

Overview: Sharing Insights and Explanations

You and your students are now deeply engaged in exploring your class's "Should We" question. Along with students and their families, you have now conducted a series of investigations, made models to explain phenomena, and identified patterns in your data. It is now time to share claims from the evidence that you have, and to **deliberate** about what the evidence is telling you around your class's "Should We" question. At this point in the Seasonal Storyline, the data may even be contradictory. This is where **deliberation** comes in and the class considers: what ethical and relational values are guiding our thinking? How does that relate to what the evidence is telling us? It is quite possible that your class will decide that you don't yet have enough evidence to decide what action to take around your "Should We" question, in which case, you can return to LE 7 and do more investigations. In fact, you probably won't be able to make a decision about your "Should We" question with just one round of investigations. Remember, this is an iterative process!

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

Asking "what should we do," and deliberating in order to make a decision is something that all people do everyday. Deliberations and decisions can be informed by personal experience, values and beliefs, cultural norms, social networks, and evidence from a myriad of other sources. In field-based science, deliberating and then making decisions involves utilizing knowledge, clarifying values and goals, and exploring potential impacts on humans and more-thanhumans, at micro and macro scales, across multiple timescales, and from powered positions. "Should We" questions require deliberation and action even with uncertainty. "Should We" questions require that we think about power and historicity as part of our deliberations and decision making.



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LE 9 LEARNING GOALS

In LE9, students are focused on reflecting on their knowledge so far, based on outdoor fieldbased investigations at school and in their neighborhoods, community interviews, and other research (like finding information in a book or by listening to a podcast). They will form initial recommendations around their "Should We" questions and list the evidence they have for their thinking. The lessons in LE9 will set students up for either returning to LE 7 to gather more data and conduct more investigations, or move on to LE 10 to publicly share their deliberations and decisionmaking. Specifically, students will be able to

- 1. construct evidence-based explanations for phenomena that they investigated in LE 7 and patterns that they saw in their data from LE8.
- 2. understand that thorough explanations and decisions around "ShouldWe" questions should be supported by at least three sources of evidence.
- 3. understand that our ideas can change after collecting more data, hearing insights and explanations from other scientists, and examining our own and our families' values.

CONNECTIONS TO NGSS

 » Crosscutting Concepts:
 Patterns; Cause and Effect; Scale; Systems and System Models, Energy & Matter Structure and Function; Stability and Change
 (NOTE: several of these might apply depending on the focal phenomena)

» Science Practices:

Obtaining, Evaluating, and Communicating Information, Analyzing and Interpreting Data, Constructing explanations, Engaging in argument from evidence, Developing and Using Models

» 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 and investigations you and students chose.]

Learning Engagement in LE9

Learning Engagement 9 has one lesson:

LE 9.1 Sharing initial decisions and explanations: In this lesson, students reflect on the status of their progress towards exploring their "Should We" questions. Students come up with their best decisions around actions they should take around their "Should-We" questions so far, and list the corresponding evidence that they have for those decisions. They explore questions such as "What are the data suggesting that we should do, and why? Do we have enough information to make a decision? Did we include all of the important perspectives and voices in our research? If not, what should we do next? What questions do we still need to answer in order to make a decision?"





Engaging the Rhizome

Complex Socio-Ecological Systems: LE9 engages students in considering what knowledges are important in making decisions about actions they can take around their "Should We" questions. "Should We" questions ask us to think about scales of time, including seasons, and processes of change. They ask us to take on others' perspectives and ask, "who would we help with our decision? Who might we harm?" "Should We" questions require deliberation and action even with uncertainty.

Field-based science Learning: LE9 engages students in forming evidence-based explanations, which is a core Science and Engineering practice in the Next Generation Science Standards and a core practice of scientists. Three key features of explanations are (McNeil, et al, 2017, p. 210):

- 1. Explanations offer a plausible answer to a question about a phenomenon
- 2. Explanations include a how or why account that draws on a scientific model or generalized principles that use disciplinary core ideas
- 3. Explanations are based on evidence.

In their work so far in the seasonal storyline, students have an abundance of information and data. They now need to put all of that together to share those insights and explanations with other scientists in their class to see how complete their explanations are. **Culture, families, and communities**: In LE9, students are asked to consider evidence from a variety of sources, including investigations done in students' neighborhoods with their families and in their communities. Students are also asked to deliberate around what actions they might take around their "Should We" questions--and what kinds of values, evidence, and relations drive those actions. These include family and community knowledge and practices, as well as family and community connections to place.



Power and Historicity:

We are always making decisions from contexts of power and historicity. For example, we could choose a human-dominant perspective when deciding what action to take around the "Should We" question, or we could choose to consider more-than-human perspectives as we decide. 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.







LE9.1: Sharing initial decisions and explanations

Purpose

In this lesson, students reflect on the status of their progress towards exploring their "Should We" questions. Students come up with their best decisions for actions they should take around their "Should-We" questions so far, and list the corresponding evidence that they have for those decisions. They explore questions such as "What are the data suggesting we should do and why? Do we have enough information to make a decision? Did we include all of the important perspectives and voices in our research? If not, what should we do next? What questions do we still need to answer in order to make a decision?" Students also reflect on what they should be considering but are not yet—who is left out of our decision? Who should we include?

Why this is important

Human communities have always made socio-ecological decisions. From choices about what to eat, where to live, how to get around, to whether water is safe to drink, amongst many others. These choices are shaped by our values and cultural practices and fundamentally reflect what we call construals of nature-culture relations. Nature-cultural relations are the ways human communities construct their ways of thinking and being (everyday, institutional, legal, etc.) with the natural world. Importantly, these relational construals have changed over time for different communities, and are often shaped by the technologies and uses of energy that have become central to human life in some parts of the world. Since the industrial revolution there has been global scale change to practices of extraction and large scale agriculture, amongst other things. These changes significantly impact nature-culture relations in many places in the world, but are having heightened impacts in what is known as "climate change hotspots". These changes have a pronounced correlation with the development of nation-states, capitalism and the histories and power dynamics that created them, and continue to.

Engaging family and community knowledge and practices

In this lesson, students consider evidence from a variety of sources, including investigations done in students' neighborhoods with their families and in their communities. Students are also asked to deliberate on what actions they might take around their "Should We" questions—and what kinds of values, evidence, and relations drive those actions. These include family and community knowledge and practices, as well as family and community connections to place.



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LEARNING GOALS

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

- Use patterns and explanations from LE8 as evidence for decisions and actions to take around the "Should We" question.
- 2. Deliberate about socioecological decisions and actions even with incomplete information. This includes articulating family, cultural, and community values that drive their decision-making.
- 3. Reflect on the status of their knowledge so far around their "Should We" question.
- 4. Construct new questions to investigate related to any knowledge gaps that they identify.

CONNECTIONS TO NGSS

- Crosscutting Concepts: Patterns; Cause and Effect; Scale; Systems and System Models, Energy & Matter Structure and Function; Stability and Change [NOTE: several of these might apply depending on the focal phenomena]
 Science Practices:
- Obtaining, Evaluating, and Communicating Information, Analyzing and Interpreting Data, Constructing explanations, Engaging in argument from evidence
- » 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 choose.]

ASSESSMENT OPPORTUNITIES

- » LE9.1b: the ways in which students use patterns from their data across multiple sources to back up their initial decisions
- Student talk (observations they make, questions they ask, wonderings they voice) during the small group discussions
- Whole-group discussions around initial decisions, reflections on their knowledge so far, new questions that are raised

To prepare for this lesson

It will be important for you to review the explanations and evidence generated in LE8 and come up with your own initial decisions around the class's "Should We" questions based on those explanations and the evidence for them. Also, try to fill out the graphic organizers in LE9.1b and 9.1c. That way, you'll be able to anticipate missing pieces that the students might identify, as well as next steps that you might encourage students to take to come to a decision around their "Should We" question.

The Ethical Deliberation and Decision-Making in Socio-ecological Systems Framework and the Wonderings, "Should we", and Investigation Questions in Field-Based Science Framework will both be good references for you as you prepare for this lesson.





Teacher background information

We are living in an unprecedented time in human history–what has been named the Anthropocene. The Anthropocene is a new geological era in which human activity is fundamentally reshaping earth processes– and unfortunately in ways that are having devastating and cascading effects for the social and ecological arrangements of life on earth. However, these impacts are heavily mediated by powered differences across history. For example, many climate change hotspots are not places or communities that are reflective of the technologies or societal structure and uses of energy that created the Anthropocene. While humans have entered this era perhaps unintentionally through development, inventions, and a range of other factors, there are many critically important lessons to be learned. A key skill for coming generations will be to engage in forms of sensemaking, deliberation and decision-making about social-ecological systems that can hold the complexity of the challenges and possibilities in front of us to restore and develop just and sustainable nature-culture relations that support our collective adaptive capacities in the changing earth.

Centering equitable practices

- Make decision-making visible: Avoid making complexity in decision-making invisible. We are always
 making decisions from contexts of power and historicity. For example, we could choose a humandominant perspective when deciding what action to take around the "Should We" question, or we
 could choose to consider more-than-human perspectives as we decide. 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. When you make underlying assumptions visible to students, they become
 more nuanced and ethical decision-makers. There are several ways that this lesson makes
 decision-making visible:
 - Reflecting on the evidence base for decision-making-and what might still be missing
 - Reflecting on which values are driving decision-making—and what other values might be left out
 - \cdot Taking the perspective of others and considering who the decision benefits and who it does not
- **Encourage more-than-human perspective taking:** Avoid describing ecosystems only in terms of how ecosystems are useful for humans. In order to engage in ethical deliberation and decision-making about places, we need to support students in taking the perspective of more-than-humans in natural systems. How is this decision good for the trees? How is this place good for the worms? for the soil? Beginning to ask these questions will encourage students to take on broader perspectives when engaging in ethical deliberation and decision-making around ecosystems.
- Encourage human connections to ecosystems: Avoid positioning humans as disconnected or apartfrom nature. This learning engagement encourages thinking about connections between humans and the rest of the natural world and starting from assumptions of complex interdependence instead of human-centric or dominance.



MATERIALS

- » Explanations and evidence from LE8.2
- » Student sheet LE9.1a: Initial decisions around our "Should We" question
- » Graphic organizer 9.1b: Our class's initial decisions around our "Should We" question
- » Graphic organizer 9.1C: What should we consider when deciding on our "Should We" question?

Instructional Sequence

- Begin the lesson by reviewing some of the key evidence-based explanations that students formed in LE8.2. Review with students that they just completed investigations in the field (outside) both in their neighborhoods and around the school, with community members, and on the internet/in books. Remind them that they found patterns in those data and formed some explanations based on evidence from those data about their focal phenomena.
- 2. Ask students: What was the "Should We" question that we were exploring through our investigations?
- 3. Explain to students that in this lesson, they will be putting the pieces together to see if they are ready to make a decision about what to do about their "Should We" question. Show LE9.1a: Initial decisions around our "Should We" question on the doc cam. Model for students that, in small groups, they will be making some initial decisions about actions they can take around the "Should We" question. They should come up with at least one action they SHOULD do and one action they SHOULD NOT do. The most important aspect of this should be their "because" statement—and that should be based on what they found in their field-based, community, and other research.
- 4. Hand out **LE9.1a: Initial decisions around our "Should We" question** and allow groups of students to discuss. As you circulate around the room, some questions you can ask are:
 - a. What did we find in our field-based research that makes you think we should/should not do that?
 - b. How did our community-based research help you think about this?
 - c. What did you find in our book/internet research that helps you decide that?
 - d. Is there anything else that we're not considering yet? What else would you want to know?

Class deliberation and decision-making

5. Gather the class back together and show **LE9.1b graphic organizer** as a way to record students' sharing of initial decisions and reasons from the three types of research that they conducted and analyzed in LEs 7 and 8.







Having evidence to support decisions is a form of arguing from evidence.

Assessment Opporunity:

Listening to students' initial decisions will give you an idea of the sense they are making from the data.

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- 6. Ask students: what do you think we should do? Why? Record students' ideas.
- 7. Ask students: what do you think we should NOT do? Why? Record students' ideas.
- 8. As students share, be sure to ask them for their reasons for why they think we should or should not do a certain action, and these reasons should be grounded in the research they conducted. Ask students: why do you think that? What did our evidence from our research tell us?

What is missing in our decision-making?

- 9. Now show students LE9.1C graphic organizer and remind them of the 5 socio-ecological dimensions that we first explored in LE2.3. Explain to students that because our "Should We" question is about a place, and places have lots of different aspects to them, and we need to make sure we're considering how our decision might have an affect on different spects of a place and system, including who else might be affected, how the natural world might be affected, what values drive our decisions, and what evidence is most important to consider. We want to make sure that we haven't missed an important aspect of our question as we try to make a decision.
 - a. You can either keep this as a whole class discussion or ask students to break up into small groups and each take a column of the graphic organizer. The point of this activity is for students to reflect on the evidence that they considered and listed in LE9.1b graphic organizer and see if there are any aspects of socio-ecological systems that they are missing.
 - b. Finally, talk as a class about which **values** are driving their decisionmaking at this time, and who their decision benefits or hurts. It is important for students to see that, along with scientific evidence, our family and community values always affect our decision-making, and that our decisions always have consequences for different human and more-than-human communities.

What questions do we have now?

- 10. Explain to students: it seems like we have some evidence telling us that we should take certain actions, and some evidence telling us that we should NOT take other actions. We have also identified some aspects of our question that we might need to know more about or include in our decision-making. What other questions do we have now that could help us be more sure about which decision to make? What else do we need to know? How should we gather that information? Are we ready to make a final decision?
 - a. If the class feels ready, move on to LE10
 - b. If the class feels like they need more information, go back to LE6.1 to revise their models and ask more questions.

Assessment Opporunity: Asking students for evidence to back up their decisions is a way for you see how they are constructing arguments from evidence.

Considering decisions from multiple viewpoints and reflecting on who is left out of decision-making is a step towards ethical deliberation and justice-oriented methods for research and decision-making.

Making visible the familial, cultural, and communitybased values that drive decision-making is an important step in supporting students' identities as decision-makers in science.

Evaluating the state of one's knowledge and deciding on next steps of an investigation are key scientific practices.

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- 11. If the class moves back to LE6.1 to revise their models, you can remind them of the three kinds of revisions outline in LE6.1:
 - **a. Digging Deeper:** Sometimes we revise our models to get more specific about our phenomenon or questions.
 - **b.** Facing the Sun: Sometimes, like plants moving to chase the sun, we shift our thinking as we observe and make sense of our observations. We can often shift our thinking when we observe the same phenomenon from a different perspective.
 - c. New Growth: we want to add new information learned from our various resources; such as what plants attract different species of pollinators, what we learned about snags from an arborist, or from our tally observations, the different kinds of animals that use cone trees.
- 12. Ask students: what kinds of revisions will we be making? Do we have more specific information about something we have on our models? Are we seeing things differently now and do we need to add a new perspective? Do we have new information to add?
 - a. Use the procedures in LE6.1 to revise students' models.
 - b. Using their models, students should identify new questions they have and conduct more investigations.



Make sure to emphasize to students that the "because" is a very important part of their decision! And it should be based in the evidence from their investigations.

LE 9.1a Initial decisions around our "Should We" question - Student Tool

LE9.1a Initial decisions around our "Should we" Question

Overview: At this point you have done investigations and shared patterns with peers. We are going to try to make some decisions around our "Should we" question based on the evidence we have so far.

| Decision about our Should we Question so far | Evidence for this decision |
|--|---|
| We should because | From our field-based investigations at school and in our neighborhoods: |
| | From community-based interviews |
| | From other sources: |
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| | It is important to emphasize from all three kinds of research is imporant in other words, the field-based investigations are not more imporant than the community-based interviews, for examples. |



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LE 9.1a Initial decisions around our "Should We" question - Student Tool

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| Decision about our Should we Question so far | Evidence for this decision |
|---|---|
| We should | Service our field-bacod invactionations at school and in our noidbhorboods. |
| because | FIOIII dur Heid-based Investigations at school and in our heighborhoods. |
| | |
| | From community-based interviews |
| | |
| | From other sources: |
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LE 9.1a Initial decisions around our "Should We" question - Student Tool

| From other sources: | From community-based interviews: | We should NOT because From our field-based investigations at school a |
|---------------------|----------------------------------|--|
| | erviews: | tigations at school and in our neighborhoods: |

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| | because | We should |
|-------------------------------|--------------|--|
| Evidence for this decision | stion so far | Decision about our Should We que |
| ound our "Should We" question | ion is: | LE9.1b Class Graphic ou Our "Should We" quest |
| | | |

LE 9.1b Class initial decisions around our "Should We" question - Graphic organizer

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LE 9.1b Class initial decisions around our "Should We" question - Graphic organizer

Ν

| We should | | | | | | |
|---------------------------------|-------------------------------------|---|---|--|---|---|
| Why do we need to decide? | What values are we using? | How do places we live in impact our decision? | 1. How does the natural world impact this decision? 2. How is the natural world impacted by this decision? | What options did we consider? Why was this the best decision to make? | Who else is impacted by the decision? How are they impacted? | How doe decisi impact the fut |
| | | | | | | |
| What data ar | nd evidence are | we using to de | cide? | - | | |
| Who has the | power to make | this change? W | /hy? | | | |

LE 9.1c Graphic organizer: What else should we consider when deciding on our "Should We" question?

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decision? Are we ready to make our final recommendation? What questions do we have now? What do we need to know more about in order to make our

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