LE 7 Overview

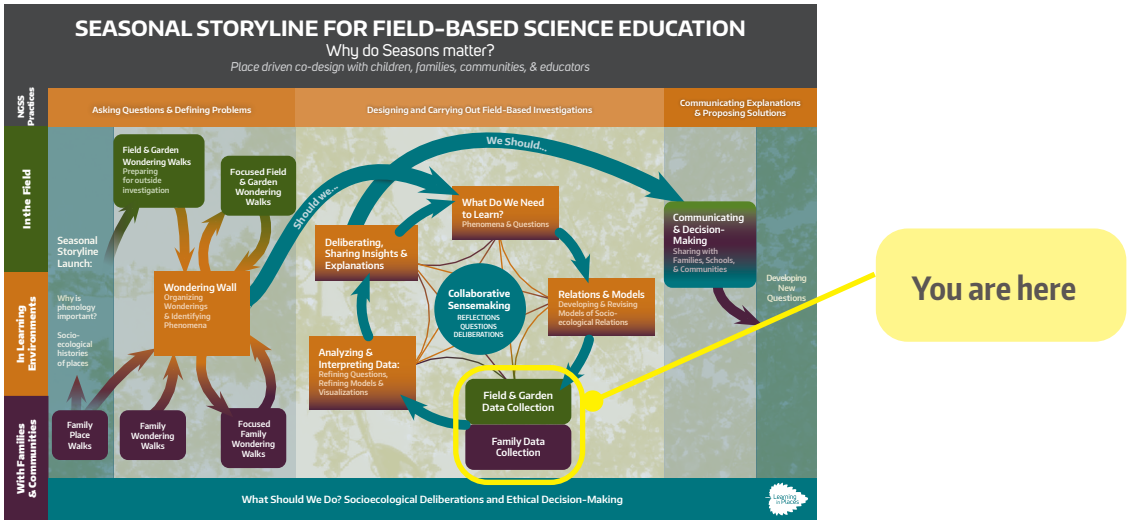
Overview: Designing an Investigation and Collecting Data to Answer "Should We" Questions

This process of planning and carrying out investigations enables us to move from opinions, beliefs, or initial ideas about phenomena to making claims from evidence. Abundant research demonstrates that students' initial ideas about a phenomenon or a key concept can be difficult to change. These initial ideas are often rooted in experience and their own conceptual models about how the world works. Unlike memorizing "facts" about phenomenon, however, students in this Learning Engagement wield their own observational and sensemaking capabilities to collect first-hand data that will help them revise or refine their own original concepts [LEs 8-9].

In this learning engagement, students will design their own investigations and collect data in the field, classroom, and their neighborhoods. As they make sense of the data in Learning Engagement 8, the data become evidence that can support claims about phenomena. This will help to answer investigation questions and make decisions around "Should We" questions.

Big Ideas About Nature-Culture Relations To Have In Mind As You Plan For Learning Engagement

In addition to providing an opportunity for students to engage in place-based investigations, these learning activities help teachers and families learn more about what phenomena students and families notice around their neighborhoods and schools, and what they wonder about in those places. This is a key first step in **ethical decision-making:** as learners notice and wonder about places they are connected to, their wonderings will reflect questions about human decisions that may have been made or could be made in the future that affect all who inhabit those places. By starting with places they are already familiar with, this bundle will give students practice learning and investigating outdoors.



LE 7 LEARNING GOALS

This bundle of learning engagements incorporates both school and family learning activities to engage students and families in wondering and observing socio-ecological phenomena. By the end of this bundle, students will be able to:

1. design field science investigations that help answer/refine our investigation question(s) and class "Should we" question
2. try out and refine data collection protocols to make accurate claims about our phenomena
3. collect a robust data set of field observations that allow them to find patterns across our data set

CONNECTIONS TO NGSS

» **Crosscutting Concepts:**
Patterns, Cause and effect, Scale, proportion, and quantity, Structure and function, Stability and change
[NOTE: several of these might apply depending on the focal phenomena]

» **Science Practices:**
Asking Questions and defining problems, Planning and carrying out scientific investigations

» **Disciplinary Core Ideas:**
LS1: From molecules to organisms; LS3: Heredity; LS2: Ecosystems; LS4: Biological Evolution ESS2: Earth's systems; ESS3: Earth and Human Activity [NOTE: Applicable DCIs will depend on the focal phenomena you and students have chosen.]

Learning Engagement in LE7

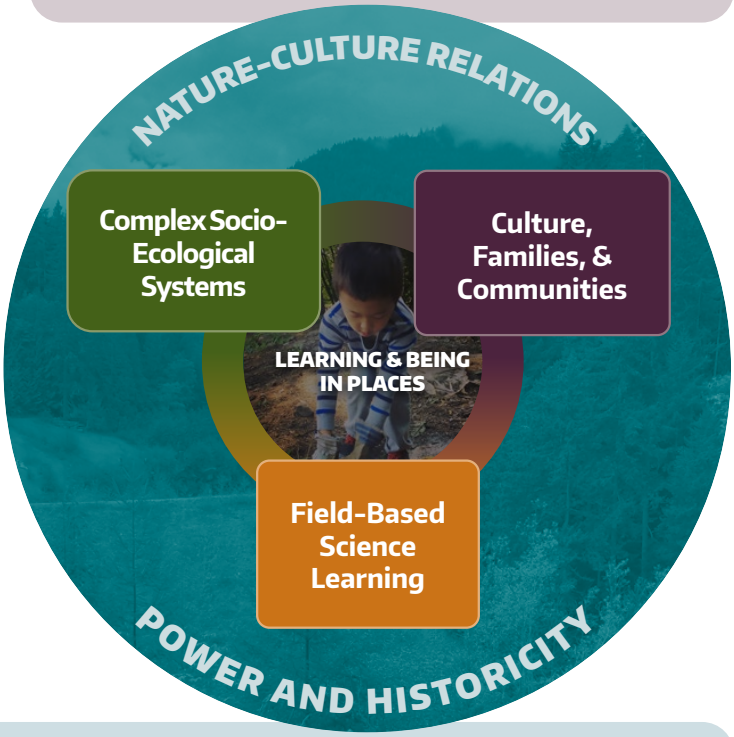
LE7.1 has **three parts** that engage students in designing an investigation and collecting data. First you will use students' questions from LE6.2 to design an investigation that will include family and school investigations as well as background and community research. Next, students engage in co-designing the investigation. Finally, students use data collection protocols to collect data with their families and at school, and use additional tools to conduct community and background research.

Engaging the Rhizome

Complex Socio-Ecological Systems: There are many types of relationships within and across systems. These relationships include predator-prey, helping or hurting, causal relationships (X causes Y to happen), among others. Research demonstrates that even young learners begin to understand causal relationships among organisms and natural components within a system. Revisiting models allows students to create increasingly complex models as they synthesize observations across space and over time as they move through the storyline.

Field-based science Learning: This learning engagement incorporates scientific practices that are critical to field-based science learning: (a) modeling of socio-ecological phenomena which also engage students in (b) argumentation from evidence as they decide on how to represent relationships in their models, which sets students to (c) ask questions to frame their field-based investigations.

Culture, families, and communities: Families play a central role in this learning engagement by engaging with their child in field-based science investigations and in conducting community-based research.



Power and Historicity:
When students see their families as valuable sources of information and as educators, it is empowering. It signals to students that families' perspectives, knowledge, and lenses on the natural world are important because they are helpful in better understanding socio-ecological phenomena. The activities in this learning engagement are designed, in part, to make visible to students that scientists are not the only people who engage in modeling as a practice to better understand the world. Students, families, and teachers can expertly engage in this sensemaking practice too!

Power and Historicity while learning outdoors:
As you have learned in LEs 1-5, classroom and outdoor teaching and learning are always done from powered positions. When student and family ways of knowing, doing, wondering, etc. are included in classroom learning, and positioned as equal to the knowledge, ideas, and wonderings generated in school, it signals to students and families that family knowledge is important and valued in the classroom. As a reminder, when students see themselves, their families, and the places that are important to them play a central role in what they learn in school, they understand that school science is related to their lives and their communities. This also signals to students that science does not stop when they leave school, and that their "Should We" models and investigation questions are relevant in their own neighborhoods as well as at school. Also, we are always making decisions from contexts of power and historicity. For example, we could choose we could choose to ignore historicized racial inequities in places when deciding on our actions, or we could choose to include BIPOC (Black, Indigenous, People of Color) people in our community research to understand all of our collective perspectives and be better informed as we deliberate. How we conduct our investigations is crucially important to the quality of the data that we collect, and consequently the kinds of evidence-based claims we can make as we deliberate.

Learning in Places

Lesson Plan

LE7.1: Designing an Investigation and Collecting Data to Answer "Should We" Questions

Purpose

In this learning engagement, you and/or your students will design investigations and collect data in the field, classroom, and their neighborhoods. LE 7 begins with planning your class's investigation based on students' questions from LE6.2. You will find planning supports embedded in the first part of the Instructional Sequence to support the planning process. Depending on the age and experience of your students, you may choose to use students' prior noticings, wonderings, models and questions to guide your design of the experiment before bringing students into data collection activities. Note the first part of this Learning Engagement is designed to support your own learning around types of field-based experiments, experimental design, and data collection in order to support your students' early efforts to co-design investigations with you as a guide. For this reason, you will find that the Teacher Planning is longer than prior Learning Engagements and includes multiple planning tools in the text. Take the time to read through the details of this lesson plan, knowing that many of these details are not yet necessary for younger learners to know (such as types experiments).

Why this is important

Throughout human history and across cultures, people have been engaged in observational practices to build their knowledge of systems. Observations are also a primary source of information in scientific inquiries, and through scaffolding and guidance, systematic observations can become a form of data collection. Adding incoming observational data to learners' models, and incorporating this with other forms of data - such as community and background research - are important processes that lead to sensemaking, deliberating, and making decisions about socio-ecological phenomena. This process of planning and carrying out investigations enables us to move from opinions, beliefs, or initial ideas about phenomena to making claims from evidence. Students build initial ideas about natural phenomena through everyday observations and explorations within their communities. The prior learning engagements across settings set the foundation for building more complex and disciplined ways of knowing through field-based science investigations that engage students in the practices of developing and using models and planning and carrying out investigations. In this lesson, you will use students' focal phenomena and "Should We" question(s) to design field-based investigations that allow students to gather data across the settings of their lives, including home, their communities and school. As students see phenomena unfold across these settings they will be able to analyse and make sense of data and engage in informed ethical deliberations in order to answer their "Should We" questions in later Learning Engagements.

Engaging family and community knowledge and practices

There are many ways to collect data and gather information to explore a "Should We" question, because "Should We" questions explore the connection between the natural world and human lives, choices, and behaviors. Doing field-based investigations is one way. You can also talk to people in your community, like elders or people who live and work in places that you are investigating. Research tools in this Learning Engagement will help you do this type of community-based research! You can also do background research by finding information in books, podcasts, on the internet, and other forms of media to see what people already know about your "Should We" question. Most of the time, you'll need to do all three kinds of evidence-gathering in order to fully explore your "Should We" question. For example, in LE 1, we ask students to make some initial claims about how they know what season we are experiencing. Students may say they know it is summer because it is hot or it is winter because it is cold. This is not wrong, per se, but it is an incomplete explanation of seasonal changes. Collecting multiple data points enables students to build on their experiences and knowledge about the relationship between temperature and seasonal impacts to refine their ideas.

LEARNING GOALS

By the end of this lesson, students will be able to:

1. design field science investigations that help answer/refine our investigation question(s) and class "Should We" question

CONNECTIONS TO NGSS

» **Crosscutting Concepts:** Patterns, Cause and effect, Scale, proportion, and quantity, Structure and function, Stability and change

» **Science Practices:** Planning and carrying out scientific investigations

» **Disciplinary Core Ideas:** LS1: From molecules to organisms
LS3: Heredity
LS2: Ecosystems
LS4: Biological Evolution
ESS2: Earth's systems
ESS3: Earth and Human Activity
[NOTE: Applicable standards will depend on the "Should We" question, and related focal phenomena you and students chose.]

ASSESSMENT OPPORTUNITIES

» Class discussions offer formative assessment opportunities to guide the final design of your field-based investigation.

» Observing and listening to student talk during data collection.

» Research design planning documents and data collection documents.

» Community interviews offer writing assessment opportunities.

Centering equitable practices:

- **Provide equitable access to outdoor learning experiences:** Avoid centering student behavior outdoors as your main concern. While it is natural to be nervous about students' behavior outdoors, which might come from concerns about safety while outside, centering their behavior often eclipses their sense-making and robs them of opportunities to learn. Additionally, centering behavior often results in policing children of color more often and more harshly than white children. As you have already seen previous learning engagements, students **will** be excited to be outside. They **will** speak in louder voices than they normally would in the classroom. They **will** spread out but will come back together as they share their ideas, observations, and wonderings. Allow them both emotional and physical space to do this. Consult the **Supporting Learning Outdoors Framework** for strategies you can use to support students in their learning and sense-making outside.
- **Use the 5 socio-ecological dimensions to frame observations and wonderings:** Avoid too-simplistic framings of the activities in this learning engagement such as assuming simple cause and effect relationships among observations or observing only one variable at a time. As you and students design and collect data related to your field-based investigation(s), use these times and spaces as opportunities to use the 5 socio-ecological dimensions. This includes modeling how to take the perspective of more-than-humans, how to focus on relationships among species, kinds, lands, and waters, how to use different scales when observing and wondering (time, space, size), and how to look for evidence of human decision-making (because remember, humans are part of ecosystems, not dominant over them and not absent from them). Create a set of back-pocket questions related to the 5 dimensions and take them with you out on your field-based investigation(s) to prompt students as they are collecting data.

Teacher background information

Scientists use investigations to help them answer questions. They carefully plan investigations so that they know what data they want to collect. It is important to know that scientists don't usually do investigations without a purpose—they are always trying to learn more about something and answer some questions. This is why it is important for you to know how an investigation can help you answer your "Should We" question.Working with models helps scientists and science learners visualize their thinking and better understand the kinds, relationships, behaviors, and various scales being explored. Scientific models are dynamic and change based on new information learned through investigations of phenomena, discussions and deliberations with others like family and community, and media of various types. As you co-plan your field-based investigation with students, consider revisiting revised models in order to help students visualize the systems that they will be investigating and consider which types of research questions are the best fit for the phenomena and "Should We" question that your class is investigating.

Investigation questions are a unique type of question that can be explored through systematic observation of the social (human) and/or natural (non-human) world. Below is a list of three kinds of investigation questions - these are not the only ones, but will be helpful to you as you construct your investigation. Investigation questions often begin with how, where, when, and under what conditions.

Kinds of Investigation Questions

- **Descriptive Questions:** Describes the behaviors or characteristics of a species and/ or describes the relationship between two or more living/non-living beings.
  - » Descriptive Questions help us better understand why a particular species acts or relates to others the way it does.
  - » A good answer will include many details about what you have observed over time and in several locations.
  - » Example: How do worms move in the soil? - a close study of worms and their movements/ behaviors in different kinds of soil.
- **Comparative Questions:** Compare and contrast phenomenon across places and times
  - » Comparative questions help us understand why or how a phenomenon occurs, and under what conditions.
  - » A good answer will include details about similarities/differences across places and across times (day/night, seasons, years, etc).
  - » Example: Where can I find the most worms? - a close study of worms in different locations
- **Correlative Questions:** Explain patterns between different species and/or species and their environment.
  - » Correlative questions help to answer relationships and patterns in the world.
  - » A good correlative question will include details about observed patterns.
  - » Example: What happens to worms when it rains? - a close study of worms in different weather conditions.
- **Other Types of Questions:** Your investigation, or several investigations, might be guided by an overarching explanatory question (why or how so) or decision question (can we, should we). These kinds of questions give purpose to your investigations, but may not be answered solely by one investigation or even a series of investigations. They may require additional research such as reading what other scientists have learned or discussing your investigations with community members or leaders.

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Example of a series of field-based research questions from one "Should We" question:

- **Decision Question:** Should we rake dead leaves on our greenspaces?
- **Explanatory Question:** Why might dead leaves in our greenspaces be helpful or harmful to those who live in and visit our neighborhood?
    - » **Descriptive question:** Who/what can we find under dead leaves in our greenspaces? How many critters can we find under dead leaves?
    - » **Comparative question:** What are some similarities and differences between who/what is under dead pine needles and dead leaves? What are some similarities/differences between who/what we find under leaves versus a mowed green space? [comparative question]
    - » **Correlative question:** What happens to the plants in the garden if we find a lot of slugs in the dead leaves? What happens to plants whose roots are covered by dead leaves versus plants whose roots are not?

To prepare for this lesson

Before students co-design an investigation in LE7, it is important to talk about what investigations are and how they can help the class answer the "Should We" question. Conducting investigations is a key scientific practice that requires choosing data to collect, and careful examination of these data in the "field". Family investigations will also be critical for gathering evidence to make claims about phenomena of interest. These investigations will eventually help you decide on what action to take around the "Should we" question.

1. Designing a Field-Based Investigation at home and school (can be designed for or with students) (LE71.a)
2. Doing community based research and/or background research using a variety of sources including family and community members (LE7.1c, LE7.1
3. Gathering observation field-based data at home and school (LE7.1b, LE7.1d)

There is no "right" order for students to collect data from home, school, and other resources. For example, you might start with research into what is already known about your "Should We" question to inspire ideas about where to start with your field-based investigations or your community-based research. Or, if you start with your community-based research, that community member can give you clues about resources to read or field-based investigation questions to ask. Or, if you start with field-based investigations, your community-based research can help you explain your findings or it can help you think about the next questions to ask. As mentioned earlier, depending on the age and experience of your students you may choose to do the field-based experimental design before engaging students in the smaller details of planning and data collection practices. There is an appendix at the end of this Learning Engagement (after the instructional sequence) with planning support tools for how to design your field-based science investigation.

MATERIALS

- LE7.1a Data Collection Planning Tool
- LE7.1b Data Collection Protocols (choose from a set of 12 protocols which are described in the appendix).
- LE7.1c Community Knowledge Data Collection
- LE7.1d Data Protocol Family Tool Cover Page
- LE7.1e Conducting Background Research
- LE7.1f Overview of Data Collection Tools (with example questions and data)

TIME

15-60 Minutes (Time varies by how much students are involved in the experimental design process). See two planning paths below.

Instructional Sequence

Step 1 (Teacher Planning): Design your Field-Based Investigation

Note: this part is to be done as preparation before you teach the lesson.

Step 1: Coming up with a research question

1. Our "Should We" question is: _____

_____

2. Brainstorm phenomena related to the "Should We" question.
3. Review student-generated questions from LE6.2. Write, modify, synthesize or copy students' questions that relate to the "Should We" question and related phenomena.
4. Review the list of available protocols for field-based research in LE7.1f (also in appendix below). Choose a protocol or set of protocols that can be used to support your students exploration of the "Should We" questions. Review the example research questions and data as models of how you can design your field-based investigation. List protocols that you can use below along with possible research questions and data.

Protocol # and Title (LE7.1b)	Investigation Questions	Qualitative and Quantitative Data

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5. Design an investigation question or questions based on the work you did above. As you conduct your investigation, we recommend beginning with descriptive questions that might lead to comparative and correlative questions. The more data you collect - the more questions you will have!

   Our investigation question: _____

   _____

6. Review the other data collection tools to think about how they can be integrated into your field-based investigation. Be sure to include at least one everyday knowledge tool (LE7.1c & LE7.1e) as well as the family data collection tool (LE7.1e) in order to position scientific knowledge in the community, in everyday resources as well as in the land and from school.

   LE7.1c Community Knowledge Data Collection
   LE7.1d Data Protocol Family Tool Cover Page
   LE7.1e Conducting Background Research

Step 2: Share the Investigation Questions with the Class and Engage in Co-Design of the Investigation

Whole Group

1. In LE6.2 students generated possible research questions to answer the "Should We" question. Tell students: "You all came up with excellent questions in the last lesson to help us make decisions around our "Should We" question. I read over all of your questions and compared them to some of the tools we have available for our research, and came up with one investigation question for us to explore together! Our questions is: _____"
2. Ask students to brainstorm what this question means to them: can you tell me, in your own words, what you think we'll be investigating? Where do you think we should investigate this question at school/ Where do you think you and your family could investigate this question in your neighborhood?
3. Tell students: "Now that we have our investigation question, we are going to think about types of data that we need to collect, and how we will use that data to answer our "Should We" questions. Ask students, "Who can tell me what "data" means?" Ask for their ideas, and confirm that when we say "data", we mean types of information that will help us answer our question. Data can come from studying something outside, talking to people, or reading books/ watching videos, etc.

   Give students a brief overview of the investigation structure, and let students know that they will be collecting data at school and at home, and also read books and talk to community members to find more about their research topic.

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Small Group Work

1. Arrange students in small groups, and give each student a copy of the LE7.1a Data Collection Planning Tool. Have students complete the tool together in order to consider when, where, and how they will collect their data, and to engage in the practice of designing experiments. The purpose of this tool is to get students to think about experimental design, and to share their ideas with the class. You will synthesize and streamline students ideas in the final investigation design.
2. Remind students to think about designing an investigation that they can do with their families as well as at school, and to think about family and community experts, books and other resources that they would use to learn more about their research questions.
3. ReviewLE7.1a with students before they complete the document in small groups.

    Column 1: When will they collect data?
    Column 2: How many groups of students should collect data (i.e. work in pairs, etc.)
    Column 3: Where are all of the places you can collect data?
    Column 4: What data would you collect?
    Column 5: What tools will you need?

Whole Group

1. As part of a whole group discussion, ask students to share a summary of their research design with the class.
    - » Option 1: Students verbally share their research designs with the class. As students share, record the details of their details of their designs in a visible place in the classroom, such as the board or a piece of easel paper.
    - » Option 2: Students draw a model of their research designs to share with the class.
    - » For both options, draw a table similar to the one below on the board or easel paper (or project it onto a screen) to record students' ideas.

Assessment Opportunity: Surface students' understanding of research design, types of data, and data collection.

When will you collect data?	Where will you collect data?	What data would you collect?	What tools will you need?

2. Tell students: "We have done a great job of thinking about all the ways that we can collect data to find out more about our investigation question(s) and answer our class "Should We" questions! I will use your ideas as I look through all of the tools we have for our investigation, and we will begin collecting around our homes and school soon!"

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Step 3: Place Map and Pick your Tools for the Investigation

1. Before finalizing your investigation plan, engage in place mapping around your school. Look for places where students can collect data using the data collection protocol. Test the protocol by collecting data and using the same tools as the students. Adapt the protocol if you need to meet the affordance of your investigation site.
2. Use students research designs to adapt your original research plan, and complete the table below with the final protocols, LE7.1 tools, and other materials that you will need for your investigation. Consider reserving books from the school library to support students LE7.1e work.

Data Collection Tool	How, when, with whom it will be used
The protocol(s) I will use for our school investigation (LE71.b): See the overview in the appendix, and adapt or create your own if you have other data collection needs	
The protocol(s) I will send home to families (LE7.1d cover page + protocol) This should be the same as or support the ones used in class	
Community Knowledge Data Collection (LE7.1c) Have students interview or email others in their community who know about the investigation topic. Make sure that family and community members are positioned as experts and not just professionals in related fields.	
Conducting Background Research (LE7.1e) Engage students in background research using podcasts, books, videos and other resources that students use in their everyday lives.	

3. If your protocol requires student-made tools, plan an activity for students to make these tools as part of an engineering lesson! Make sure that each student has the tools they need or knows how they will be sharing tools as part of data collection.

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Step 4: Collecting Data (These steps can occur in any order, but make sure to engage students in family-based learning before collecting data at school)

Invite families to collect data in their own neighborhoods

a. Send home the family tool (LE7.1d along with the protocol for your investigation from LE7.1b) and invite families to participate before you and your students conduct your investigation at school. This will give families time time to make sense of phenomena and investigation questions before students engage in these practices at school.

b. Before sending home this family tool, ask students to fill out the first page of the tool with the necessary information for families.

c. Let families know that it is okay if they can only complete part of the protocol. Engaging their child in data collection around a shared research question is the most important part of family learning.

Collect Investigation Data

a. Prepare to collect field-based science data from your selected site. You can use the Supporting Outdoor Learning Framework to think about roles for students outdoors, and practices that can support learning outdoors.

b. Students should have already practiced the LE7.1b protocol with their families, but also review the protocol with students before heading to your research site. Make sure that students have the data collection tools they need, and understand if and how tools will be shared as part of data collection.

c. As students collect data, they should be using the 5 socio-ecological dimensions to guide their observations and observations.

d. Whenever you can, ask questions to deepen students' observations, wonderings, and sense-making about the focal phenomena. Use the **back-pocket questions** you created when preparing for this lesson.

e. Remember to consult the Avoiding Potential Challenges section of this lesson plan for important things for you to keep in mind during this Wondering Walk.

Community-based and Background Research

a. In addition to using the protocols at home and school, use one or more of the LE7 research tools to collect additional information about your investigation topic.

b. **LE7.1c** Community Knowledge Data Collection- invites students to interview or email a more knowledgeable community member about the research question and topic.

c. **LE7.1e** Conducting Background Research- invites students to collect information about their investigation topic from a variety of resources.

d. You and your students will synthesize and analyze their data in LE8.

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Appendix:

LE7.1f Data Collect Tools Overview

These data collection protocols are designed to support your field-based science investigations. As you plan your field-based science investigation, review these tools to see which one(s) support research your focal phenomena and "Should We" question. Throughout the year, you may choose to do multiple protocols to collect more data to answer the "Should We" question.

Name of Data Collection Tool	Example Investigation Questions (but there are many more!)	Types of Data Collected
1. Invertebrates (Critters) Biodiversity Tally Sheet	» Where do we find the most bugs/invertebrates (under rocks, in the sun, by water, etc.)? » Do bugs like sunny or shady spots, moist or dry soil?	» Quantitative: number of invertebrates » Qualitative: species of invertebrates
2. Biodiversity Species Type and Abundance	» The type and abundance of species in an area	» Quantitative: number of types of species and how many of each » Qualitative: types of species, maybe also details about them (juvenile, adult, male, female, etc.)
3. Species Behavior	» What do species do in our neighborhoods? » How do species interact with each other and kinds? » How does species behavior change with weather, time of day, etc.?	» Quantitative: number of different species, number of each species » Qualitative: behavior and relationship observations
4. Leaf Observations	» How do leaves change after they have fallen off of a tree? » How does weather affect the look and feel of leaves? » How are leaves similar and different?	» Quantitative: Relative number of leaves on the ground. Size of leaves. » Qualitative observations: Changes to leaf structures based on conditions (time, weather, etc.)
5. Canopy Coverage	» How does canopy cover affect species on the ground? » How does temperature change under canopy cover? » How does canopy cover change by season?	» Quantitative: Densiometer shadings (see tool for details), corresponding species or temperature data » Qualitative: Quality of canopy cover/health in different areas. Behavior of species/ response of plants related to canopy cover. Feeling of air temperature, moisture related to canopy cover.
6. Soil Observations	» What organisms are found above, below the soil? » How are organisms related to each other? » Relationships between species and kinds.	» Quantitative: relative soil moisture, soil temperature, species counts. » Qualitative: species-kind, species-species relationships, behaviors, etc.
7. Soil Moisture	» What types of soil are around my school or in my neighborhood? » How does soil type relate to moisture, species diversity, abundance, rain runoff, etc.?	» Quantitative: Soil moisture levels approximated through paper towel "test"; soil temperature readings (and then identification of soil type) » Qualitative: Soil type, feel, relationship to runoff, etc.

8. Density of Coverage	» How does the density of species vary in different places? » How does the physical environment (soil, leaf coverage, weather) affect the density of species?	» Quantitative: grid shavings or density coverage (density observations vary by questions). Count of types of species observed. » Qualitative: species behaviors
9. Observing Relationships at Scales	» How species are related to each other in a place. » How organisms interact with their physical environment in a place. » How we can notice different types of relationships by observing them at different scales (i.e. zooming and and zooming out)	» Quantitative: numbers of species and counts. » Qualitative observations at different scales (zoomed out and zoomed in)
10. Daily/ monthly/ seasonally Time & Temperature Readings	» How does temperature change throughout the day? » How do species (plants and animals) and kinds (water and soil) respond to daily changes in temperature?	» Quantitative: Time and temperature » Qualitative: (optional) The relative feel of the temperature throughout the day (when sun is high/low)
11. Daily/ monthly/ seasonally Weather Documentation	» What is the weather like where I live? » How does the weather change on a weekly and/or monthly basis?	» Quantitative: Dates, months, and temperature (optional) » Qualitative: Identification of weather (sunny, cloudy, etc)
12. Daylight by Season	» How does the amount of daylight change throughout the year? » How does the amount of daylight relate to other things I observe in my neighborhood, like species abundance and behaviors, bloom times, leaf fall, and temperatures.	» Quantitative: Amount of daylight (documenting time of sunrise and sunset) » Qualitative: Seasonal data and optional data

LE7.1a Data Collection Planning Tool

When and where are we collecting data? What do we need?

This tool is meant to be an example of the type of chart you can put in front of students to help keep track of data collection locations, tools, and data by group. You might want to make one of these each day you do data collection. Alternatively, you could have students fill this class chart in the day before they collect data.

Data collection date	Group # or name	Where is data collection taking place? (field, garden, home)	What data are we collecting?	What tools do we need?

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Doing Research with Community Members

Part 1: Deciding on a community member to interview

There are many people in your community who know a lot about the places that are important to you and the questions that you're asking. These people could be community elders, people who have a job that is related to your "Should We" question, or people who have hobbies related to your "Should We" question, for example. One type of research that you can do is to **interview** people to see what they know! You can learn a lot from asking questions and listening. This is a kind of **data** that will help you learn more about your "Should We" question!

Once you decide on who you want to interview or talk with, you can call them or write them an email or letter, and let them know what you're interested in talking to them about. Sometimes you might feel unsure about how to ask someone to talk to you, but you'll be surprised at how excited people are to share their knowledge with you!

In case you need some help reaching out to community members, here is an example note you could send. You can change this to reflect how you want to talk with this person (over email, on the phone, on something like Zoom, by sending a letter):

Dear [insert the name here],
My name is [put your name here] and my family is trying to explore the question [put your "Should We" question here]. You are someone who lives in our community and knows a lot about this topic! We were hoping that you would be interested in talking with us about this topic so that we can learn from you!

We think this might take about 10 minutes. Would you be interested? If so, please email me back at [put your email address here]. We are excited to talk to you and hope you are available!

Thank you,
[put your name here]

Part 2: Coming up with questions to ask

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Sometimes, even though you know what you want to learn about, it's hard to come up with questions to ask. In case you need some help coming up with questions, here are some suggestions:

- How did you learn about [this topic]?
- We are asking the question: should we [put your should we question here]. What do you think is important to know about this before we try to answer this question?
- What do you think is the best way to investigate this?
- How did [this topic] come to be in our community? What is the history of [this topic] in our community?
- What resources do you think would be helpful for us to use?
- Are there other people who you think we should talk to?

Part 3: Getting ready for your interview!

Once you have your date set and your questions prepared, it's time to do the interview! Make sure you have the following materials:

1. The questions written out on a piece of paper so you don't forget them! You might even find that a table like the one below is helpful to organize yourself during the interview:

Write your questions here	Write their answers here

2. A pen or pencil to write down the answers. You can also ask permission to record the interview on a phone! But it's totally ok just to write down some notes!

Part 4: Getting back from your interview

You did it! Now what? Now you need to look over the answers you got and figure out what you know about your "Should We" question now that you've done the interview.

When you go to LE8 and 9, you will have a chance to bring all of your data together (from your field-based investigations, your community-based research, and your internet research) to see what you've found out and how you can decide on your next steps.

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Family Field Data Collection

Please return your observations and wonderings by: _____

Hello, Classroom Families!

As you know, we have been noticing, wondering and modeling the phenomena we see at our school and in our neighborhoods in order to pose a "Should We" question to guide our science learning this year! In our class we are now conducting *investigations* to help us answer our "Should we" question! In an investigation we collect *data* in the field, such as in the garden, on the trail, or in the forest. Data that we collect will become evidence for us to make sense of what we are observing. From this we can make claims about why we think it's happening.

Our class "Should We" question is _____
_____

Our investigation question is _____
_____

Activity Purpose: We need your help! An important part of science is collecting data in multiple places and at multiple times. The more data we collect, the stronger our *evidence* for claims that we will make. Please use the attached investigation protocol to conduct an investigation in your neighborhood, at the park, or anywhere you go to be outside!

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[attach data collection protocol here]

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Conducting Background Research about Our "Should We" Question

Deciding on what to research

Scientists often look to previous research to see what other people already know about the topic they are interested in studying. This helps them so that they can build on other people's knowledge and create new knowledge! This kind of research can help scientists decide on a starting point for an investigation, explain their findings, or even raise new questions about their topic. This kind of research should be a part of the field-based and community-based research that you're doing.

You can do research on a topic at the beginning of your investigation, in the middle, or at the end to try to explain what you found. The research you do can be in magazines, books, on websites, through podcasts, or in the newspaper. You have so many choices!

Complete the table below or on a separate sheet of paper to keep track of your research!

Website/podcast/magazine/ tv shows, book (etc.)	What we're learning from this source	How this helps us explore our "Should We" question

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Data Collect Tools Overview

These data collection protocols are designed to support your field-based science investigations. As you plan your field-based science investigation, review these tools to see which one(s) support research your focal phenomena and "Should We" question. Throughout the year, you may choose to do multiple protocols to collect more data to answer the "Should We" question.

Name of Data Collection Tool	Example Investigation Questions (but there are many more!)	Types of Data Collected
1. Invertebrates (Critters) Biodiversity Tally Sheet	Where do we find the most bugs/invertebrates (under rocks, in the sun, by water, etc.)? Do bugs like sunny or shady spots, moist or dry soil?	Quantitative: number of invertebrates Qualitative: species of invertebrates
2. Biodiversity Species Type and Abundance	The type and abundance of species in an area	Quantitative: number of types of species and how many of each Qualitative: types of species, maybe also details about them (juvenile, adult, male, female, etc.)
3. Species Behavior	What do species do in our neighborhoods? How do species interact with each other and kinds? How does species behavior change with weather, time of day, etc.?	Quantitative: number of different species, number of each species Qualitative: behavior and relationship observations

4. Leaf Observations	How do leaves change after they have fallen off of a tree? How does weather affect the look and feel of leaves? How are leaves similar and different?	Quantitative: Relative number of leaves on the ground. Size of leaves. Qualitative observations: Changes to leaf structures based on conditions (time, weather, etc.)
5. Canopy Coverage	How does canopy cover affect species on the ground? How does temperature change under canopy cover? How does canopy cover change by season?	Quantitative: Densiometer shadings (see tool for details), corresponding species or temperature data Qualitative: Quality of canopy cover/health in different areas. Behavior of species/ response of plants related to canopy cover. Feeling of air temperature, moisture related to canopy cover.
6. Soil Observations	What organisms are found above, below the soil? How are organisms in the related to each other? Relationships between species and kinds.	Quantitative: relative soil moisture, soil temperature, species counts. Qualitative: species-kind, species-species relationships, behaviors, etc.
7. Soil Moisture	What types of soil are around my school or in my neighborhood? How does soil type relate to moisture, species diversity, abundance, rain	Quantitative: Soil moisture levels approximated through paper towel “test”; soil temperature readings (and then identification of soil type)

	runoff, etc.?	Qualitative: Soil type, feel, relationship to runoff, etc.
8. Density of Coverage	How does the density of species vary in different places? How does the physical environment (soil, leaf coverage, weather) affect the density of species?	Quantitative: grid shavings or density coverage (density observations vary by questions). Count of types of species observed. Qualitative: species behaviors
9. Observing Relationships at Scales	How species are related to each other in a place. How organisms interact with their physical environment in a place. How we can notice different types of relationships by observing them at different scales (i.e. zooming and and zooming out)	Quantitative: numbers of species and counts. Qualitative observations at different scales (zoomed out and zoomed in)
10. Daily (monthly/seasonally) Time & Temperature Readings	How does temperature change throughout the day? How do species (plants and animals) and kinds (water and soil) respond to daily changes in temperature?	Quantitative: Time and temperature Qualitative: (optional) The relative feel of the temperature throughout the day (when sun is high/low)

11. Daily (monthly/seasonally) Weather Documentation	What is the weather like where I live? How does the weather change on a weekly and/or monthly basis?	Quantitative: Dates, months, and temperature (optional) Qualitative: Identification of weather (sunny, cloudy, etc)
12. Daylight by Season	How does the amount of daylight change throughout the year? How does the amount of daylight relate to other things I observe in my neighborhood, like species abundance and behaviors, bloom times, leaf fall, and temperatures.	Quantitative: Amount of daylight (documenting time of sunrise and sunset) Qualitative: Seasonal data and optional data