      - *How do those parts connect to/interact with other parts of the ecosystem?*
      - *What do you wonder about the ecosystem?*

[Optional] *Thought Swap* (~5–10 minutes)

1. **If you need to move locations between *What Lives Here?* and other activities, use some of the following questions to help students keep thinking about the theme:**
   a. Explain: I once saw an interesting interaction between two animals. [Describe an interesting interaction you've seen, ideally at your site.]

      ▶ *Tell your partner about a time you've seen animals interact (do something with each other) in nature. It could be from a video.*

b. Explain: I once saw an interesting interaction between an animal and a plant. [Describe an interesting interaction you've seen, ideally at your site.]

▶ *What are some ways that animals and plants might interact?*

c. Explain: I once saw an interesting interaction between a living thing and a nonliving thing. [Describe an interesting interaction you've seen, ideally at your site.]

▶ *What are some ways organisms interact with nonliving things in their ecosystem?*

What Lives Here? (Parts 3–5) (~25–30 minutes)

Note: See the BEETLES *What Lives Here?* activity write-up to lead this activity. (http://beetlesproject.org/resources/for-field-instructors/what-lives-here/).

1. **Seat the group and have students add the names of any organisms they've seen to their journals.**

2. **Lead the remaining three parts of *What Lives Here?* as described in the BEETLES activity write-up:**
   a. Making Ecosystem Models
   b. Discussing Ecosystem Models
   c. Wrapping Up

TEACHING NOTES

Lunchtime question. A lunchtime question that can help students think at the level of environmental planning and management is: *Should we preserve ecosystems? If so, should humans be allowed into them?* If you discuss this question, point out the disproportionate impact people have had on ecosystems for students to use as evidence in their discussions. Also mention that people often think nature in America was pristine when colonists arrived, but it wasn't. Indigenous people managed nature for centuries throughout the continent, using such strategies as controlled burns. Hold back from telling students *how* to think. Encourage a diversity of ideas from different perspectives.

Give students a break. Students need to be seated to make and discuss their Ecosystem Models during this part of *What Lives Here?* Taking a break and giving students a chance to move around a bit or hiking to a new location before starting the activity can help them release some energy so they can focus on the activity afterward while sitting.

ABOUT BEETLES™

BEETLES™ (Better Environmental Education Teaching, Learning, and Expertise Sharing) provides environmental education programs nationally with research-based approaches and tools to continually improve their programs.

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The following programs contributed to the development of these materials by field testing and providing invaluable feedback. For a complete list of contributors and additional partners, please see beetlesproject.org/about/partners/

California: YMCA Camp Campbell, Rancho El Chorro Outdoor School, Blue Sky Meadow of Los Angeles County Outdoor Science School, YMCA Point Bonita, Walker Creek Ranch, Santa Cruz County Outdoor Science School, Foothill Horizons Outdoor School, Exploring New Horizons Outdoor Schools, Sierra Nevada Journeys, San Joaquin Outdoor Education, YMCA Camp Arroyo, Shady Creek Outdoor School, San Mateo Outdoor Education, Walden West Outdoor School, Westminster Woods.

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Photos: Pages 1 and 2 by Kevin Beals. *Icons*: Backpack by Rémy Médard; Growth by Arthur Shlain; Cut by Nathan Thomson; Outside by Petr Holusa; Park by Antar Walker; Time by Wayne Middleton; & Diversity by Cara Foster all from The Noun Project.

Funding from 2012-2020 for BEETLES publications such as this one has been generously provided by the S.D. Bechtel, Jr. Foundation, The Dean Witter Foundation, Pisces Foundation, the Mary A. Crocker Trust.

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