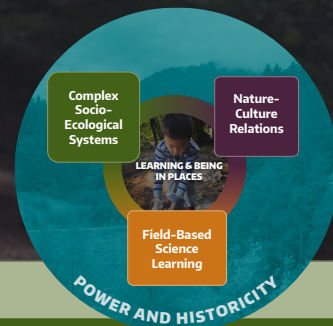




Family Science Learning Engagement



Bundle: Decision Making and Deliberation from Evidence

LE 7 Planning Field-Based Investigations and Collecting Data

Activity Purpose

This is the beginning of a 3-part bundle of LEs that includes LE 7 (planning investigations and collecting data), LE 8 (analyzing data), and LE 9 (connecting investigations to “Should We” questions). In LE 7.A, your family will choose which field-based investigations you want to do in order to explore your “Should We” question from LE 6.B. You can do as many investigations as you want—after each investigation your family will return to your model and “Should We” question from LE 6.B to add new understandings, revise your thinking, and see what else you want to learn more about.

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. LE 7.B 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. LE 7.C will help you do that kind of research! Most of the time, you’ll need to do **all three kinds of evidence-gathering** in order to fully explore your “Should We” question.



Scientist Tip

Scientists use investigations to answer questions. They collect and then analyze data so that they can have **evidence** for answering their questions, but many times one investigation brings up more questions that lead to more investigations! So, you may find that you’re doing this bundle of LEs 7-9 more than once!

In LE 7, you don’t have to go in any specific order from 7.A through 7.C.



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.



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.



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.

There are many sources of information—from your data that you collect in your field-based investigations, to the knowledge that community members share with you, to books and TV shows about the topic that you’re studying. Just remember that there is no correct order to building knowledge in science!

Activity Overview

This activity can have many parts, depending on how many investigations you decide to do.

- » **Part 1: Review your “Should We” question:** Look over your activity sheet from LE 6.B.2. What **questions** did your family decide you needed to ask in order to explore your “Should We” question? What **data** did your family decide to collect?
- » **Part 2: Decide your research path:** Look over the list of investigations in LE 7.A, look at LE 7.B to ask some questions of people in your community, and look at LE 7.C to do research on what people already know about your “Should-We” question.
 - Choose the order that helps you answer the question and collect the data that your family decided on. Doing all three kinds of research will help you explore the different aspects of your “Should-We” question!
- » **Part 3: Conduct research:** Do the investigations and research!



What can you do to support learning?

- » If your family is having trouble thinking about which investigations you want to do, you can ask questions like:
 - What was our “Should We” question that we decided on?
 - What do we need to know more about to explore our “Should We” question?
 - What other information do we need to gather?
Which of the investigations will help us gather that information?
 - Who do we know that we can ask about this?
 - Can we actually create an investigation to answer our “Should We” or is our question better answered by gathering information from a community member or by a media research?

CONNECT TO OTHER ACTIVITIES

- Learning Engagement 6.B.2: Asking investigation questions related to your “Should We” question
- Learning Engagement 7.B: Conducting community-based research
- Learning Engagement 7.C: Conducting Book and Internet Research
- Learning Engagement 8: Summarizing and Visualizing Data
- Learning Engagement 9: Connecting to “Should We” Questions

LEARNING IN PLACES FRAMEWORKS TO CONSIDER

- Modeling Socio-Ecological Phenomena
- Relationships in Socio-Ecological Systems
- Observation and data collection

Key Ideas

Planning and carrying out scientific investigations

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 question. This is why it is important for you to know how an investigation can help you answer your “Should We” question.

Modeling

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.

Relationships in 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.



Photo courtesy of Tilth Alliance

Connecting with other families

- » Collaborate with other families on your “Should We” question! You can work together with another family on a field-based investigation to collect data in different places. You can decide that one family does a field-based investigation and one family does a community-based interview, and then compare what you found.

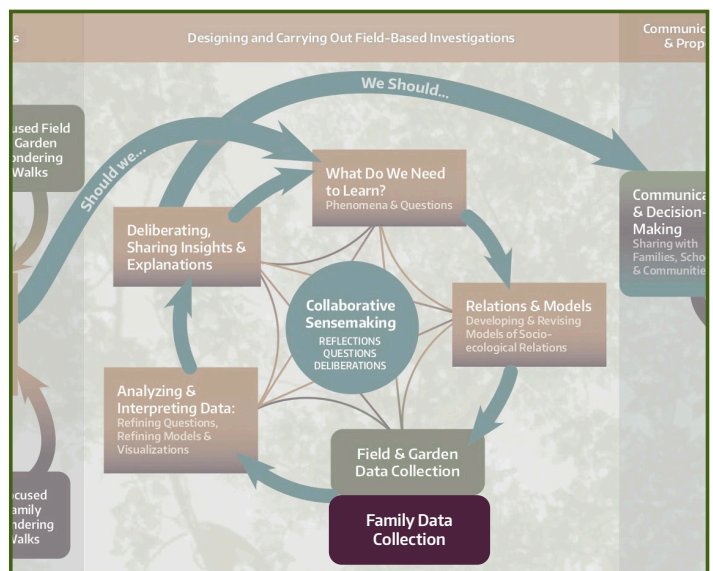
Connection to Science Processes and Sensemaking

Everyone “should have opportunities to plan and carry out several different kinds of investigations.... At all levels, [people] should engage in investigations...in order to expose an issue or question”. (NRC Framework, 2012, p. 61)

Science Practices Emphasized


- Planning and carrying out scientific investigations
- Obtaining, evaluating, and communicating information

YOUR PLACE IN THE SEASONAL STORYLINE



Biodiversity – Invertebrate (Critters) Tally Sheet

We are going to explore the *biodiversity* of invertebrates--critters like bugs, worms, and snails--living in a specific area!

 <p>Field Based Investigations</p>	<p>Use this tool if you are interested in asking investigation questions like:</p> <ol style="list-style-type: none"> 1. How do the kinds and numbers of invertebrates change if I check in an area that is covered with leaf litter and not covered with leaf litter? 2. How do the kinds and numbers of invertebrates change when it's rainy vs. when it's sunny? 3. How many of the same kinds of invertebrates are there near my house vs. near my school? 	<p>You can use this tool either on its own to explore investigation questions like these, or as part of exploring your “Should We” question. Get your family outside to investigate your neighborhood!</p>
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Why is biodiversity important to socio-ecological systems?

Biodiversity, or the *variety of plants and animals in an ecosystem*, is important in complex systems because all parts of the system are connected in some way. Making decisions that can affect the biodiversity in systems that we are part of is important for humans to think about whenever we make changes to our ecosystems.

Connect to your “Should We question”: Why does biodiversity matter to my neighborhood?

”Should We” questions like “Should we plant a garden?” or “Should we let our cat roam free outdoors?” or “Should we rake the leaves or keep them on the ground?” all have to do with biodiversity in some way. For example, if you wonder if you should rake the leaves, you might want to know who lives in, around, and underneath leaf litter in order to answer that question. In this way, you could use this critter count tool to investigate the *biodiversity* in areas with leaf cover and without leaf cover.

The investigation question we are asking is: _____

The should-we question we are exploring is: _____

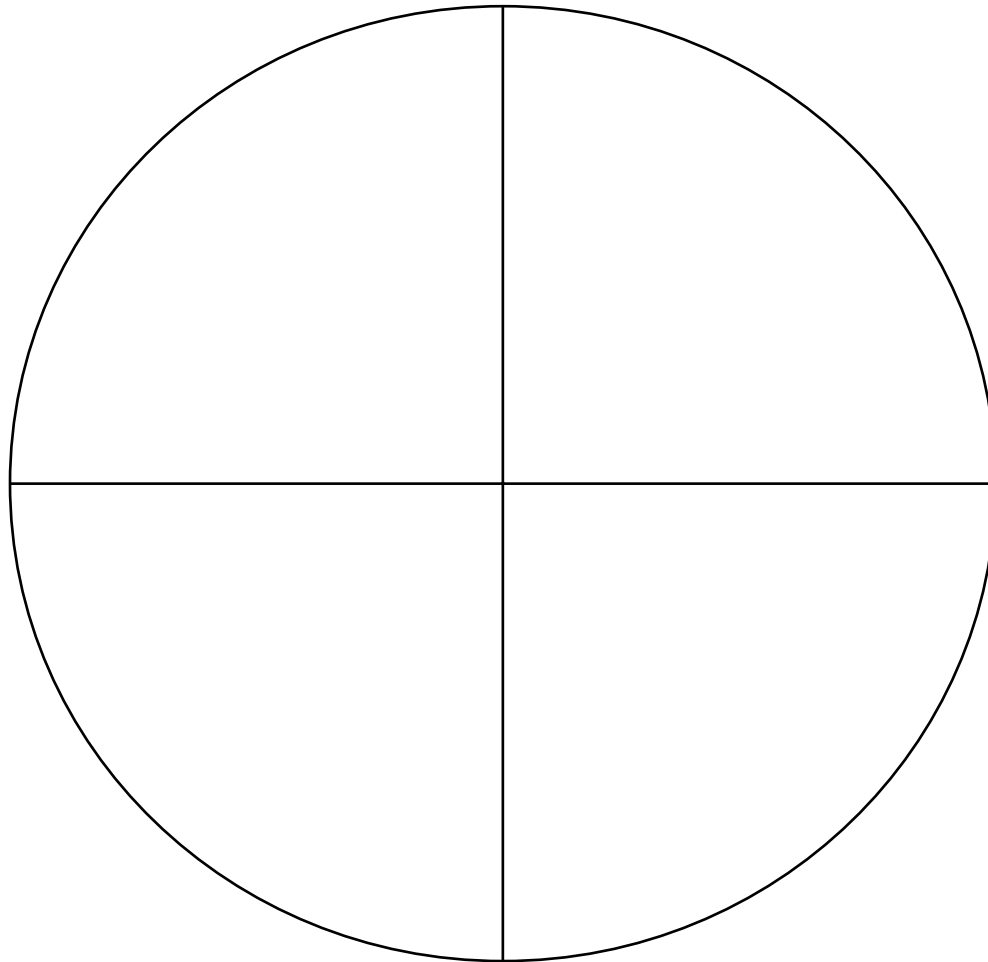
Materials needed:	Directions:
<ul style="list-style-type: none"> <input type="checkbox"/> hula hoop, string (at least 2 feet long), or some other way to mark a spot to observe <input type="checkbox"/> pencil <input type="checkbox"/> blank paper or the next two pages 	<p>Part 1:</p> <ol style="list-style-type: none"> 1. Place your hula hoop down in Location 1. 2. If there is leaf litter on your spot, you can <i>gently</i> move it aside. 3. In the circle draw what you see in your hula hoop, include plants, animals, rocks, etc. <p>Part 2:</p> <ol style="list-style-type: none"> 4. In the table, write or draw the invertebrates – critters – that you find and tally how many of them you find. 5. Gently place your leaf litter back where it was. <p>Part 3:</p> <ol style="list-style-type: none"> 6. Repeat steps 1-5. Depending on the question you’re asking, you might repeat your observation in another place or in the same place at another time. <ul style="list-style-type: none"> ○ All scientists repeat their observations so that they can say whether what they’re seeing is unique to one place or time.



Part 1

Date _____ Weather _____

Draw what you see in your hula hoop!




What questions do you have about what you found?



Critter Count

Part 2		Part 3	
<input type="checkbox"/> Location 1 or <input type="checkbox"/> Time 1: _____		<input type="checkbox"/> Location 2 or <input type="checkbox"/> Time 2: _____	
What did I find? (<i>draw or write</i>)	How many? (tally marks)	What did I find? (<i>draw or write</i>)	How many? (tally marks)

Soil Data Collection

 <p>Field Based Investigations</p>	<p>Use this tool if you are interested in asking investigation questions like:</p> <ol style="list-style-type: none"> 1. What is the soil like in and around our neighborhoods and gardens? 2. What kinds of relationships can we observe in the soil? 3. How have humans shaped what kinds of soil and relationships we can observe? 	<p>We will gather data about:</p> <ol style="list-style-type: none"> 1. what is above, around, and below our soil: relationships to other animals, plants, rocks, and elements 2. how much water our soil holds: moisture content 3. temperature of the soil at different depths
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Why is soil important to socioecological systems?: One important role that soil plays is to store water and nutrients for plants. Sometimes other plants, like mushrooms, and animals (like worms) who live in soil help to make nutrients by breaking down dead things (decomposition). Different plants and animals need different amounts of water and nutrients stored in the soil. Soil temperature also helps plants know when to transition into different parts of their seasonal cycle, like when to bud in the spring, fruit in the summer, or get ready for dormancy in the fall - this is called phenophase.

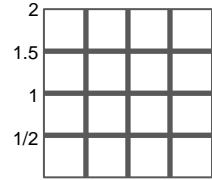
Why does soil matter to my neighborhood--connecting to our “Should We” questions:

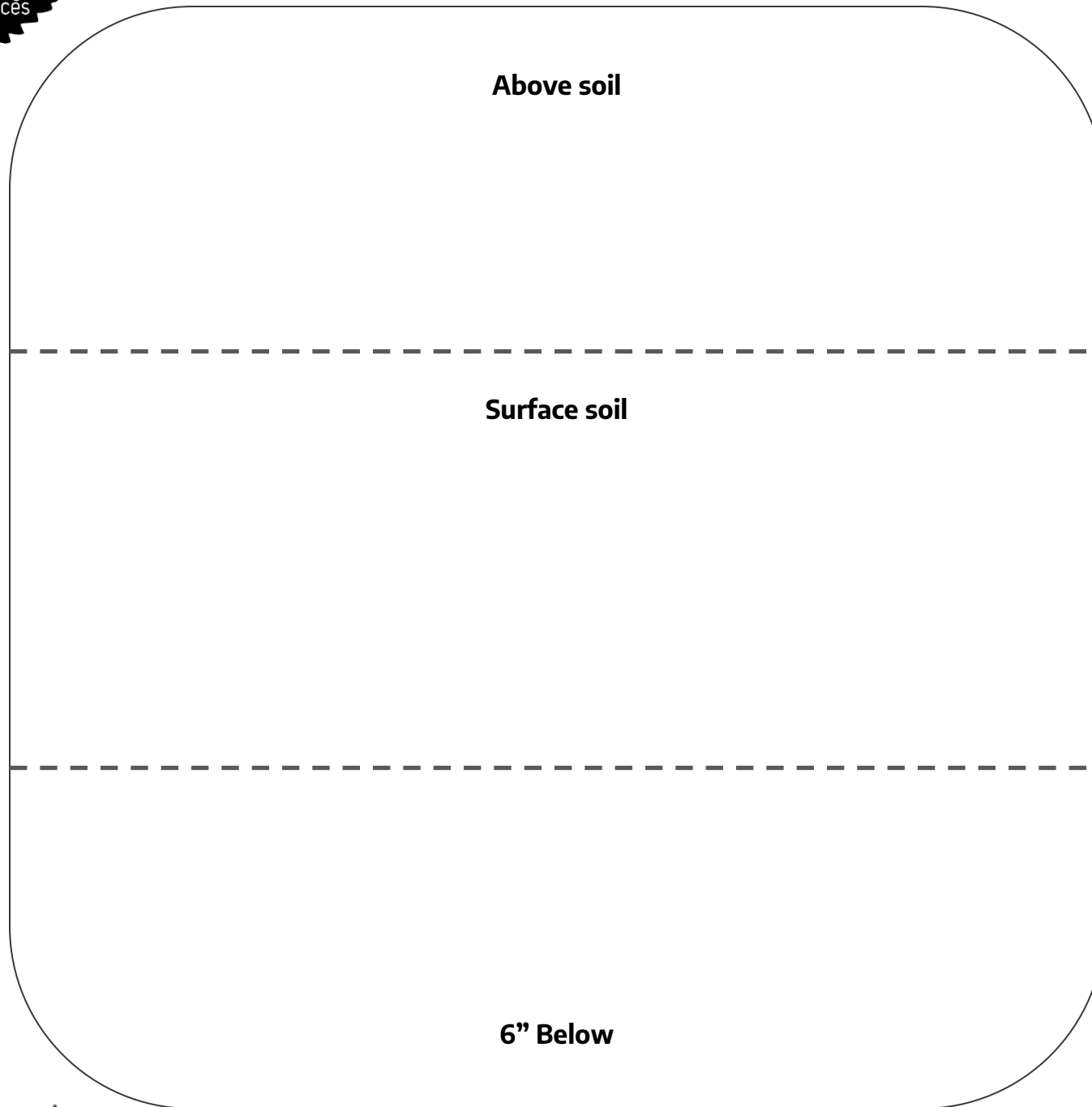
“Should we” questions like “Should we plant a garden” or “Should we rake the leaves or keep them on the ground” or “Should we grow grass in our parks” are all related to soil and soil health. For example, growing and mowing grass does not usually contribute to decomposition and give nutrients back to the soil. It may lead to other “should we” questions about using fertilizer to help continue the health of soil and growth of grass. You may want to study what you find in the soil of a grassy lawn and compare it to the soil of a garden, under a tree, or a forest. Are there differences in temperature, moisture, or in the diversity of root systems and critters?

The investigation question we are asking is: _____

The “Should We” question we are exploring is: _____

Materials needed:	Directions:
<ul style="list-style-type: none"> <input type="checkbox"/> Something to dig with: a small shovel, trowel, cup, etc. <input type="checkbox"/> ruler <input type="checkbox"/> paper towel <input type="checkbox"/> pencil <input type="checkbox"/> colored pencils or markers <input type="checkbox"/> this sheet or blank paper <input type="checkbox"/> <i>Optional:</i> thermometer 	<p>Cut out a 2x2" square of paper towel and draw lines every ½" to make a grid on it</p> <p>Find a place where you can dig deep into the ground (at least 6 inches).</p> <p>Above</p> <ul style="list-style-type: none"> ❖ Observe what is above the soil using all your senses. Draw or write this in "above soil" section ❖ If you have a thermometer: Record the air temperature <p>Surface</p> <ul style="list-style-type: none"> ❖ Observe the top layer (or surface) of the soil. You may need to gently move leaf litter. Draw or write this in the "surface soil" section. ❖ If you have a thermometer: stick the thermometer about 1 inch into the soil and record the temperature <p>6 inches below</p> <ul style="list-style-type: none"> ❖ Dig a hole about 6 inches deep with your shovel or trowel. Draw or write what you find in the "6" below" section. ❖ Using the 2"x2" paper towel, gently but firmly press the paper towel into the hole you've dug so that all of it is evenly pressed on the soil. Be careful not to press so hard you rip the paper towel. Count to "5 Mississippi" slowly, trying to be as even as you can. Lift out the paper towel to see how much water it soaked up – this is called absorption. How many squares are wet? Using your pencil/colored pencil color in the corresponding squares on your data collection sheet.





Air Temperature

Surface Soil
Temperature

Soil Temperature
at 6"

Soil Moisture Absorption

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. You may have already talked to these people in earlier LEs. 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

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 question 1 here]	[Write the answer to question 1 here]
[Write question 2 here]	[Write the answer to question 2 here]
[Write question 3 here]	[Write the answer to question 3 here]
[Write question 4 here]	[Write the answer to question 4 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.

Finding Out What Others Already Know 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!

Keeping your research organized

As you do your research, it’s important to keep your information organized, and to remember where you found the information! You can use a table like the one below to organize your information:

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

What do you do next?

Remember that you’ll be doing a combination of field-based investigations (LE 7.A), community-based research (LE 7.B), and internet/book research (LE 7.c). Once you’ve done some research, you can go to LEs 8 and 9 to find some patterns across all of the data you’ve collected across all of your research. This will help you decide what your next steps are: either to do more investigations or to move to LE10 to take action on your “Should We” question.