Learning Frameworks

Complex Socio-Ecological Systems

Why is learning about complex socio-ecological systems important?

All social and ecological systems interact in a complex web of relations across time and place. These are referred to as socio-ecological systems. Understanding complex socio-ecological systems is increasingly important in a world that is socially and ecologically shifting at rapid rates. For example, it is important for people to be able to reason about patterns in the Earth's climate or diversity of life. Systems reasoning, or being able to understand properties and behaviors of systems, is an academic demand in science learning environments but also increasingly a demand of everyday communal life as we use information to make decisions, respond to and solve problems related to contemporary, complex problems such as climate change and the spread of infectious diseases.

This framework provides an overview of the dimensions of socio-ecological systems, and the types of reasoning that facilitate complex systems sensemaking. Previous research has claimed that systems sensemaking was too hard for novices, leading to models of science education that simplified concepts into linear and hierarchical relationships. However, more recent research has demonstrated that there is cultural variation in how people understand and make decisions about socio-ecological systems. Importantly, learners can understand and reason about complexity from a young age (early elementary or younger!). Designing instruction with the right scaffolds can support learners to sensemake, deliberate, and make decisions about socio-ecological phenomena in ethical and rigorous ways. This includes fostering multiple types of reasoning and integrating family and cultural knowledges and practices.

Features of complex socio-ecological systems

Complex systems, such as the Earth's climate, food webs, or the human nervous system behave in web-like organization (as distinct from linear chains), have emergent properties, and are self-organizing across time and space. Complex ecological systems, such as a coral reef or forest, refer to natural systems and the dense web of relationships and interactions of which they are comprised. *Social* systems refer to human systems, such as cultural communities, economies, and governments. *Complex socio-ecological* systems bring these different systems and their interactions in focus and consider the relationships between human systems and ecological systems.

Complex socio-ecological systems are dynamic, continuously adapting systems that are comprised of a wide range of factors (such as natural, socioeconomic, and cultural factors) and relations that exist and interact across multiple *spatial, temporal, and organizational* scales. In other words, a complex socio-ecological system can span across time and places–from momentary interactions in one place, to large-scale processes that span geologic eras and global events. For example we are living in a geological era known as the Anthropocene, in which humans are having a huge effect on climate and ecological systems. This era has a long time scale–events and decisions in the past have impacts that are far reaching into the future and across the globe. At a small scale, this impacts our day to day lives, and in turn, our daily decisions contribute to these global processes.

As in all complex systems, socio-ecological systems do not have one, central organizing mechanism. Instead, they consist of multiple, dynamically-interacting actors and forces. Interactions and relations among parts of a socio-ecological system produce emergent behaviors. For instance, when a set of relationships reach a certain threshold, the result is a phenomenon that is greater than the sum of its parts. For example, a decision made by an individual, like buying seasonal produce, can have a small impact, but that decision made by a large number of people can have a huge impact. Similarly, a small decision made by a large company or institution can have a large impact. Supporting learning about these different scales and understanding what makes different scales unique is important for learning. For example, learning the behavior of singular agent, like a beaver (e.g. the cutting of trees or its impacts on a singular river bank) verses studying the impacts of a species in the aggregate, like beavers across a watershed (e.g. critically important role in water storage and seasonal flows) leads to very different insights. These multiplicities can pose challenges and are important to support in learning environments through scaffolds and representations. Further, the multiple parts of a complex system interact in both direct and indirect "feedback loops"–when a change in a particular variable has an effect on that variable and scale, as well as other parts of the system and can manifest at a different scale. Another important feature of complex socio-ecological systems is that because they are non-central and non-linear, they have their own "memory", or historicity. Events and phenomena that occurred in the past always live on in the system, and whether it plays a dormant or active role depends on power.

How to use this framework

Learner Sense-Making: Use this framework to scaffold learner sensemaking across multiple dimensions of socio-ecological systems. Support learners to engage in multiple forms of reasoning, depending on the phenomenon of interest. Make connections to family and cultural knowledges and practices, and to reflect on the (many) socio-ecological systems that are part of their lives.

Collaborative Practice: Socio-ecological systems span across multiple communities, places, and time scales. Model complex socio-ecological systems sensemaking by collaborating with other multiple stakeholders who are part of a given socio-ecological system; this includes: educators, families, and community members, and so on.

Planning and Implementation: Place walks, researching histories of places, and learning about local and global impacts of decisions are important ways to plan for learning and instruction about socio-ecological systems. Additionally, make heterogeneous (diverse) perspectives central in the learning environment by connecting to learners' lived experiences and family and cultural knowledges and practices.

Educator Reflection: Reflect on the multiple (and often intersecting) socio-ecological systems that you are connected to. Think about how your role intersects with the roles of learners' and their families. For example, how did you facilitate sensemaking using multiple types of reasoning, or about the behaviors and functions of species and kinds within socio-ecological systems?

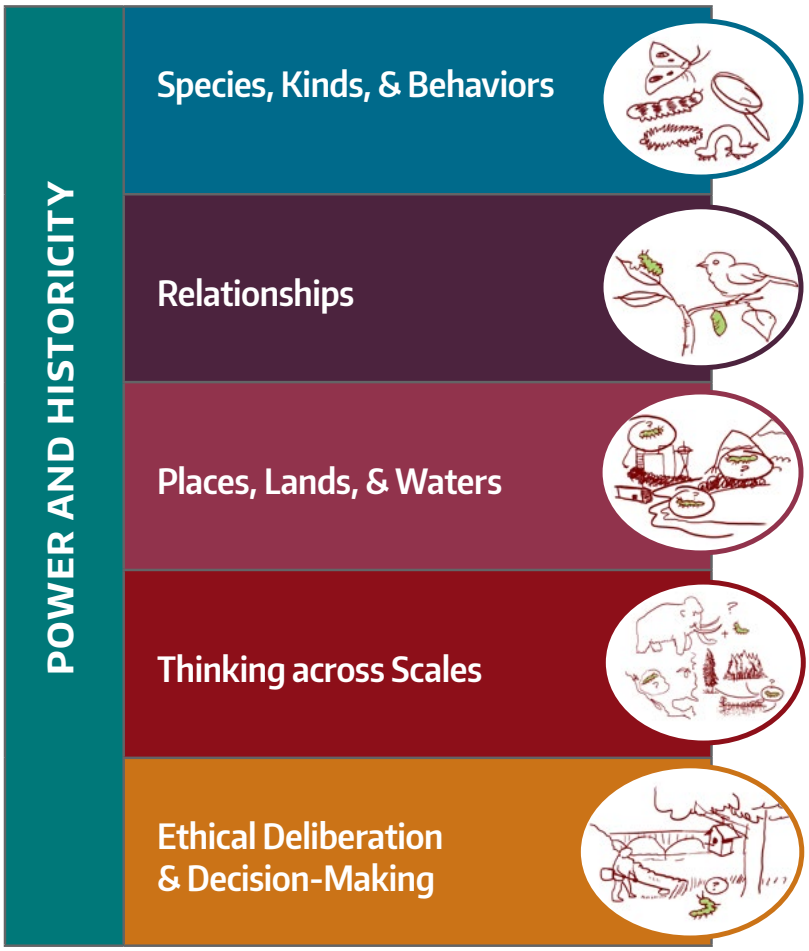
Co-Design and Assessment: Use this framework to guide co-planning with other educators, families, and communities to foster socio-ecological systems thinking. Also, use this framework to guide formative assessments that help you understand how learners are sense-making across multiple scales, about the interdependent relationships among species and kinds, and connections to places and lands and waters. Assess if and how sensemaking and deliberations led to ethical decision-making about socio-ecological systems.

Connections to expert thinking:

Scientists studying plastic in the environment have found that nearly every living organism on Earth has some amount of microplastics in their body. These findings highlight the vast interconnections of socio-ecological systems. In this research, scientists are engaging in many forms of complex systems reasoning in order to trace the production and flows of plastics in the environment. Toggling between multiple spatial and temporal scales, tracing microplastics has shown that this phenomenon cannot be traced to a central, organizing mechanism. Small daily decisions made by a lot of individuals can accumulate and lead to impacts at a large scale. More importantly, at the same time, decisions made by medium-sized companies and large industries contribute a disproportionate amount of plastics pollution. Moreover, the intricate connections between what happens on land and how that relates to the ocean, as well as complex food webs and climate and ocean patterns all contribute to the movement of microplastics throughout socio-ecological systems. Taken together, the decisions and production of plastics, including devastating extraction methods such as fractions, have reached a point where broken feedback loops (such as the ability of some systems to rebound from disturbances) have reached a threshold in which socio-ecological systems are out of balance.

5 Dimensions of Reasoning About Complex Socio-Ecological Systems

There are many opportunities to connect learners' socio-ecological sensemaking with their lived experiences, interests, cultural practices, and the like. Here are some ways to start:



- **Power and Historicity**
  Power and historicity shape every aspect of socio-ecological systems.
- **Species, Kinds, & Behaviors**
  Species include humans, animals, plants, fungi, etc. Kinds include land, water, air, and soil, etc. Behaviors are the roles, actions, or decisions that species and kinds make within a system.
- **Relationships**
  All socio-ecological systems consist of interdependent relationships among species (including humans), and kinds. Webs of relationships can vary across scales - from agent (individual) to aggregate (population level).
- **Places, Land, and Water**
  The functions (purpose and roles) of socio-ecological systems are intimately tied to places, lands, and waters. Places, lands, and waters shape and are shaped by human and more-than-human behaviors and decisions.
- **Thinking across Scales**
  Socio-ecological systems are dynamic and span across multiple temporal and spatial scales. Sensemaking about socio-ecological systems requires learning about histories of places, observing phenomena in multiple locations, and taking the perspective of others.
- **Ethical Deliberation and Decision-Making**
  Humans have always made, and will continue to make, important daily and large scale decisions that impact socio-ecological systems. Deliberating the impacts of human decisions is a moral and ethical endeavor.

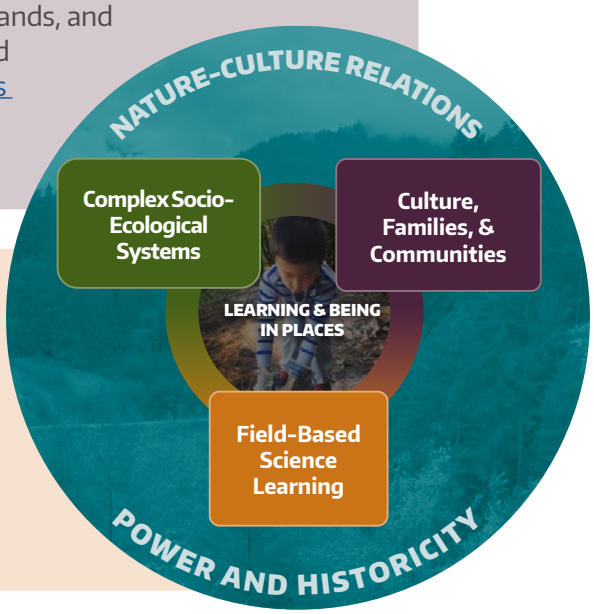
Forms of Reasoning about Socio-Ecological Systems

The list below provides sample types of relational reasoning that support sensemaking about socio-ecological systems. The goal is for learners to engage in *multiple* forms of reasoning. Educators can foster this over time and across activities. The list is not exhaustive, but meant to highlight what learners are already doing, and what can be scaffolded.

Different Forms of Reasoning for Complexity	
Relational	**Chain-Like Relationships** start with 1-1 then extend into chains that follow a linear relationship (e.g., fly - frog - snake; or succession of trees in an ecosystem). This is particularly helpful to support making predictions.
	Weblike Relationships among 3 or more organisms/kinds whose relationship is not linear (e.g., eagles, bears, and humans eat salmon, and trees absorb nitrogen from salmon die-off). This is helpful to support reasoning across different spatial and temporal scales.
Analogic	Reasoning that relies on an analogy to compare similarities across two or more entities. Finding the limits of similarities is often also a helpful aspect of analogical reasoning. Analogical reasoning is a robust and helpful form of sensemaking. This type of reasoning can support many different aspects of complex socio-ecological systems reasoning, like exploring **functions and roles of species or kinds** within a socio-ecological system. For example, bioengineers have specific relationships with land and/or waters and many different organisms perform this bioengineering role including humans, beavers, bees, ants, etc).
Perspectival	Taking the perspective of others in order to make sense of behaviors or functions of different parts of a system. This includes taking the perspective of more than humans! For example, reasoning about the **impacts of human decisions** on human and more-than-human relationships requires considering conflicting perspectives about positive, neutral, or negative impacts to different relationships.
Toggling	Thinking with at least two scales at a time (could be temporal, spatial, agent/aggregate, relational, etc) or holding complementary/contrasting perspectives. In complex systems reasoning, it is important to toggle across scales because these systems e*xist at multiple scales and a change at one scale can lead to unpredictable or nonlinear changes at another level.* Any given place, phenomenon, or event has multiple histories, and connections to phenomena in other places.
Reasoning with Uncertainties	In complex systems decision-making, there are a series of factors and relationships that are seemingly obvious, but making decisions about them is less clear. It is important for learners to think about possible, emergent connections or decisions.
Abductive	Complex systems often require us to use a wide range of observations as foundations for sensemaking and problem solving. We use abductive reasoning when we synthesize our noticings in order to engage in decision making that includes some level or sense of uncertainty.

Connections to the Learning in Places Rhizome:

Culture, Families, and Communities: Complex socio-ecological systems consist of a web of relations that are directly and indirectly tied to places, lands, and waters. These systems span across temporal and spatial scales, and influence and are influenced by family and community knowledges and practices.



Field-Based Science Learning: Field-based science learning can support complex socio-ecological sensemaking. Through scaffolded observations, rigorous data collection across multiple places, times, and with community members, learners can deepen their understanding of components of a system and how those components interact.

Power and Historicity: Power and historicity are deeply embedded in socio-ecological systems. These dynamics shape, and are shaped by, socio-ecological factors and relationships. For example, we are now living in a global age known as the Anthropocene, a time in which human impacts are disproportionately affecting the balance of ecological and social systems. Local and global decisions have led to this era, and are rooted in powered ideas of human supremacy and dominance. Importantly, these decisions have disproportionate impacts on marginalized communities–particularly communities of color. Actively seeking to recognize and dismantle these power imbalances is a critical part of ethical decision-making about socio-ecological phenomena.

Nature-Culture Relations: Sensemaking and decision-making about socio-ecological phenomena varies across cultures. These are deeply impacted by family- and culturally-based conceptions of nature-culture relations, or whether humans are considered part of or apart from the natural world.

Appendices

The following appendices provide examples and other supports to help educators use and then deepen their use of the Complex Socio-Ecological Systems Framework over time. Appendix A is a vignette that showcases one example of how a teacher used this framework. Appendix B contains some example data to highlight how young people engage in socio-ecological sensemaking. Appendix C is a set of educator prompts and questions to scaffold learner sensemaking about socio-ecological systems. Appendix D is a self-assessment that educators can use to think about what practices or concepts related to using and supporting complex socio-ecological systems thinking and reasoning they already engage in, and what practices or concepts they want to learn more about and try out.

APPENDIX A

Vignette: Mr. Jackson's observation walks

PLANNING FOR INSTRUCTION:

Mr. Jackson recently took his kindergarten students on a wondering walk around the school grounds. They walked the perimeter of the school along a city sidewalk where there was a bioswale, a type of green infrastructure designed by transportation planners and engineers in which water is rerouted through landscaped channels instead of going directly from the street into the streams. The kindergarteners, and Mr. Jackson himself, were curious about what this area was and why it was there. The class noticed that there was some water running through the channel, and as they continued on their walk they began to notice other places where water was either flowing or pooled up.

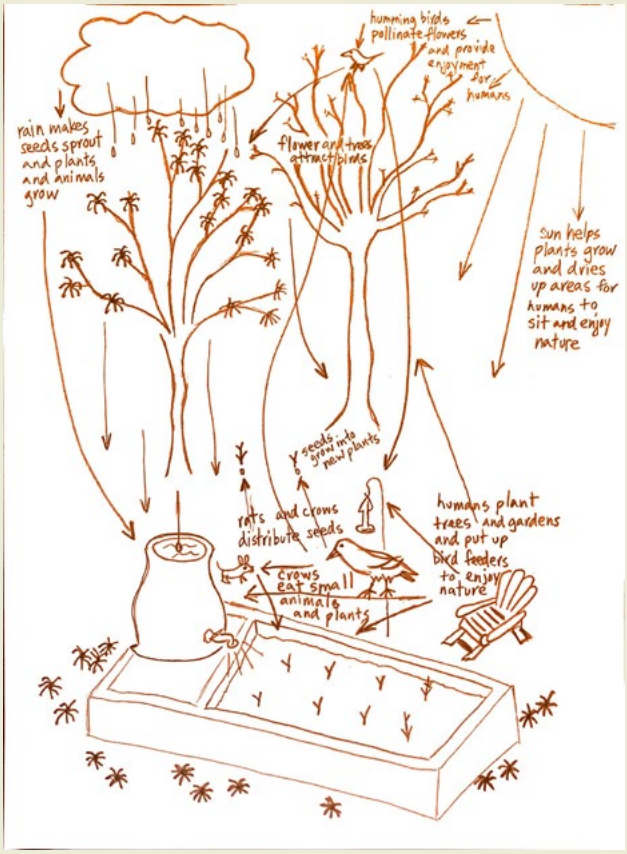
When they returned to the classroom to debrief their walk, many of the students shared observations of either the bioswale or the other places they had noticed water. Mr. Jackson wrote these observations on a whiteboard with simple drawings (like icons) to support students who could not yet read. After the debrief, Mr. Jackson decided to follow up on this line of inquiry - where they were noticing water. Their next field based activity was going to be another observation walk, this time with a shared focus for the entire class. Mr. Jackson wanted the shared focus to be something that emerged from student noticings, and he also wanted to scaffold student observations in a way that supported complex socio-ecological reasoning. Mr. Jackson realized that socio-ecological systems was a broad term, so he decided to focus on **relationships** for this upcoming walk. He revisited the **Relationships Phenomena** in the Complex Socio-Ecological Systems Framework and decided to focus on different base relationships that the class could attend to. To do this, Mr. Jackson would ask or prompt students to **notice where there was water, and who or what water was in relationships with**. Mr. Jackson had done some place-designing prior to taking his students out on a walk, so he decided to do the next walk on another trail along the perimeter of the school overlooking a ravine in an adjacent park.

LAUNCHING INSTRUCTION:

Mr. Jackson launched the second observation walk in the classroom. He revisited what many of the students had noticed in the first walk– water. He told the class that today they were going to focus on water but this time they were going to "observe who or what water was in relationship with" during the walk. He first asked the class to explore what the term "relationship" meant by thinking about the relationships in their own lives. Many students talked about relationships they had with family members or friends, but he also noticed that students talked about relationships that were not human centered. For example, one student shared that she had recently heard a drumming sound on her chimney, and learned that a woodpecker had been drumming on the metal part to make a loud sound. This example reminded Mr. Jackson to introduce the concept of

base relationships that he had read about in the Relationships in Socio-Ecological Systems Framework, such as natural kind (e.g. water to animals or plants). After the students had shared their understanding of the concept, they prepared to go on a walk. Students were arranged in pairs, with one student as the designated recorder (holding a clipboard, pencil, and paper), and one student as the designated reporter (sharing out).

As the students walked outside they were tasked with first observing where they saw water, and then noticing what was **above, around, and/or below** where they saw water. He used his backpocket question guide (Appendix C) to scaffold students' attention to the myriad of relationships that water has with other species and kinds, and encouraged students to **toggle across scales** - an important type of reasoning in socio-ecological sensemaking. For example, he asked questions such as, "who or what is water in relationship here? Are you noticing different or similar relationships as the first spot we stopped at? How do you think water is in relationship with the soil here?". To support toggling across timescales, Mr. Jackson asked questions such as, "How do you think this place would look in summer? Do you think we would see the water here? It is raining really hard today. What would happen if it kept raining for 2 weeks straight? How would this puddle change?" Pedagogically, these scaffolds supported thinking across multiple dimensions of socio-ecological systems: (1) species, kinds and behaviors; (2) relationships; (3) thinking across scales, and (4) places, lands, and waters.



Upon returning to class, Mr. Jackson asked the reporter in each group to share what they had observed. He wrote and drew the relationships on the whiteboard, and as students were sharing he began to model how to map connections. For example, one pair shared that there was water on some of the leaves.Mr. Jackson wrote the word water (and drew a water droplet as an icon), and then leaf (and drew a picture of a leaf), and then drew a line connecting the two to demonstrate that they were in relationship with one another. He continued to do this for the rest of the pair share-outs. At the end of the debrief, there was a web of relationships among water and other species or kinds that was visible on the white board. Mr. Jackson also made a list of questions and wonderings that students generated as they were sharing out. For example, one student shared that they noticed there were little puddles everywhere along the walk, and that when they were visiting family in Arizona, they didn't notice very many puddles. Mr. Jackson wrote this down, and then followed up with the student to ask when they were visiting family, and why they think they observed such different things in each place. This led many students in the class to wonder if there was a connection between the amount of puddles and water they saw and the time of year they were in (fall), and also if other places are as rainy as where they live in the Pacific Northwest. Mr. Jackson told the class they would continue to explore these questions throughout their field based science inquiry.

CONNECTING TO FAMILY AND COMMUNITY KNOWLEDGE AND PRACTICES:

Mr. Jackson followed up with student wonderings and questions, even if they did not seem to directly connect to the observation walk. For example, when the student shared what they noticed in Arizona, Mr. Jackson's questions prompted the class to think across multiple spatial and temporal scales. His engagement also opened the space for other students to think with family or community experiences in their sense making.

REFLECTING ON INSTRUCTION:

Mr. Jackson noticed some types of reasoning that his students were engaging in, and other types of reasoning that would take some scaffolding in future activities. For example, the students were starting to toggle across spatial scales as they. noticed.... The prompts on the walk also asked students to look at what was above, around, and below. Students were also thinking about how what they were seeing outside of the school was related to family or community experiences, and this led to reasoning across temporal scales as they considered if the time of year impacted the amount of water they saw outside. Mr. Jackson also noticed that in the debrief, students were mostly reasoning about chain-like, 1-to-1 relationships. He was eager to have students think about webs of relationships, but realized this may take more time and scaffolding, such as diving more deeply into how place and season are connected to rainfall and water accumulation.

Mr. Jackson also thought about how in their next activity, they should revisit the bioswale and talk more explicitly about human decisions and the impact they play on the design of outdoor spaces. Importantly, he decided to create a family activity in which students explore their neighborhoods with their families, and think about where they notice water, and who/what water is in relationship with.

Educator Prompts: What would you do next?

What other forms of reasoning would you want to scaffold in future activities? How would you do this?

What types of indoor or outdoor activities could you do next to deepen socio-ecological sensemaking?

How could you facilitate sensemaking about nature-culture relations, and how these impact/impacted the design of outdoor spaces?

How could you start to engage learners in how ideas about power and historicity intersect with their thinking, investigating, and decision-making about water and its relationships in the socio-ecological systems they are exploring?

APPENDIX B

Example of Learner Thinking about Complex Socio-Ecological Systems

The following transcript segment is from an interview with an elementary school student. In this interview, the interviewer showed the student a photograph of an outdoor place that included a person standing in a pond or flooded area in a forest. Some of the trees in the picture have evidence that they were chewed by a beaver. The interviewer then asked various questions about the photograph (for example, about what the student observed in the photograph, what season the student thought it was in the photograph and why, what the student would be doing if they were in the place in the photograph and why).

Interviewer:	Cool. Okay. So **who do you think might live in this place?**
Student:	**Beavers**.
Interviewer:	You think beavers?
Student:	**Beavers, worms, fish, probably not fish**. I thought fish would live here but probably not.
Interviewer:	Maybe some fish?
Student:	Maybe some, but-
Interviewer:	Probably not, why not?
Student:	**Oh I know, catfish might be here.**
Interviewer:	Oh.
Student:	**Because there's a lot of rocks**.
Interviewer:	Mm-hmm (affirmative).
Student:	**And they usually go under rocks.**
Interviewer:	Catfish do?
Student:	**And they're usually in lakes** that travel where ... **But it has to be beavers, because a clue**.
Interviewer:	Because you can see a clue? Okay. That's pretty cool

In this clip, the student was asked who he thought lives in the place where the picture was taken. His response demonstrated that he was engaging in multiple forms of reasoning about ecological habitats. For example, this student said beavers, worms, and fish lived there. This reflects an emergent form of web-like reasoning because he was considering multiple animal species that share this general habitat. He went into further detail as he explained features of places, lands, and waters that made this habitat particularly suitable for catfish when he said "they usually go under rocks" and "are usually in lakes". Additionally, this student was engaging in a form of perspective taking as he considered both the needs of this particular fish and the features of the habitat. This student was also toggling across multiple spatial scales, zooming in to consider what was below the water (rocks, even though he could not actually see rocks in this picture), and zooming out to think about lakes more broadly.

Educator Prompts:

What else do you notice in this clip about how the student is sensemaking about socio-ecological systems?

What prompts or questions could you ask to facilitate multiple forms of complex systems reasoning?

APPENDIX C

Socio-ecological dimension	Background research questions (to ask with learners)	Place-mapping questions (for educators to think about as they plan instruction)
Species, Kinds, Behaviors (SKB) 	• What species, kinds, and behaviors exist around our school? • Who used to be here? Who is here now? • Make sure to include humans	• What SKB can I observe around my school? • What is a good time of day to explore/observe SKB around the school? • What kinds of behaviors can we realistically expect to see? When?
Relationships 	• What relationships occur between the species and kinds around the school? Why might those relationships be important? Who benefits from the relationships, how, and why? • When in the year do these relationships become visible (if at all)? • What are human relationships to these species and kinds? • How does power and historicity impact these relationships?	• What relationships can we observe around the school? What relationships exist at different scales (for example, a tiny spider web on a leaf vs. trees in relation with each other in a forest)? • What nature-human relations can we observe around our school?
Places, Lands, Waters (PLW) 	• What is the topography of the land around the school? What did it used to look like? How is it different now? • What waters does the land around the school interact with? What are significant water-land relationships in the area? • How is human activity or human decision-making affected by the lands & waters in the area?	• Walk around your school and see how the land dips and rises. Notice what happens to the water when it rains--where it puddles, where it drains. • Walk around your school and notice if there are different kinds of soil and plants in different parts of the school and where the land is higher vs. lower.
Ethical deliberation & decision-making 	• How is human activity or human decision-making affected by the lands & waters in the area? • What decisions were made about the land to build the school? Who made those decisions and why? What did the land around the school look like before the school was built?	• Walk around the school grounds and notice what evidence of human decision-making you can collect. What kinds of decisions were made? What kinds of decisions are still being made? How does power and historicity influence decision-making? • What decisions do you (and students) make every day around the school? Where and what are they?

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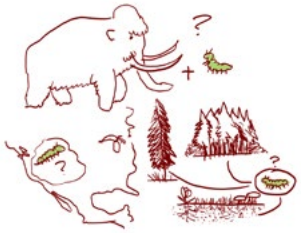
Socio-ecological dimension	Background research questions (to ask with learners)	Place-mapping questions (for educators to think about as they plan instruction)
Thinking across scales 	**Temporal scales** • What are **Histories of Places** around your school (temporal scales)? • Also thinking about shorter and longer temporal scales: how do places change from morning to night? from hour to hour? from minute to minute? from season to season? **Size scales** • What are examples of different **scales of size** that you can think of? How do these show up in your own life? • How does your perspective on something change as you look at it under a microscope, then gradually look at the entire object, and then the object in its natural environment? **Spatial and perspectival scales** • How do your perspectives change when you learn about what is above, below, and under focal objects? **Population scales** • What are examples of different **population scales** that you can think of? What is the difference between studying 1 tree vs. a group of trees, or 1 bird vs. a group of birds vs. a population of birds that inhabit a large region?	**Temporal scales** • Connect to the Histories of Places framework and see what evidence you can collect of the different timescales. • Think about how the school grounds change over the school year, across one season, across a day/week/month. **Size scales** • What are different scales of size to notice outside, from a grain of sand to the whole beach, from a small tree to a towering cedar? **Spatial and perspectival scales** • Go outside and notice the different spatial scales you can observe. How do you understand a place differently when you only look at eye level vs. when you look above your head, at your feet, and even dig beneath the ground? **Population scales** • How will you support your students in observing and wondering about **aggregate** groups or kinds (groups of plants vs. just 1)? What species and kinds are in your area where you can ask population-level questions?

APPENDIX D

Self-Assessment for Educators

Use the following self-assessment to reflect on the educational practices you currently use related to the Complex Socio-Ecological Systems Framework, and to identify those practices that you want to begin to use. Return to this self-assessment periodically to continue to reflect on your educational practices as a way to deepen them.

Which of the following do you incorporate into your teaching practice?

Yes!	Some!	Not yet!	Dimension of Practice
			I consider how humans and more-than-human species and kinds have impacted the places, lands, and waters that we are in.
			I provide scaffolds for learners to engage in **multiple forms of reasoning** about socio-ecological systems.
			I provide scaffolds for learners to take the perspective of more-than-human species and kinds in the places we are in.
			I provide scaffolds for learners to consider the species, kinds, and behaviors of more-than humans (and humans) that are part of socio-ecological systems.
			I provide scaffolds for learners to consider the relationships between species and kinds (including humans) of socio-ecological systems.
			I provide scaffolds for learners to consider the places, lands, and waters (including their histories) of socio-ecological systems.
			I provide scaffolds for learners to move beyond chain-like relationships and consider web-like relationships in socio-ecological systems.
			I provide scaffolds for learners to toggle across multiple scales (spatial, temporal, agent-aggregate) when reasoning about socio-ecological systems.
			I provide opportunities for learners to explore how power and historicity intersect with different dimensions of complex socio-ecological systems (for example with respect to decision-making and who has and continues to make-decisions and why).
			I collaborate with multiple stakeholders to better understand the roles and impacts of different human communities in socio-ecological systems.
			I provide space in my instruction to center family knowledges and practices about socio-ecological systems.
			I reflect on the histories of places in which we are living and learning.
			I gather and incorporate data and evidence from a variety of sources (including field-based investigations and research) to facilitate complex systems reasoning.
			I support learners in using evidence to engage in ethical deliberation around socio-ecological systems.
			I support learners in imagining their futures, and the futures of more-than-human communities as part of socio-ecological systems.
			I build relationships with and incorporate multiple perspectives - from learners, families, stakeholders, and communities to understand the connections between nature-culture relations and complex socio-ecological systems.
			I provide opportunities for my learners to engage in ethical decision-making around socio-ecological systems.

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