



Learning
in Places

Family Science Learning

Family Storyline Example

One family's field-based
science journey

N

tilth
ALLIANCE

W
BOTHELL



Family histories of places



What are the functions of the trees in our neighborhood?

Who are the trees in relation with?

What will this place be like in the future?
How will we be in this place in the future?



Family seasonal walk



Leaves change colors and fall to the ground. We often have to clear the storm drains on our street from leaves in the fall or else our street gets flooded.



We love raking leaves and jumping in them.

Family wondering walk



Noticing leaves changing colors on trees,
also noticing worms on the sidewalk and
wondering about where they live.
Why do we only see them when it rains?



Noticing snails and wondering where they
go when they're not out.
Do they live in the soil? If so, should we
think about how healthy our soil is?

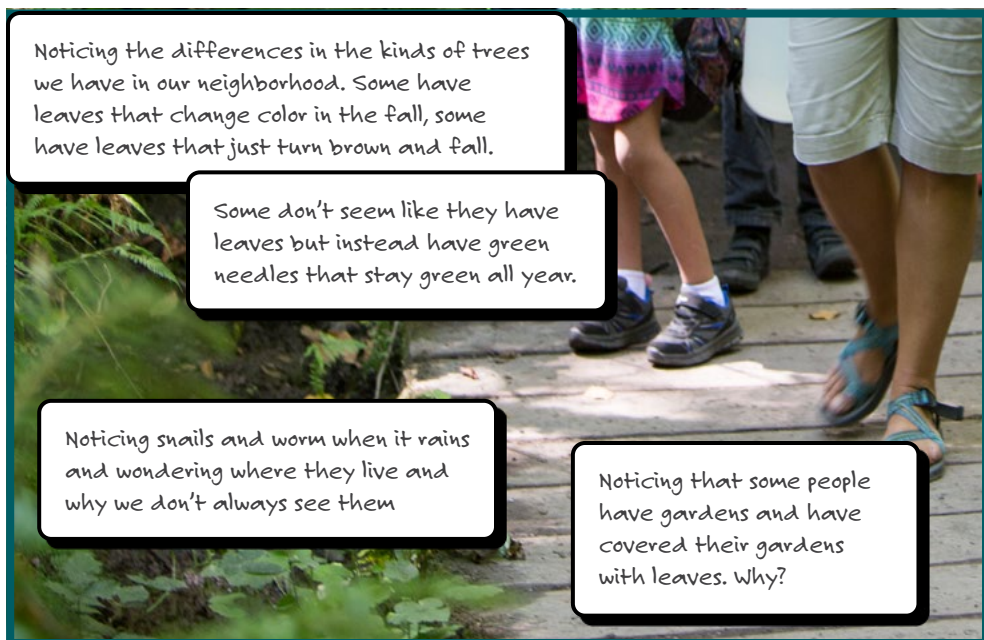
Are snails and worms good to have in our neighborhood? Why?

LE 3 | Taking a Focused Walk Together

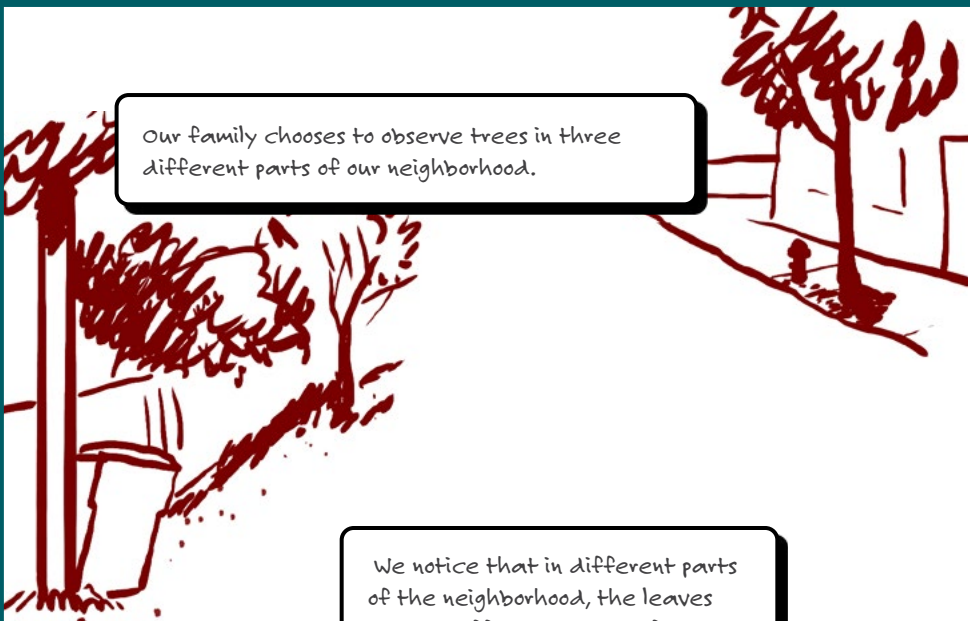
Relationship walk



Species, kinds, and behaviors walk

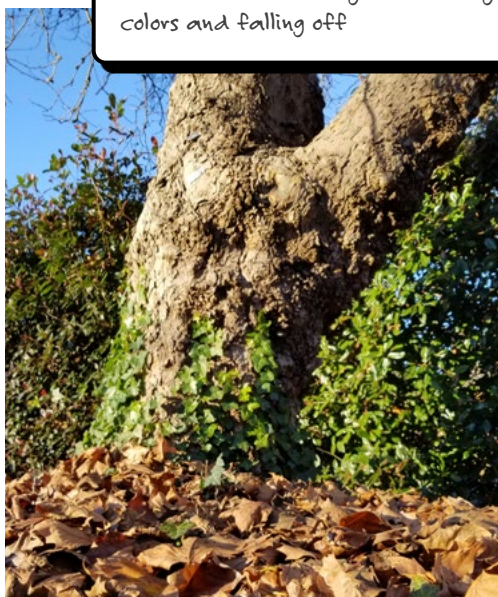



Choosing our phenomenon to observe, and observing and comparing our phenomenon



Our family chooses to observe trees in three different parts of our neighborhood.

We notice that in different parts of the neighborhood, the leaves are at different stages of turning colors and falling off



LE 5 | What “Should We” Do?

Modeling a neighborhood “should we” question

We sat down with our daily decision log and talked through some of our daily decisions.

DAILY DECISION LOG			
Decision	Why did we make this decision? GOAL/PURPOSE	Who/What was impacted?	Who was involved w/ decision making?
Go to produce market	We need food. I want to eat fresh produce. We like their snacks.	- us in the house. - People in store - Employees of store - Suppliers of groceries - animals on the road	- Store employees - myself - my employer who pays me \$
Go on a walk every day	Dr. told me to. to be healthy.	- family members home alone or going with - people on the street - birds nesting	- self - doctor
Join friend on a video call every	- B/c we like our friends we like to spend time with them. - No: too tired, were on too many calls	- us - our friends - power company - our electric bill - meeting services - my mom has to call at a different time	- friends - friends' employers (when are they free?) - us - internet company

Decision	How does PLACE shape this decision?	How do societal structures shape our decision?
Go to produce market	- It's close enough to drive to - produce is still fresh when it gets here. Some is local	- have access to gas for the car - inter-state roads, road ^{main} road - the cheap price + location are decided by taxes + farm subsidies
Going on a walk in the neighborhood	- want to walk away from busy street/cars - don't want to bother people, so no heavy traffic - we choose to walk in the neighborhood where it feels safe - like walking near plants	- city decides where to put sidewalks - freeway is nearby: cars are important in this area - laws decide where we can walk: jaywalking, private property, etc

Thinking about how we make our every day decisions helped us think about what our “should we” question could be.

Part 1: Taking a Neighborhood Walk to Observe and Then Ask “Should We” Questions



Our family went for a walk around our neighborhood. We live in a city and the place around our apartment is a collection of city blocks with houses and apartments. As we walked, we wrote down some of our observations. When we got home, we thought about “Should We” questions linked to some of our observations.

Where we went for our walk in our neighborhood:

around our city block

We made these observations on our walk: (Write and/or draw the observations you made.)

we noticed that some of the sidewalks by trees are raised and cracked.

we noticed signs on utility poles about killing rats.

we noticed a big bird in a tree (and a squirrel and a raccoon under the tree)



We are curious about these “Should We” questions based on our observations: (Write as many “Should We” questions as you want.)

should we fix the sidewalks?

should we use poison to kill rats in alleyways?

should we hang bird feeders in the trees where we notice big birds?

should we rake leaves off the ground?

We also noticed a neighbor's yard. They had a garden bed with flowers and vegetables in it. They had a rain barrel sitting by the bed. They had a lot of different kinds of trees in their yard. And it looked like there were a lot of leaves on their grass.

Learning in Places



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LE 5 | What “Should We” Do?

Part 2: “Should We” Our Family Wants to Focus On

We got really interested in the sidewalk question: Should we fix the sidewalks? When we took our walk, we noticed that the sidewalks were raised in some places, usually right next to very large trees.

We also noticed that they were cracked a lot of times. We wanted to explore this, so we filled out this chart.

Should we fix the sidewalks?

Species + kinds in our neighborhood <ul style="list-style-type: none">trees (different kinds)cement sidewalkswe looked again and saw different kind of bugs on the sidewalksrabbits, squirrels, birds, and around the trees	Relationships <ul style="list-style-type: none">trees — treestrees — cement sidewalksbugs — sidewalkstrees — soil aroundrabbits, squirrels, birds — each otherrabbits, squirrels, birds — trees
Connections to places, lands, waters? <p>not sure</p> <ul style="list-style-type: none">do these trees only grow in this place (the midwest)?is the type of soil somewhere connected to any of this?	Seasonal differences? <p>not sure</p> <ul style="list-style-type: none">does freezing temperatures and snow make the sidewalks worse?

Part 3: An Initial Model of Our “Should We” Question

Next we attempted to create an initial model of our “Should Question” to see if drawing and diagramming some of these different parts would help us better understand the different aspects of our “Should We” question.

We also thought that maybe this would help us figure out different types of information we might need to understand so that we could deliberate about our “Should We” question.



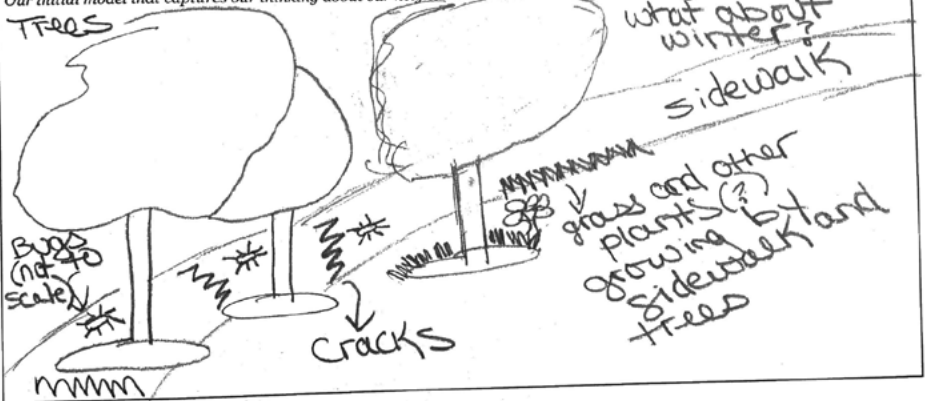
Part 3: Now, using your discussions, create an initial model of the different parts of your “Should We” question. Scientists use models for several reasons. For example, they use models to help make their thinking visible and explore their ideas. You can make an initial model of your “Should We” question (including its parts and how those parts are related and why) by drawing diagrams, or using words and arrows (or other symbols). If you want to, you can use a lot of different materials to make your model (pencils, pens, markers, crayons, yarn, and/or pictures, for example).

- The point of your model is to capture the important elements of your “Should We” question.
- How can you represent how species and kinds, places, and relationships that are part of your “Should We” question work together?
- How does your model explain your thinking about that?

Our neighborhood “Should We” question is:

Should we fix the sidewalks?

Our initial model that captures our thinking about our neighborhood “Should We” question...




None of us can draw very well but we decided that wasn't the point. The point was to further our thinking and see what else we needed to learn.

LE 6.A Observing & Modeling Specific Relationships

Part 1: Taking a Neighborhood Walk to Observe Relationships



Our family went for a walk around our neighborhood again. When we were taking a walk for LE 5.C, choosing our "Should We" question, we remembered one neighbor's yard that we were really interested in! There was a lot to observe in just that yard.

LE # 6.A

Observing and Modeling Specific Relationships

Part 1: Taking a Neighborhood Walk to Observe Relationships
Take a walk in your neighborhood and see if you can find examples of some of the relationships listed in the chart. Then draw or write about the relationship(s) you observed. Don't worry if you do not observe all of these relationship types. The point is to document the relationships you do observe. (If you have gone on other walks as part of LEs 1, 2, 3, and 4, you can use your observations from those walks too.)

Where we went for our walk: around a few blocks in our neighborhood

The temperature is: 75° The time of day is: 9:00 a.m. The weather is: sunny

The season is: Summer

Part 1.A: Put a star or a checkmark next to each type of relationship you observed out on your walk.

<input checked="" type="checkbox"/> Animal-Animal	<input checked="" type="checkbox"/> Animal-Plant
<input checked="" type="checkbox"/> Animal-Human	<input type="checkbox"/> Plant-Plant
<input checked="" type="checkbox"/> Plant-Human	<input checked="" type="checkbox"/> Animal-Natural Kind (for example: water, rock, sun, air)
<input checked="" type="checkbox"/> Plant-Natural Kind (for example: water, rock, sun, air)	<input checked="" type="checkbox"/> Human-Natural Kind (for example: water, rock, sun, air)
<input type="checkbox"/> Human-Human	<input type="checkbox"/> Other?

We wanted to go back there to take a closer look and see if we could identify some relationships.



Observing & Modeling Specific Relationships LE 6.A

Part 2: Modeling a Specific Type of Relationship

Then, we documented some of the relationships we observed in more detail, including our questions and wonderings about them, so that we didn't forget what we observed.

We made this chart:

LE 6.A - Part 1.B

TYPE of Relationship	Details	Questions/Wonderings
Humans - Plants Humans - kinds natural kinds	we saw our neighbors rain barrel - it looks like they positioned it to help water their garden	we wonder whether the neighbors have to water their garden or if the rain barrel provides all the water the garden needs
animals to plants or animals to animals	we saw a crow grow in their yard eating something animal? plant?	we wondered what crows eat? And we wondered what this crow was eating
Plants - natural kinds	we saw a lot of leaves on the ground by the flower garden or vegetable garden or both...	why would these leaves be on the ground in summer?

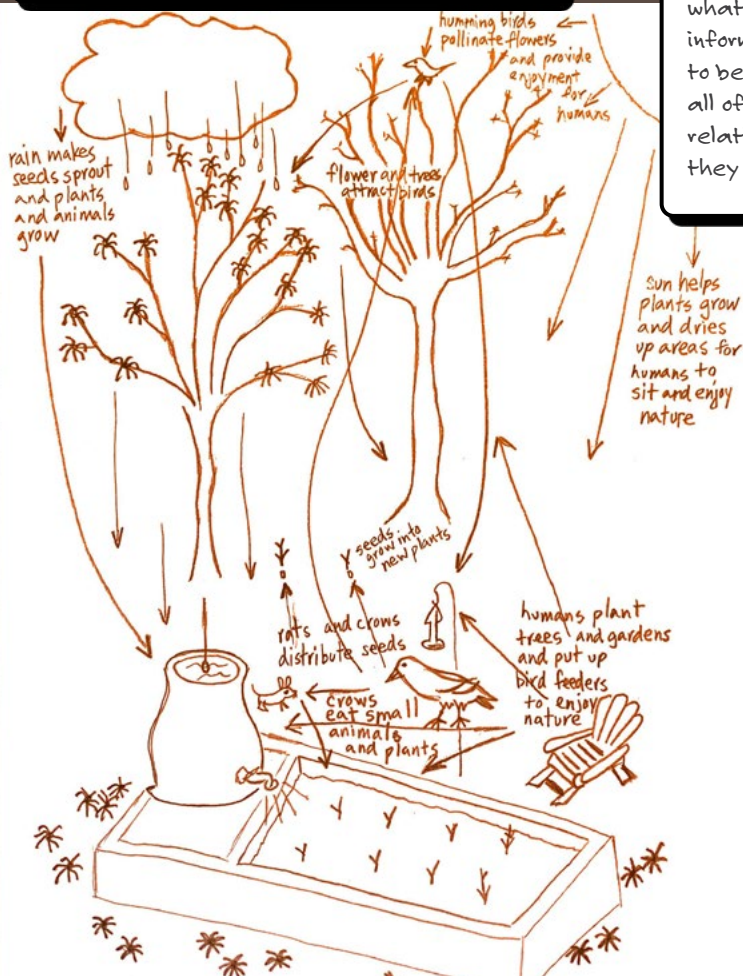


LE 6.A Observing & Modeling Specific Relationships

Part 2: Modeling a Specific Type of Relationship

Next, we decided to model the different types of relationships we saw on our walk as another way to keep thinking about who and what are in relationship with each other.

We thought that if we made an initial model, we might be able to figure out what additional information we need to better understand all of these relationships and why they are important.



This is amazing! All of these relationships in just one neighbors' yard in the middle of a city! Through our model and chart we saw that humans are only one part of a very complex ecosystem of species and kinds!

Questions, Models, and Preparing | LE 6.B

Part A: Pick a “Should We” Question

We returned to the “Should We” questions we brainstormed in LE 5.C. We started to explore our “Should we fix the sidewalks” question.

But we were also really interested in whether we should rake leaves off of the ground in our yard.

Learning in Places LE # 6.B.1

“Should We” Questions from LE 5.C (or new ones)	Which of these criteria does the “Should We” question meet? (Check all that apply!)
should we fix the sidewalks?	<ul style="list-style-type: none"><input checked="" type="checkbox"/> involves relations between humans and more than humans (like animals, plants, rocks)<input checked="" type="checkbox"/> involves multiple base relationships (like animal-plant, plant-plant; see LE 6.A)<input checked="" type="checkbox"/> involves multiple socio-ecological timescales (see LE 1.C)<input checked="" type="checkbox"/> We could collect data about this.<input checked="" type="checkbox"/> requires us to think about how our decisions would help create different social structures and futures<input checked="" type="checkbox"/> no obvious right answer<input checked="" type="checkbox"/> connected to your neighborhood<input type="checkbox"/> interesting, important, and exciting to us
should we rake leaves in our yard?	<ul style="list-style-type: none"><input checked="" type="checkbox"/> involves relations between humans and more than humans (like animals, plants, rocks)<input checked="" type="checkbox"/> involves multiple base relationships (like animal-plant, plant-plant; see LE 6.A)<input checked="" type="checkbox"/> involves multiple socio-ecological timescales (see LE 1.C)<input checked="" type="checkbox"/> We could collect data about this.<input type="checkbox"/> requires us to think about how our decisions would help create different social structures and futures<input checked="" type="checkbox"/> no obvious right answer<input checked="" type="checkbox"/> connected to your neighborhood<input checked="" type="checkbox"/> interesting, important, and exciting to us

Which question did you end up choosing and why? should we rake leaves in our yard? (we are more interested in this question.)

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We decided to fill out this chart to help us decide which “Should We” question we wanted to explore in depth and deliberate about.

LE 6.B | Questions, Models, and Preparing

Should we rake the leaves in our yard?

Part B: Exploring Our “Should We” Question

Now that we have settled on a “Should We” question, we need to explore the question more fully.

3 Dimensions of Socio-Ecological Systems	Our Notes
Species, Kinds, and Behaviors <ul style="list-style-type: none">What species (plants and animals, including humans) and kinds (things like water, rocks, the sun) are involved in your “Should We” question?Consider the different time scales in LE 1.C. Would the same species and kinds you identified show up in all the various time scales or might there be other species and kinds present? Is that important for your “Should We” question, and if so, how?Describe any plant and/or animal (including human) behavior that is involved in your “Should We” question.What species and kinds have power over others? How does that	<ul style="list-style-type: none">US leaves from different trees, critters under and on the leaves, grass, soil, rain, sunplant + animal + time, nation + time, future, maybe geologic time (soil?), indigenous people + time (practices?)

This will help us understand what we need to learn more about so that we can deliberate about the question and, ultimately, make a decision. We used these charts to help us explore our “Should We” question.

Thinking Across Scales (Time, Space, and Perspective)

- What different time scales are important to think about related to your “Should We” question? (Look back at LE 1.C for some time scales you might consider.)
- What different scales related to space might be important to consider given your “Should We” question (looking at something from above or below, for example)?
- Try and take the perspective of species and kinds that you listed. Would doing that help you think about your “Should We” question differently?



→ We think plants + animal + time, and nation + state + time, but maybe geologic time (soil?), + indigenous time (practices?) → future!

→ looking under leaves, for example

→ yes! (our earlier question about decisions that might make?)

Human Decision-Making

- What evidence of human decision-making is important to take into account given your “Should We” question?
- Who gets to make the decisions and why? Would different decisions be made if others were making the decisions?
- How could you find out the history of decision-making related to your “Should We” question? If you can find that out, what is that history?



→ what are neighbors doing and why?

→ We do. But is the city involved? (e.g., city ordinance?)

→ talk to different experts and consult various media and text?

Learning in Places



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There are a lot of questions in these charts, so we decided to explore our “Should We” question over several days.

Relationships

- What relationships between species, kinds, places, lands, and/or waters are involved in your “Should We” question?
- Who benefits from these relationships? Who might not benefit? Why?
- If you consider the different time scales in LE 1.C, how might the relationships you identified stay the same or change across time?



→ trees - trees, leaves - leaves, critters - critters, leaves - grass, grass - critters, soil - trees, critters, soil - water

→ US

→ sun

Places, Lands, and Waters

- What places, lands, and/or waters are involved in your “Should We” question?
- Who is involved in making decisions about these places, lands, and/or waters? Who is not involved in decision-making, and is that problematic? How so?
- How have these places, lands, and waters changed over time?



→ our land (soil), rain (ground water?)

→ we are the city? what kinds of decisions are the trees, grass, and critters making?

As we talked about our “Should We” question, we thought back to our Histories of Places discussion. We realized that our actions today, can help shape what our community will look like in the future in ways that recognize the important roles of species and kinds in our own community!

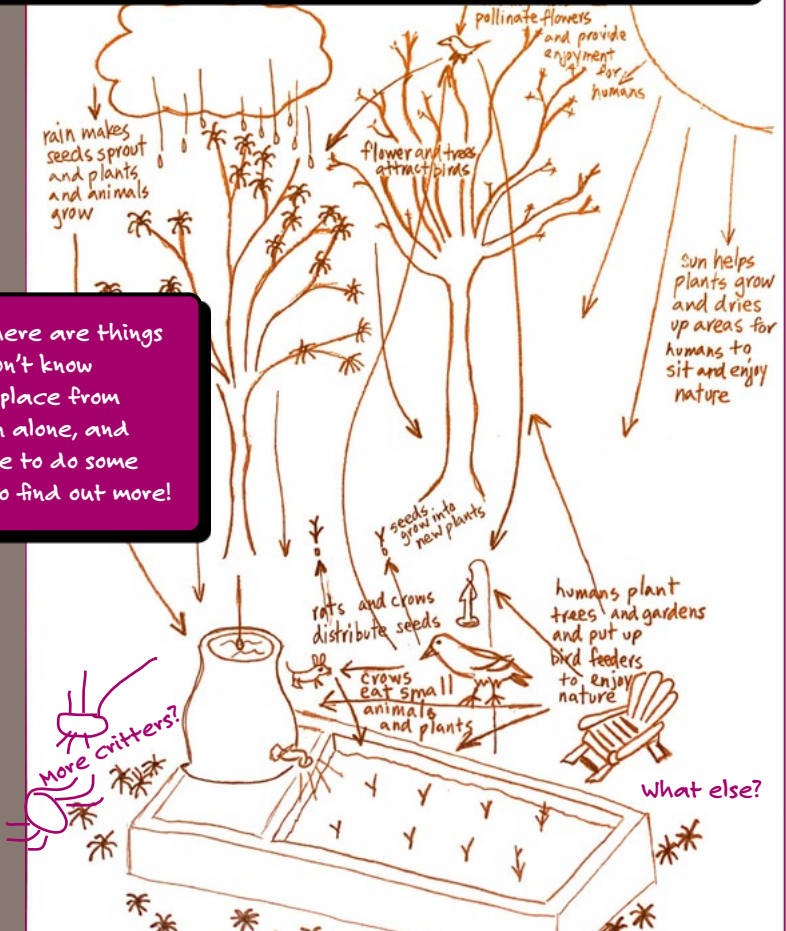
Questions, Models, and Preparing | LE 6.B

Should we rake the leaves in our yard?

Part C: Create an Initial Model of Our "Should We" Question

Our initial model from LE6.A showed us what we already know from our observations about the "Should We" question. It shows how species and kinds are in relation to each other and how their behaviors and interactions shape the place where we live.

However, there are things that we don't know about this place from observation alone, and we will have to do some research to find out more!



We decided to use the initial model we created for LE 6.A for this "Should We" question because we think it captures various parts of the questions and some of the relationships involved.

LE 6.B | Questions, Models, and Preparing

Should we rake the leaves in our yard?

Part A: Identify Events, Processes, and/or Relationships from Our Initial Model of Our “Should We” Question

Our next step was to identify specific events, processes, and/or relationships in our initial model.



Once we understood better, we could more effectively deliberate about our “Should We” question and make a decision. We used this chart to start to identify some.

Event or Process or Relationship	If we learn more about _____ [event, process, or relationship], then we think _____ about our “Should We” question.
* Relationship between critters and leaves	If we learn more about this relationship, then we might decide not to rake our leaves.
* Relationship between critters and other animals	If we learn more about this relationship, then we might rake our leaves (animals eat critters)
Trees shedding their leaves	Why are leaves on the ground anyway?
* Relationship between rain-soil moisture-critters	Are there more critters when it's damp?

It was fun to do this because we realized how much we didn't know! We are excited to start to investigate some of our questions!

Now, select at least two events, processes, or relationships that you want to investigate (you can put a check-mark or a star next to them, for example, to remember which ones you chose).

Next, we used our model and our prior knowledge and observations from our neighborhood walks and family discussions to deliberate, or deeply consider, the various parts of our models and what more we need to learn about to answer our “Should We” question

Questions, Models, and Preparing | LE 6.B

Should we rake the leaves in our yard?

Part B: Asking Investigation Questions

Now that we know there are specific events, processes, and relationships that we need to know more about, we need to ask investigation questions that will help us learn more. We made this quick chart to help us pose investigation questions linked to what we want to learn more about, and then think about what types of data we are going to need to collect.

Events, Processes, Relationships	Example Investigation Questions	Data
Relationships between critters and leaves	How do the kinds and numbers of critters change if I check an area with leaf litter and without leaf litter?	Critter counts in different areas (with leaf litter and without)
Relationships between soil moisture and critters	Is soil "healthier" or more moist in areas with leaf litter or without? Are there more critters around moist soil?	Measure of soil moisture (in areas with leaf litter and without)
Relationships between critters and other animals	What animals eat critters? Are animals eating critters in areas with leaf litter or without?	Longitudinal observations in areas with leaf litter and without

We looked at the different Learning in Places data collection tools that we could use for our field-based experiments and thought about community members that might know more about the role of leaves in supporting ecosystem health.

We thought we might try to talk to:

- Someone who has a lawn care business and is an expert about leaves, grass, soil, etc.
- Someone who is an expert on different critters who might live in our neighborhood.
- Someone who is an expert on other animals we see in our yard (squirrels, birds, rabbits) so we could learn more about what they eat.

We also wanted to read books, listen to podcasts, and learn more about our city's ordinances related to raking and collecting leaves. We were pretty certain that after we talked with some of the people on our list, we would have other resources to consult too!

We cannot wait to investigate so that we can learn more about our "Should We" question!

LE 7 | Deciding what path we should investigate

Should we rake the leaves in our yard?

Deciding what path we should take in our investigation

We now have our "Should We" question and we've identified some information that we need to gather. We now need to make a decision about what our next steps are. Here are some questions we need to ask ourselves:

- **Who in our community do we know who can help us explore our "Should We" question?**

We know that our neighbor, Xi, is a landscaper and part of his job is to clear leaves from people's houses and around apartment buildings and schools. He lives just down the street and he might be able to help us think about why we should clear leaves.

We also know that there is a community garden in our neighborhood. The person who organizes it, Rosaria, encourages people to cover their gardens with leaves in the fall. We should ask her why.

- **What do people already know about why it's important to rake leaves or keep them on the ground? What media sources can we explore to help us with this?**

We also got books out of the library about vegetable and habitat gardens to understand more about the role of leaves for species and kinds.

Should we rake the leaves in our yard?

Community-based interviews



We decide to start with our community-based interviews. Both Xi and Rosaria agreed to talk to us on the phone!

From those interviews, Xi told us that it's important to clear the leaves from around buildings and from the sidewalks because they can clog the storm drains and then the streets can flood. He also told us that if you keep leaves for too long on the ground, nothing can grow underneath it—it can kill the grass or other plants because they won't be able to get any sun.



Rosaria told us that putting a layer of leaves on your garden in the fall can actually be really good for the soil and what is underneath it. Bugs and other kinds of animals use the leaf litter for food and habitats, and as the leaves decompose over the winter, it can keep your garden and the soil warmer and more moist. More things can live in the soil and keep your soil healthier for planting in the spring.



Based on what we learned from our interviews, we think we have some questions to investigate!

- Is the soil "healthier" or more moist in areas with leaf litter or without?
- Does leaf litter cause the grass to die underneath it? Does it matter how thick the layer of leaves is?
- Do plants grow better in soil that has been covered in leaf litter or in soil that has not been covered?

We think we can answer these questions through field-based investigations!

LE 7 | Collecting Data

Should we rake the leaves in our yard?



Doing field-based investigations



We decided to first investigate the question:
Are there more critters in areas with leaves or without leaves?

We used the Learning in Places data collection tools to help us design investigations to answer our “Should We” question.










We decided to use two tools:
LE7A.1 Critter Count, which lets us know how leaves affect soil health by the number of “critters” we find, and **LE7A.2 Soil Observation**, which can tell us more about how leaves affect soil moisture and other factors important for worms, plants, and other species!

Should we rake the leaves in our yard?

Critter Count (LE7A.1)

One piece of data that could help us decide was to find out who lives in areas that have leaves, and in areas that do not have leaves. We needed to count the numbers of critters we found to understand the biodiversity of both of these areas.

9 Am		5 pm	
Location or Time 1	How many	Location or Time 2	How many
What I found		What I found	
			
Reddy Poly 			
		worm	
	1		
little fly			

Critter counts are a measure of biodiversity in a place. The more types (diversity) of species we observe, the higher the biodiversity. In addition to diversity, we can also measure abundance which tells us how many species an area is able to support. High levels of diversity are signs of a healthy ecosystem.

In this chart, we counted critters at two different times (9am and 5pm) on the same day. We also could have come out at 9am on two different days.

However, abundance does not tell us as much about ecosystem health. Depending on which species are present, high numbers of a single species can be a sign of a system out of balance. The greater the biodiversity, the more resilient a system is to short- and long-term changes.

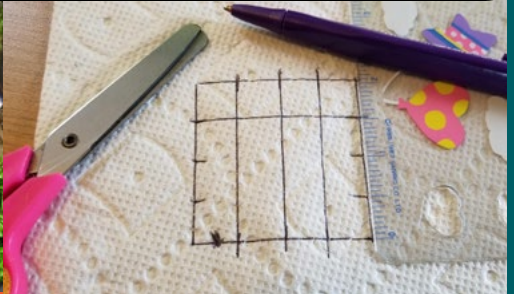


LE 7 | Collecting Data

Should we rake the leaves in our yard?

Soil Observation (LE7A.2)

We used the Soil Observation data collection tool to find out if leaf cover hurts or helps the health of the soil. We made observations about what is going on in both areas covered by leaf litter and areas open to the air.



Soil is really important to our socio-ecological systems! One important role that soil plays is to store water and nutrients for plants. Sometimes other plants, or organisms, like mushrooms, and animals (like worms) who live in soil help to make nutrients by breaking down dead things – this is called **decomposition**.

Different plants and animals need different amounts of water stored in the soil. Some like a lot of water, like skunk cabbage. Some like some water but not too much, like worms and ferns.



Should we rake the leaves in our yard?

Data Visualization

When you organize your data to find patterns, this is called **data visualization**. Scientists use data visualization to turn their data into **evidence** that they can use to explain a phenomenon or to find out which questions are important to ask next.

We used the LE8 tools in the Family Storyline to help us with this. We went through these three examples of summarizing and visualizing data:

Example 1: Comparing across two spaces of the same place

(In our case, an area with leaf litter and an area without leaf litter)

Example 2: Comparing across places

(How many critters do I find in front of my apartment, in front of my friend's apartment, or by the church?)

Example 3: Comparing across time

(How does the number of critters change throughout the season in my neighborhood?)



These three kinds of comparisons can be important to your own investigations. Of course, you might come up with your own ways of summarizing and visualizing your data!



LE 8 | Data Visualization

Should we rake the leaves in our yard?

Example 1: Comparing across two spaces in the same place

Suppose we asked the investigation question: How do the kinds and numbers of invertebrates change if I check in an area that is covered with leaf litter or not covered with leaf litter?

This is a question about comparing quantity of the same living things in different conditions

What would we need to know to find this out? We could choose to compare how many of each kind of critter we found in areas with leaf litter and no leaf litter. Here is an example of what our table might look like filled out:

Critters	Area with leaf litter	Area with no leaf litter
Number of snails we counted	5	1
Number of worms we counted	8	2
Number of isopods we counted	10	3

In this comparison, we could start to notice if there is a difference between the numbers of critters we found in these areas.

In this table, we started to find some patterns in our data:

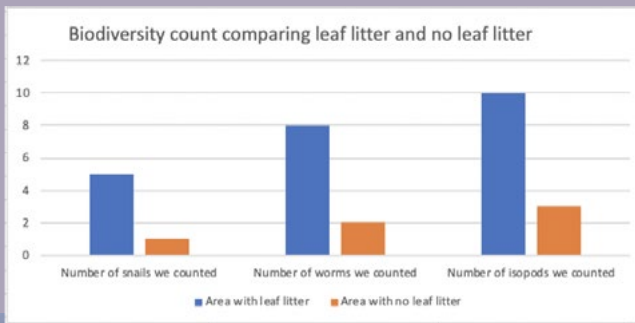
- We found more critters in areas with leaf litter than without leaves.
- The total number of isopods we found was higher than worms and snails.
- We can also see that the least number of critters we found was snails.

Consider for your investigation:
What are the kinds of data you want to collect?
What conditions can you compare?

Should we rake the leaves in our yard?

Example 1 continued: Using graphs to visualize data

Another way we can see patterns in our data is to convert the data into a graph to see how the areas with leaf litter compare to areas with no leaf litter. A graph might look something like this:

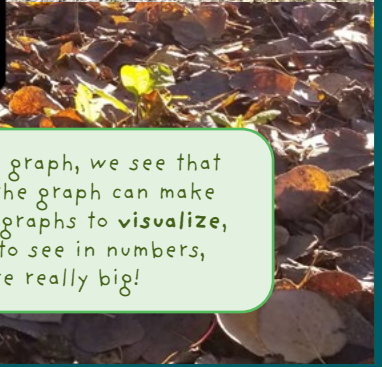


In this graph, the **blue** bars are the number of each critter type in areas with leaf litter and the **orange** bars are counts of each critter type in areas with no leaf litter.

Understanding making graphs:

On the left, or Y axis, we started at 0 and made marks up to the highest number of critters we counted. On the bottom line, or the X axis, we wrote down all the types of critters we counted. Because we counted five snails in the area with leaf litter, we filled in a block from zero up to the number 5 in blue. Next to that, we colored in an orange block to represent the number of snails we counted in the area without leaves. This way we can easily see the difference between the numbers.

When we look at the data table and the graph, we see that they tell us the same information, but the graph can make it easier to see patterns. Scientists use graphs to **visualize**, or see, patterns that might be harder to see in numbers, especially if their data tables are really big!



LE 8 | Data Visualization

Should we rake the leaves in our yard?

Example 2: Studying across places

Another example we can think about is if we wanted to answer the question: How many critters do I find in front of my apartment, in front of my friend's apartment, or by the church?

In this investigation, we would investigate the same critters (in our case, isopods, snails, and worms) in at least three different places.

This would be a question about **place**.

Our data table looked like this:

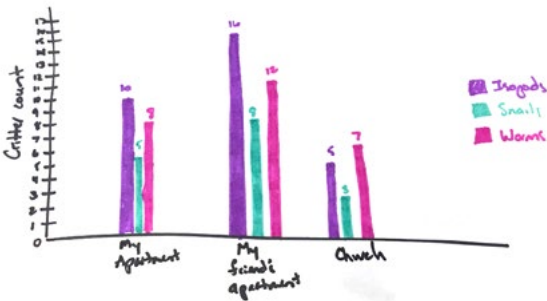
Critters	In front of my apartment	In front of my friend's apartment	In front of the church
Number of isopods	10	16	5
Number of snails	5	8	3
Number of worms	8	12	7

Data Table

A table displays data in rows and columns.

Graph

A graph is a kind of chart illustrated in symbols such as bars, lines, or slices.



When we graphed the data, we started to see some patterns:

- We found the most critters at my friend's apartment and the least number of critters at the church.
- We found the most isopods total and the least number of snails total.
- We found the most snails at my friend's apartment.

Should we rake the leaves in our yard?

Example 3: Comparisons across time

Suppose we asked the question,

"How does the number of critters change throughout the season in my neighborhood?"

This would be a question about how things change over time.

In this case, our summary table looked like this:

Our critter count for
Winter + Spring

	1/20/20	2/20/20	3/20/20	4/20/20	5/20/20	6/20/20	7/20/20	8/20/20
Number of isopods	2	2	4	6	8	8	11	12
Number of snails	0	0	2	3	5	6	7	7
Number of worms	1	0	2	4	6	7	8	8
Total critter count	3	2	8	13	19	21	26	27

In this chart, we counted the numbers of different kinds of critters (isopods, snails, and worms) once a month for 8 months.

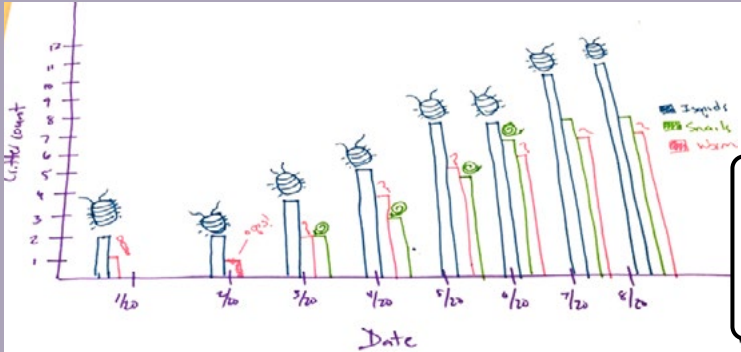
We also added them up for each month to get a total number of critter counts. This gave us a good overview of how the number of these critters changed over a long time.

LE 8 | Data Visualization

Should we rake the leaves in our yard?

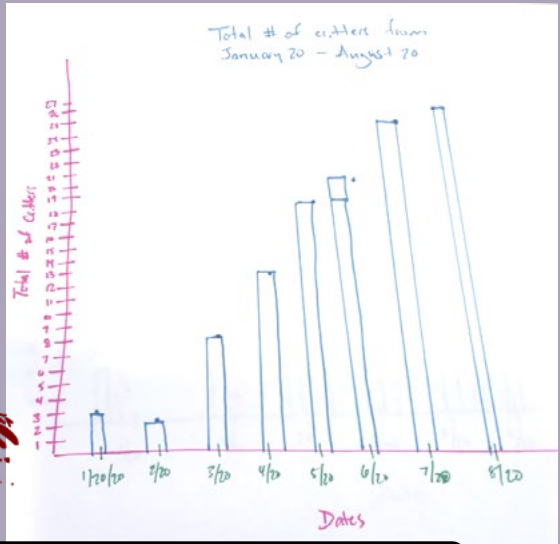
Example 3: Comparisons across time continued

Now we have a couple of choices of how to graph this data.



One choice is to graph each kind of critter for each month

Another choice is to graph the total critter counts



In both of these graphs, we can see these patterns:

- The number of critters increases as the months go on.
- We almost always found more isopods than worms and snails.

Consider: Why might you use one graph over another?
What do you want to know about?

Should we rake the leaves in our yard?

Understanding our data

Let's return to an example from LE7 and LE8 where we asked the question: *Are there more critters in areas with leaf litter or in areas without leaf litter?*

We found the following patterns:

- We found more of everything in areas with leaf litter than without.
- The total number of isopods we found was higher than worms and snails.
- We can also see that the least number of critters we found was snails.



We remember that, after we talked to Xi and Rosavia, one of our questions was "Is the soil "healthier" or more moist in areas with leaf litter or without?"

Based on our data from our investigations above, one of the patterns we saw was that we found more of everything in areas with leaf litter than without.

But why would that be?



This is where we can do some research into what people already know about leaf litter and soil health.

For example, we might start with researching where worms, snails, and isopods live, and then see if that has anything to do with why we found more of them in areas with leaf litter. We might want to know what those critters eat, or how they reproduce.

All of this information might tell us some reason why we found the pattern that we found. Or, we might find that we had more questions now that we wanted to study!

Scientists do this by looking at other scientists' findings, by doing research just like this about what other people know about their question, and by doing more investigations! This step in **forming explanations** often leads to more questions, which in turn, lead to more investigations.

The most important part of explanations is that they are based on research including your data and community knowledge.

LE 9 | Understanding our data

Should we rake the leaves in our yard?

Researching our questions

In our example, we already conducted research when we talked to our community experts Xi and Rosaria, but there's still more that we want to know about the critters we saw.



Doing some research on the internet would help us understand:

- Isopods and worms like dark, moist soil, and leaf litter helps keep moisture in soil and light out.
- Worms and isopods also like to eat plants that are decaying, and that is where there is more leaf litter.
- Worms, isopods, and other decomposers help to break down leaf litter, help air and water reach deeper into the soil, and their waste helps plants grow.

Now that we've investigated our questions, it's time to return to our model and think about what we now know about our "Should we" question.



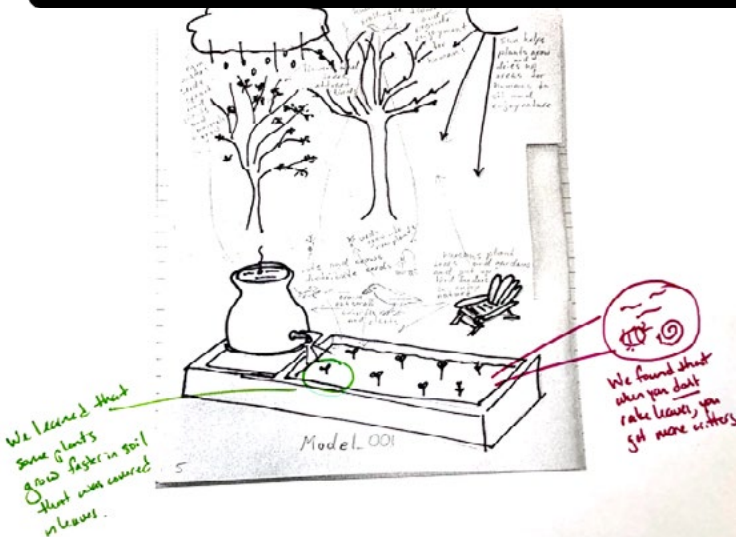
Should we rake the leaves in our yard?

Returning to our model and should-we question

- Return to the should-we question: In our example, we asked the "Should we" question: **Should we rake leaves or keep them on the ground?**
- Investigation question we asked:
We decided to use LE7.A to ask the investigation question: "Are there more critters in areas covered with leaf litter or areas without?"
- Patterns we found in the data:
We realized that there were more snails, isopods, and worms in areas with more leaf litter.
- Research we did on the internet to explain our patterns:
We did some research on the internet and realized that isopods and worms like dark, moist soil, and leaf litter helps keep moisture in soil and light out. Worms and isopods also like to eat plants that are decaying, and that is where there is more leaf litter. We also found out that worms and isopods are good for the health of our soil.

NEXT STEPS:

- Revise our model based on what we've learned. We returned to our original model and added in the new information that we found from this investigation.



We can keep returning to our model to add in what we've learned, and also to reflect on how our investigation influences what decision we might make.

LE 9 | Understanding our data

Should we rake the leaves in our yard?

Returning to our model and should-we question continued...

- **Deliberate as a family:** Do we need to make a decision? Are we ready to make a decision, or do we need more data?



- **Need more data?**

Based on this investigation, it seems like we should leave the leaves on the ground to improve the health of our soil in our neighborhood, but we need to find out more about why these species prefer a leafy environment. If we choose to investigate more, we can use the available protocols to collect data about soil moisture or temperature, or we can do more background and community research. Or, we might decide that we have enough information to decide whether or not we should rake our leaves based on the biodiversity data we have already collected.

Next step: Return to LE7, collect more data.

- **Ready to make a decision?**

Based on this investigation, it seems like we should leave the leaves on the ground to improve the health of our soil in our neighborhood.

Next step: Go to LE10



- **What else do we want to know?**

We decided that we need to still do more research to understand if plants grow better in areas with leaf litter or in areas without.

We are going back to LE7 to choose a data collection tool to help us with this!

Making & Sharing Ethical Decisions | LE 10

Should we rake the leaves in our yard?

Family deliberation and discussions

- We are ready to make a decision about our "should we" question!

We used these tools to discuss what we learned in investigations, as well as how this decision is important to our family and why.

SHOULD WE RAKE THE LEAVES?

Why is this question important to our family / community?

Every year, lots of leaves fall from the trees in our neighborhood. When the wind blows, they can get stuck in the storm drains & then our streets can flood. Also we want to make healthy choice for the neighbors (birds, bugs, people, opossum, plants, more!)

What do we hope to ~~see~~ accomplish?

We want a plan for raking leaves that we do every year & can tell our (human) neighbors about so we can all make good choices

Option ①

Rake the leaves & put them in yard waste.

Reason

Might clog the drains, flooding the street. Too many leaves might kill plants underneath

Option ②

Don't rake the leaves. Leave them where they fall.

Reason

The crickets in the soil seem to like areas covered with leaves. The soil stays moist, might be healthier.

Option ③

Rake the leaves, but put them in one area

Reason

We might have healthier plants in the future if we ~~can~~ keep leaves on the ground. We will keep most of the leaves from washing into drains / the street.

We talked through our options and our reasons for choosing or not choosing them based on evidence

LE 10 | Making & Sharing Ethical Decisions

Should we rake the leaves in our yard?

Family deliberation and discussions

We discussed our choices and came to a shared decision:

We should rake the leaves, but put them in one area

This decision is supported by these 3 pieces of evidence:

1. **Evidence from our outdoor investigations:** we counted more critters and measured more moisture in the areas covered with leaves than without leaves.
2. **Evidence from our community interviews:** We heard why removing leaves is important for human structures, and leaving them is good for soil health.
3. **Evidence from other research we have done:** we read books and did online research about isopod and worms that help make soil healthy

Family and community values that are guiding our decision:

We want to keep our streets from flooding.

We want to keep our soil healthy.

We care about the critters that live in our soil and think the leaves might help keep them healthy.

We asked ourselves: have we thought about this decision from multiple perspectives?

Who might be affected by our decision?

Perspectives that we're taking into account: Xi, Rosaria, critters in the yard, our family that lives here, our neighbors down the street, people who clean storm drains

Perspectives that we're still missing: The people who clean our streets, the HOA, our ancestors (did they remove leaves where they lived?), the rivers that get our run-off

Making & Sharing Ethical Decisions | LE 10

Should we rake the leaves in our yard?

Family deliberation and discussions

Who might affect our decision?

What are possible outcomes?

Who has power to support our decision & act on it?
our neighbors

Who has power to
1. prevent us from acting on our decision?
Apartment management that manages groundskeeping

How might our decisions change the way things are
in our communities & places we live?

The soil might hold more water, plants might
have more nutrients. We could all have richer
soil. This could be a good start for a community
garden!

Healthy soil helps
plants grow. What
if we started a
community garden?



What questions do we want to investigate next?
Will we count more rot-poles / worms / snails
next season if we don't remove the leaves?
Do we think the plants will be healthier next season?

LE 10 | Making & Sharing Ethical Decisions

Should we rake the leaves in our yard?

Communicating about our “Should We” question

After discussing who could affect and be affected by our decision, we thought about who we should communicate with and how we could do it!

Planning your communication

Here are some steps you can take in your planning about what and how to communicate about your decisions

Step 1: Decide on what the important message is that you want to communicate.

Step 2: Decide why you are telling others about this. What do you hope others get out of this?

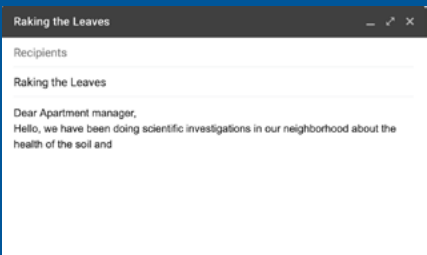
Step 3: What format do you want this to take? Decide how you want to communicate about this.

Step 4: Do it! Make something to support your conversation with others!

We decided that we can communicate with the neighbors, and with the apartment complex’s management company. If our neighbors agree, we might be able to have a community garden next season!

We decide to send an email to our apartment’s manager.

We will need their support to communicate with the groundskeepers who use rakes and leaf blowers to clear the leaves in our complex.



We will also make some signs to put up in places where the leaves are usually removed.



Family Storyline Example. 2020.

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N

tilth
ALLIANCE

W
BOTHELL

