Sustainability & Reciprocity
Lessons in Balance & Respect

"There is a great relationship between the sun, the water, the earth, everything just loves each other. The plants are a part of that too. This whole planet is like that. It is because of love that things are able to grow and survive. Love is the strongest medicine that there is. Water is always flowing and is constantly giving all the time. It never takes anything, it just gives and gives, always providing life wherever it goes. Mother Earth provides us with shelter, food, warmth, with everything that we need to survive, and She does this unconditionally. She just keeps giving and giving to her little children, despite everything we have done to Mother Earth. Just imagine if we were to give that love back to Her, how this world would be. Everything would be beautiful if we did that. Maybe we just have to look at what we are given so that we will know what we need to give back. Love is not about what you get, but what you give."

~Isaac Murdoch, Serpent River First Nation

"To be humble is to listen and to not interfere. To listen is to also learn, which is the point to all these teachings. To be humble is to try to live in balance with the Earth and to recognize where we sit in creation. Part of doing this is through offerings, by giving without expecting anything in return. Humility is knowing that we are all a sacred part of Creation and that we are equal, no better than anything else. Humility is to be practiced with all of Creation. It is to live in service to others. Knowing that you cannot know everything. The opposite of this is ego."

~Nancy Rowe, Mississaugas of New Credit First Nation

Science and Technology Curriculum Expectations - Connections:

GRADE 1

Understanding Life Systems:
•assess the role of humans in maintaining a healthy environment;
•investigate needs and characteristics of plants and animals, including humans;
•demonstrate an understanding of the basic needs and characteristics of plants and animals, including humans.

GRADE 3

Understanding Life Systems:
•assess ways in which plants have an impact on society and the environment, and ways in which human activity has an impact on plants and plant habitats; and investigate similarities and differences in the characteristics of various plants, and ways in which the characteristics of plants relate to the environment in which they grow;

Understanding Earth and Space Systems:
•assess the impact of soils on society and the environment, and of society and the environment on soils;

Understanding Structures and Mechanisms:
•identify structures in the natural environment, and explain how strength and stability enable a structure to perform a specific function.

GRADE 4

Understanding Life Systems:
•investigate the interdependence of plants and animals within specific habitats and communities;
•demonstrate an understanding of habitats and communities and the relationships among the plants and animals that live in them.

OVERVIEW:

Throughout a series of explorations involving the use of Indigenous stories, students will learn about the importance of plants and their relationship with us and the natural environment. By deepening their understanding and appreciation of the natural world, students will begin to establish a more intimate relationship with their surroundings. The key ideas that will be focused on are the concepts of reciprocity (the importance of giving), sustainability, balance, and respect in regards to how we interact with our natural world. By the end of these activities, students should be able to answer the inquiry question: *In order to live in a responsible and sustainable way, why is it important for us to know about the many different relationships that exist between plants and other living things, including ourselves?*

It is important for educators to understand that one of the main ways Indigenous Knowledge and Ways of Knowing are passed down is through storytelling. This exploration contains three indigenous stories that will explore the significance of plants and their relationship to us as well as the environment:

1) Origins of Sickness & How the Chipmunk Got Its Stripes
2) Seneca Snakeroot
3) The Three Sisters

ASSESSMENT:
Assessment for, as, and of learning is developed through the co-creation of learning goals and success criteria with students, based upon chosen overall and specific expectations. Teachers are encouraged to choose focus areas from the overall expectations listed in relation to this lesson.

INQUIRY QUESTION:

In order to live in a responsible and sustainable way, why is it important for us to know about the many different relationships that exist between plants and other living things, including ourselves?

Guiding Questions:
How can Indigenous Knowledge help us?
How can Science and Indigenous Knowledge work together to better our understanding?
What can we learn from the natural environment about relationships?
What is our relationship with plants?
How can we improve our relationship with plants?

EXPLORATION ONE:
The Origins of Sickness & How the Chipmunk Got Its Stripes

TEACHER LEARNING GOAL: By the end of this exploration, students will be able to recognize and identify the different uses that plants provide.

1) **Lead a brief class discussion on what students currently know about plants**

Possible questions to facilitate the discussion:

- What do you know about plants? **(***Possible answers: they are green, have leaves, need oxygen and water, can be used for food, etc.)*
- How do we use plants in our lives? *(Possible answers: they are eaten for food, burned for heat, made into clothing, etc.)*

2) **Prior to reading the story, you may need to go over some of these terms:**

Anishinaabek - Pronounced 'Ah-nish-nah-beck'. The plural version of Anishinaabe, meaning the people. Also, the term Ojibway is what Anishinaabek people were called by Europeans upon contact. Ojibway people are a component of the Anishinaabe people. (Terms also used: Ojibwe or Ojibewa)

Wabano - Pronounced 'Wah-bah-no'. The Anishinaabemowin (Ojibway language) word describing the moment when the sun rises in the east marking the beginning of a new day.

Zhaawanong - Pronounced 'Sha-wah-nong'. The Anishinaabemowin (Ojibway language) word meaning the south.

Eshpingmok - Pronounced 'Ish-ping-muk'. The Anishinaabemowin (Ojibway language) word describing a particular spot in the west, just south of true west.

Giywaydinong - Pronounced 'Gee (hard G)-way-di-nong'. The Anishinaabemowin (Ojibway language) word describing the northern door.

Giizhik - Pronounced ‘Gee (hard G) - shik’. The Anishinaabemowin (Ojibway language) word meaning the sky.

Aki - Pronounced ‘Ah-key’. The Anishinaabemowin (Ojibway language) word meaning the earth.

Nenaboozhoo - Pronounced ‘nen-ah-boo-joo’ The Anishinaabemowin (Ojibway language) word describing a Spirit of the Land and Sky who takes on many forms including being human to teach us lessons on how to live on the Earth.

Two legged - Refers to us human beings.

Tobacco - A sacred medicine used by the Anishinaabek (as well as many other Indigenous Peoples). There are many teachings on tobacco including how it came to be, how it is used and why. This is not the same as commercial tobacco and traditionally is used as a mixture of different barks and plants. Tobacco is used to physically express our gratitude and respect to creation. An offering of tobacco is always made before harvesting plants or anything from the Earth to recognize that we are taking a life. This is to also remind us to remain humble and grateful of the life that our Mother Earth provides to us and the importance of acknowledging that.

3) Read the following story:

The Origins of Sickness and How the Chipmunk Got Its Stripes
As told by Isaac Murdoch, Serpent River First Nation

The Anishinaabek have always learned from the Animals and four Sacred Winds. The animals were always held in high regard for their knowledge, and sacred walk of life. The Anishinaabek were so connected to the four legged, and to the ones that swim and crawl, that they could communicate and shape-shift into each other. The animals can still shape-shift into the Anishinaabe to this day because they never lost their respect for all of creation. This natural balance between humans and animals is needed for all of creation to survive. There have been many times in the past where this balance has been tested and broken unlawfully by the Anishinaabek.

The Elders say there was harmony amongst all of creation. The six spirits: Wabano, Zhaawanong, Eshpingmok, Giywaydinong, Giizhik and Aki requested this balance when Nenaboozhoo created the earth. These spirits are a force that is in everything.

There is no escaping their awesome power and great mystery. They are the natural laws that surround us, and once the two legged decided to be bigger than them, a great sickness was casted upon the earth. Here is the story that explains the origin of how sickness came to be:

Once the Anishinaabe decided to be rude and wasteful. They over harvested the animals and began walking over their food. Bones of the animals were scattered everywhere and often covered pathways and trails. The animals were very scared of them and decided to meet about the disrespect for all living things that was being displayed on the trails. In this meeting it was decided to send a delegate to the Anishinaabek to confide their issues in hopes of some sort of resolve. This delegate, who was a brown bear, was killed right away as it walked into the village and the corps was left to rot on a hillside. The animals were furious and held another council meeting to decide what to do.

The Chief of the Bear Nation stood up (who was a great white bear) and spoke and said, “We must kill the two legged or there will be no more four legged left. They have shown great disrespect to us, and do this despite us giving them their most sacred medicine: our flesh. My Nation is strong and we will destroy them.” The great white bear then gathered his Nation together and they had a sacred council meeting. It was agreed that one bear would give his life and the other bears would make bow strings out of his skin and charge the two legged head on with great vengeance. They made the bows and arrows but ran into difficulty.

Their hands and feet could not pull the string back on the bows that well. Their arms and legs could only bend so much and didn’t have the flexibility needed to shoot the bow and arrow with any sort of accuracy. The plan was good, but not good enough to carry out the mission. Again all of the animals decided to gather again in great council to discuss how to destroy the wicked two legged. After long deliberation, it was decided that there was only one way to kill them: to curse them using their strongest medicine.

Each animal provided a curse against the two legged. The deer had a curse that would cripple the two legged at the knees. The wolf had a curse that would hit them in the back of the legs causing cramping and sometimes nausea. The owl had a curse so powerful it dropped the two legged down to the ground and killed them instantly. The fish cursed them with skin ailments and bad weather, many two legged would drown mysteriously due to the fish’s curse. They would also make people dream of snakes and such, causing them to lose their appetite and die. The spiders would spin

webs in the Anishinaabek brains causing them to go insane, causing them to kill themselves. The birds sang songs and would fan the sickness down on people with their wings. It was a massive attack with brutal consequences for the Anishinabek. But what else could be done? The Anishinaabek were over populated and began destroying the earth.

The attack on the two legged worked and they began to perish and suffer at an amazing rate. No Anishinaabek was immune to this war the animals had waged against them and they were thinned out in numbers almost to the point of extinction. It was agreed by the animals to completely wipe the two legged off the earth for their absolute disrespect for all living creation. The Anishinaabek didn't know where the sickness was coming from and created big fires to burn and kill the sickness. The people started to cut themselves to release the sickness, but it was too great. The sickness that was caused was too strong.

Chipmunk attended the council meetings of the animals and knew of what was said and knew their strategies. He also knew the symptoms of each animal's curse and which ones were the deadliest. Chipmunk knew that the four legged were not going to stop their mission and decided to intervene at the risk of losing his life. He went on a warrior's mission.

Chipmunk decided to go and tell the Anishinaabek of what was happening and immediately the Anishinaabek decided to hold a sacred council. The Anishinaabek knew that their wicked ways had caused the sickness and agreed to be good-hearted people again like how their grandparents were. It was decided to give offerings of tobacco to the plants and ask them to provide cures for the sickness that was spread upon the earth. The plants agreed because they wanted the fires to stop burning and because they had a compassion that was unmatched in the natural world. They agreed to fight back the curses with their medicine and it started working with every offering of tobacco that was given. For every sickness, there was a cure by the plants. Life was restored for the people in an instant.

The plants also told the Anishinaabek that they had seen the sickness roaming the forests and that it would perish in the fires that were created. They instructed the Anishinaabek that if a person offends the animal before or after taking its life, to make a small fire on the trail on their way home and to lay tobacco and beg for forgiveness. This was to kill the curse that the animal would send to them after they lost their life. The curse would follow them on their trail and go into the fire and die. If this fire was not made as instructed, it would be possible the curse would go into the village and

strike upon the closest person. The plants also told the Anishinaabek that this type of curse would be in effect until the animals were satisfied with the amount of respect and dignity that was given.

The animals found out that chipmunk told on them because the owl was listening with his big ears when he told the Anishinaabek of what was happening. The animals got very mad after hearing about being betrayed and would often chase chipmunk under a pile of brush, scratching him on his back with their claws. This is why chipmunk has those lines on his back today. It was agreed during the council by the Anishinaabek never to kill the chipmunk for the great heroic deed that he did to save the people. This is also the origin of sickness and the mighty cures that are found in the sacred green blanket that give us life.

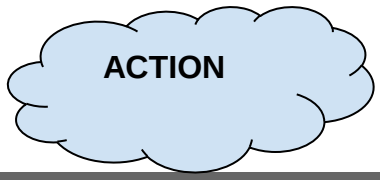
Today when we are met with sickness, it is understood that we are under attack from a force that is often greater than us, and we still turn to the natural world for help. The natural world is only a reflection of the spirit world. To prevent sickness we should never be greedy, wasteful or boastful of our hunting. When we brag about how good of a hunter we are, or waste the hide or head, we are only inviting sickness into our village. When we don't brain tan the hide of the moose or deer, we are just asking for trouble. The moose has such a big life and when it gives its life, it gives all of it. We need to use all of it. We have somehow programmed our brain into believing this is superstition and not real. We have tricked ourselves into not believing in natural law that governs everything. We have shape shifted into the greedy wasteful people that are depicted in this story. I make a plea to our good-hearted people to teach the next generation about such things, so our people can survive. The Elders say time is running out.

4) After sharing the story have a discussion by asking the following questions:

a) Who provided the cures to the sickness that the people were suffering from? *(answer: plants)*
b) What did the people have to do in order to receive the medicine from the plants? *(answer: give offerings of tobacco to show their gratitude for the medicine)*
c) What was the lesson on how to prevent sickness in the future? *(answer: not to be greedy, wasteful or boastful/arrogant/mean)*

The story tells us that plants play an important part in our lives and can provide us with medicine that helps keep us healthy and well. In fact, many medicines come from plants. Like any medicine, guidance should be sought on proper use and dosage before gathering plants. Cedar, for example, should not be taken by pregnant women or babies. Before using a plant found in the wild for the first time, consult a Traditional Knowledge Holder for any protocols which may affect the effectiveness of the medicine. Here are some examples:

- Willow bark - aspirin
- Cedar - vitamin C
- Burdock root - blood purifier
- Birch leaves and sap-detoxifier - especially for urinary issues
- Raspberry leaves and berries - tea is high in calcium and vitamin C as well as salvestrols (proven anti-cancer chemicals) if found wild (farmed raspberries do not have as high levels as organic or wild raspberries)
- Plantain - for skin irritations



Prior to the conclusion of each of the activities, conduct a whole class discussion to summarize the key learnings. You may wish to document these learnings on an anchor chart for reference throughout the exploration to make the ongoing learning visible to students.

Depending upon the time of year, you may consider taking the class outside to work on this exercise. Do you think that the use of plants that you have described is a good use of the plant(s)? Why or why not?

ACTIVITY 1: STRAWBERRIES

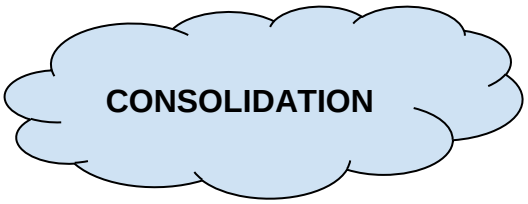
Strawberries, another early sign of spring, are known as the "O-day'-min" or “heart berry”. Their fruit and leaves signal the beginning of the foraging season for animals, including humans. One Anishinaabe teaching is to eat both the strawberry and the leaves where it attaches to the stalk. The leaves taste a little bitter and are a reminder that in life there is a little bitter and a little sweet. We may use the sweet fruit, but we should also leave some fruit for the animals and do a little work to maintain the plants for next year. Balance is important in all things, especially our use of the plants in our environment.

The First Nations observed that the strawberry was one of the first fruits to ripen. They observed that for consistency of quality, they were best harvested after the full moon in June, hence the term Strawberry moon. They also noticed through careful observation/studying that the plant had off shoots that were connected to the "mother" plant. If they broke that connection, the daughter plant would struggle and, if not nurtured carefully, wither and die; hence, the importance of "connection" to mother. This speaks to the structural and behavioural characteristics.

In terms of energy, it was observed that the strawberry, as with all plants, requires a specific amount of sunlight. Too little or too much and they struggle and die, hence another reference to balance in Indigenous teachings. The sun allows for growth which is a force that causes movement. In keeping with our role of sustainability and stewardship, we have an awareness of the needs of the plant, such as proper soil conditions and the requirement to maintain those conditions over time in order to ensure that future generations may benefit from them. We must also be aware of the natural bounty that the creator provided and the need to understand and sustain it: the sun, the soil-mineral content, the surrounding foliage for shade, the water-moisture in soil, the crawlers, insects that control other insects that may negatively or positively impact the plants, understanding seasons and lunar cycles for planting and harvesting.

> (Stephen Paquette, knowledge keeper, Mukwa Dodem (Bear clan) in conversation and email, used with permission, 2016)

Play the game Trading Cards for Plants

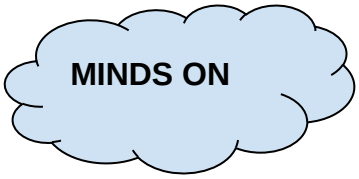


Have a class discussion by inviting students to share their learnings on the unique uses of plants. One example of this could be having a sharing circle where each student shares one favourite thing that they learned.

Ask students to reflect on the question: *Now that we have identified the many ways that plants are a part of our lives and support us, what can we do to support plants and show our appreciation to what they provide?*

EXPLORATION TWO:
Seneca Snakeroot

TEACHER LEARNING GOAL: By the end of this exploration, students will be able to identify a variety of plants and trees in their local community.



1) Read the following story:

Seneca Snakeroot
As told by Isaac Murdoch, Serpent River First Nation

Years ago, a little baby was sleeping in her Tikinaagan (cradle board), having a restful sleep while her mother worked on some bull-rush mats. A snake wandered in the wigwam (traditional house) where the baby was sleeping. The baby woke up and started crying, startling the snake by accident. The snake bit the baby out of confusion and took off out of the wigwam.

The mother heard the cries of the baby and rushed in to see what was happening. She saw the snake bites on the baby's arm. She began to panic and started calling for help. The medicine man in the village was nowhere to be seen, as he was off in another village doctoring people.

A man came into the village at that moment. He said, "What's all the commotion?" The mother explained what had happened. The man told her he had powerful medicine and would cure the baby, and he did. He then grabbed his bag of roots and threw them all over the ground outside of the wigwam. Then he said he was going to go hunting.

The mother suggested that he go find the snake and kill it, just in case it decided to come back. The man agreed. Just a short while later he found the snake basking under a stump. He asked the snake why it bit the baby. The snake explained it was

startled and it was an accident. The snake was a smooth talker and even convinced the man to give him his wampum, which the man wrapped around his tail.

The man left and the snake still wears the wampum on his tail to this day. The snake will shake its wampum to warn people of its presence. The roots that the man scattered on the ground grew into the plant that we know as Naadowe Ojiibik (Seneca Snakeroot). One of its uses is the following: Dry and grind the root into a fine powder. Sprinkle the powder around the wigwam or camp to keep the snakes away.

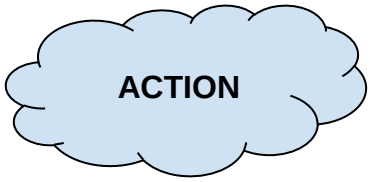
Look at how the plant even looks like the rattle on a snake's tail. Amazing.

2) Have a class discussion by asking the following

What are the different ways that we can describe people? (*e.g., hair colour, eye colour, gender, etc.)*

What are the different ways that we can describe plants? *(e.g., size of leaves, height, colour of flowers)*

How does the shape of some plants show us what they might be used for? *(for example, the long thin leaves of the cattail plant suggest it could be woven into mats. Strawberries are shaped like hearts and are good for circulation.)*



Prior to the conclusion of each of the activities, conduct a whole class discussion to summarize the key learnings. You may wish to document these learnings on an anchor chart for reference throughout the exploration to make the ongoing learning visible to students.

ACTIVITY ONE: Exploring the Characteristics of Plants
(inspired by "Creativity in the Arts and Sciences" downloaded from http://www.integrativescience.ca/Activities/)

In small groups or pairs, have students select a plant to explore and observe. This can be done with plants inside the school or outside.

Take measurements of the height of the plant, and the width and length of the shortest and tallest leaf. Look at the shade and shininess of the leaves. Look at the veins. Do they stick out or are they flat? Is the bottom of the leaf the same shade as the top? Which plants are growing? Which plants have roots showing out of the soil? What does the soil look like and feel like? What type of container is the plant growing in? Where are the sources of other needs for the plant such as air/wind and sunlight/heat? Use resources to find pictures of the plant growing in the natural environment. What are the similarities and differences between the plants kept inside and those in the natural environment? Compare what you observe in the plants. What patterns do you see? What are the plants telling you?

ACTIVITY TWO: Local Plant Walk
Take a walk through your community to identify the different plants growing

Even in an urban environment, plants such as chicory, jewelweed, false dandelion, clover, and strawberry can be seen growing through the cracks and in the ditches of built areas.

Guide the students on a walk through the community with a focus on identifying plants growing near or in sidewalks, driveways, and fences.

You may wish to contribute to “Plantwatch” which asks citizen scientists to notice the times that local perennial plants flower https://www.naturewatch.ca/plantwatch/ontario/.

Invite a local Elder or Traditional Knowledge Holder to speak to the students on the use of plants and ask if they could join you on your plant walk.
If you are unable to access anyone, here is a video link you could use:
https://vimeo.com/115933550

> *T'Uy'Tanat, also known as Cease Wyss, is from the Squamish First Nation in Vancouver, British Columbia. She has grown up learning about the plant foods and medicines of her traditional territory. Living in the city, Cease is used to practising her culture in an urban habitat -- she harvests, grows food, and teaches people about the indigenous plants of this rainforest ecosystem. This plant-rich film reminds us that everywhere we walk in North America, we are on indigenous land rich with history, knowledge, and deep roots. Listening to the stories of the land can help us all to connect more deeply with our urban environments, and learn the unique matrix of plants and other life that are indigenous to where we live. Indigenous knowledge is essential to rebuilding sustainable communities. Cease Wyss offers a beautiful vision of how to learn from the land and the plant teachers all around us.*

When you find a plant, sketch it or take a picture of it and see if you can write or draw a description of the leaves, flowers, soil type, light, and any dangers in its environment. Feel the leaves and veins. *How much water is it getting? How is it making use of the available sun and dirt? What structures on the plant help it to be successful in an urban environment? How does it reproduce? How can you tell if it is healthy or stressed? What would happen if we didn’t disturb the plants?*

Take a look at the plants which look like dandelions in your schoolyard. Spend 3-5 minutes at each location. Choose places in different locations such as near a fence, near a wooded area, next to asphalt, or next to a water source. Make sketches and notes. Measure the plants. Feel the plants and the soil. Carefully disturb the soil with a spoon and look at the insects, colour, and moisture in each location. *What patterns do you notice between the dandelions and the other plants? What patterns do you notice between the dandelions and the soil? What patterns do you notice between the dandelions and human-made elements of the environment? How is the dandelion plant*

telling you what it needs?(Possible answers: the leaves are wilting because it needs water; the edges of the leaves are burned from the sun or chemicals and it needs shade; the leaves are small because the area gets mowed frequently; it needs time to grow)

ACTIVITY THREE: Get to Know a Tree

Science tells us that to identify a tree we need to look objectively. We should note the pattern of the bark, the shape of the leaves, arrangement of the leaves on the branches, and the shape of the nuts or fruit. This activity looks at the scientific way of identifying the tree as an object or resource, then asks students to revisit the trees to get to know them in more detail alive with needs, roles, and responsibilities.

Each student should walk through the natural area and find a tree that speaks to them. Ask the students to identify the tree objectively looking at the bark, leaves, branches, and nuts/fruit, and making notes and leaf rubbings. After they have a chance to record information, gather the students and have them use their notes to decide which students visited the same type of tree. They may also use tree guides to figure out what kind of tree they found. Celebrate the learning in a knowledge circle.

Ask the students to sit with their back against the tree. Sit still for a few minutes, then sketch or describe what the tree sees. Try to focus on what the tree thinks is important. Take your time and include details.

Next imagine you are one of the creatures using the tree for support. Perhaps there is a squirrel or a bird in the branches, or a wasp nest high above. Imagine looking down from the spot where that creature might be. What would he or she see? Draw or describe the view. Don't forget to focus on what is important. What is important to a squirrel is not necessarily the same as what is important to a bird in that same tree. Take your time. Include details in your words or your drawing.

Now imagine you are an insect deep under the soil, near the roots of the tree. Look up at the tree. *What is the tree providing for you? What is important to you as an insect?* Draw or describe this new perspective. Take your time. Include details.

Invite students to express their experience by using the following guided poem prompt:

I See A Tree Poem

Sitting With a Tree

My name is_____and I am a tree.

I see _____

I wonder _____

I try to _____

I hope _____

I give thanks for _____

My name is_____and I am living in the tree

I see _____

I wonder _____

I try to _____

I hope _____

I give thanks for _____

My name is_____and I am living in the roots

I see _____

I wonder _____

I try to _____

I hope _____

I give thanks for _____

My name is_____and I am sitting with a tree

I see _____

I wonder _____

I try to _____

I hope _____

I give thanks for _____

Decorate this page however you like to show your thoughts during this experience.

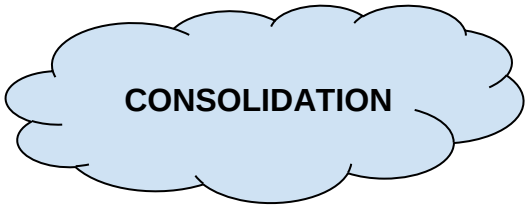
Urban Alternative

If you are in an urban environment where a woodlot or forest is difficult to find, use this as a teaching moment. Take a community walk to a mall with a parking lot containing trees, or find trees planted between sidewalks and road ways.

Measure the diameter of the tree. Take a bark rubbing. Measure the dimensions of the largest leaf and try to match its colour using paint chips. Look at the height of the tree (measure the height of a metre stick's shadow and the height of the tree's shadow. The height of the tree is roughly the height of the tree's shadow divided by the height of the metre stick's shadow). See if you can measure the size of the hole in the sidewalk or asphalt used for the tree. Feel the soil. Is it loose or compacted? How close are the roots of the tree? How far do you have to dig before you see a worm or insect? What signs of other life do you see on or around the tree? Is the tree showing that it is healthy or stressed?

Try to survey ten trees and then compare your findings to those found in tree guides for each tree. How many fully grown trees did you find? How tall will each type of tree grow? How big will its roots be? How far under the sidewalk will the roots need to grow? How will the tree get the water it needs? How does the condition of the soil and roots affect the health of the tree? How are the trees showing what they need? How could you improve conditions for our urban trees?

Teachers in the Toronto area may wish to use the Toronto Conservation Authority's tree caching trails. Using a QR reader on a smartphone or iPad, students can learn interesting facts about trees along the trail and the adjoining watershed. http://tctrca.ca/



After each student has had a chance to reflect on their learning, invite them to a knowledge circle. In their knowledge circle, each student is provided with the opportunity to share some of their own key learnings from the activities in this exploration.

As a post exploration summative activity, students can synthesize their learning by sharing their thoughts and feelings towards the natural environment by creating short poems such as haikus and hanging them from the trees using natural frames. Instructions for square lashing sticks (use natural fibres, not polyester) can be found here http://www.animatedknots.com/lashsquare/#ScrollPoint

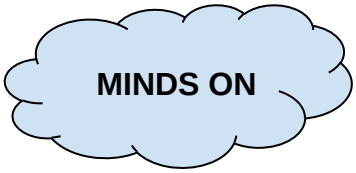
EXPLORATION THREE
The Three Sisters

TEACHER LEARNING GOAL: By the end of this lesson, students will be able to describe the relationship between plants and soil as well as their ability to grow plants to produce food.

Long before the arrival of Europeans, the Indigenous Peoples took great pride in their horticultural knowledge. Their plant and medicine knowledge was among the most advanced in the world. The Haudenosaunee were superb farmers who grew more than sixty-one varieties of sweet corn, sixty varieties of beans, and many varieties of squash, cucumbers, melon and sunflowers. One of their secrets to success is attributed to their knowledge of fertilizing and planting. For example, by planting corn and pole beans together, the corn served as a support for the beans and the beans added nitrogen to the soil. Squashes and dwarf beans were planted between the rows to reduce the growth of weeds.

Jan Kahehti:io Longboat, Mohawk Nation
Idawadadi: Coming Home, 2010, pg 69

The "Three Sisters" in Haudenosaunee teachings refer to corn, beans, and squash. The three seeds are planted together and work to support each other. Corn is the first to germinate and has a shallow root system and straight stem. A few weeks later, the bean plant will pop out of the soil and open both its dicot leaves to catch the sunlight. Its leaves are wide and heavy and it isn't long before it needs to use the corn's straight, strong stem to support it as it grows. Without the corn, the bean would be a scraggly mess along the ground. The corn allows it to make the best use of available light. After a little while, the squash emerges. It grows low to the ground and its wide, dark green leaves shade the soil and prevent it from hardening. Because the bean was able to grow up the corn, the squash can stretch out and send more roots whenever its stem touches the ground. When it rains, the corn's thin, shallow roots get the water first. The bean's deep taproot gets water next, and the squash with its many roots can get rainwater from a wider area. Everything gives. The corn gives stable height when it is needed by the bean. The squash shades the soil. The bean has a remarkable gift. It makes a partnership with the bacteria in the soil. The bean allows the bacteria to live in its roots so that it may use the bacteria's ability to change nitrogen in the air into fertilizer for the three plants. Corn planted this way did not need the addition of fertilizers to grow.
(from: Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teachings of Plants, pages 129-134, Dr Robin Wall Kimmerer. Used with permission from the author)



1. **Have a class discussion by asking the following questions:**
   What are the different kinds of relationships that you can have? *(e.g., friends, siblings, parents, etc.)*
   Can plants have relationships?

Tell students that they are going to explore whether or not plants can have relationships.

2. **Read the following story**

The following story was given permission to use by Mohawk Elder Jan Kahehti:io Longboat of Six Nations of the Grand River from her publication: *Idawadadi: Coming Home; by Jan Kahehti:io Longboat 2010, pg 70*

About our Indigenous Healing Helpers…
Our Three Sisters
By Jan Kahehti:io Longboat

In the Creation Story of the Haudenosaunee, a woman fell from the sky world to the Earth. With her she brought seeds of Corn, Beans and Squash, Indian Tobacco and Strawberries.

Since time began among the *Onkwehon:we* (original people, Mohawk), the horticulture of our Village fell into the roles and responsibilities of our women. The women as Life Givers continue to uphold this vital role of taking care of our sustenance, so life may continue for the next seven generations to come.

The cycles of our foods depend solely on the natural world for the Sun, Moon, Rain, Wind, and the Cycles of Harvest; creating a rich relationship with all of Creation.

To express our gratitude, the woman's dance is still danced. The dance and songs are in honour of the Corn, Beans, and Squash that are given to us during another good harvest cycle.

We are told by our Elders that all the Creator asks for in return is for the people to say *Mig:wech* (Thank you, Ojibwe) for the gifts of life.

Many moons ago, the people became very hungry and they asked the Creator to help them. The Creator said, "Three Sisters, will come to live with you, to look after you, but also to be a teacher."

The oldest sister, corn - came and grew tall, strong and straight, but the hot sun dried her feet and made her suffer.

The second sister, squash - came and told her older sister that she could protect her feet, so she grew around the corn and kept her feet cool and moist. However, it became difficult for squash to receive the water she needed. Sister corn agreed to funnel water down her straight leaves to assist her sister to drink.

The third sister, beans - was so weak and thin that she could not support herself at all. However, she could do something very special. She could make her own nourishment in the soil (nitrogen) and this food became valuable for all three sisters.

Sister corn grew strong with the help of sister squash and sister bean grew strong as she would make her way up the stalk of sister corn.

The people of the village saw it was very good. Not only did they have food, but they were taught what it means to work together and to share our gifts so that we all become strong.

Science has long known the importance of alternating cereal (wheat, corn), vegetable/fruit, and legume crops in farming. A well-documented study in crop rotation occurred in Rothamsted, England, beginning in 1843 (http://www.era.rothamsted.ac.uk/Broadbalk). The results showed different plants use different nutrients during their growth. Corn and potatoes, for example, use nutrients such as nitrogen and potassium for their flower and vegetable production. If farmers only grow cereal crops or vegetable crops without fertilizer, nitrogen is quickly lost from the soil so that after three to five years, the crop is not successful enough to continue.

In studies of successful agricultural plots, scientists found some plants help the soil stay healthier. The challenge is to bring nitrogen back to the root level. Though nitrogen is in the air, plants are unable to use this form. About 5% of the usable nitrogen in soil is from lightning. The other 95% of usable nitrogen comes from protein such as an insect decomposing in the soil or when it is "fixed" by bacteria in the soil or blue-green algae. These organisms have the ability to combine nitrogen with hydrogen to make

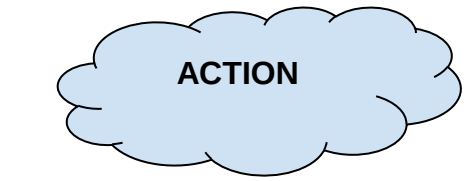
ammonium (NH_3), a form of nitrogen which can be used by plants. Farmers can add ammonium to the soil in the form of fertilizers but a more balanced approach is to use legumes like clover, beans, peanuts, or soybeans. These plants have sections of their roots, about the size of a pea, which house bacteria. The bacteria thrive in the roots and fix nitrogen from the soil. When the plants are harvested and the bacteria die, the nitrogen is returned to the soil in a form that other crops can use. The large, thin leaves of the legumes shield the soil from water loss and decompose with the roots to leave nitrogen rich ammonium in the soil.

The symbiosis between the bacteria and the legume plant replenishes the soil. The following year, the farmer may plant corn or potatoes. Organic farming experiments suggest a "row crop" such as wheat or oats the following year. These cereal crops require nitrogen as well, but the crop is placed beside the rows which housed the corn/potatoes rather than directly on top of the old seed bed. Decomposing stalks and roots from last year's corn or potato crop allow the wheat or oats a healthier soil in which to grow.

Another advantage of crop rotation is the timing of insect infestations. Insects are often picky in their choice of crop and will pass over one crop and starve to death if the familiar crop isn't available. The corn rootworm, for example, feeds on corn and overwinters as an egg laid near the roots of corn plants. When it hatches in the spring, the larvae eats the roots of the corn until it pupates into a beetle, mates, and lays eggs at the roots of corn plants. If a farmer were to only plant corn, this would devastate the crop. Planting soybeans, beans, or peanuts as part of a three-year crop rotation starves the grubs since they only eat corn roots. When the grubs starve, they do not breed and the soil becomes safe to plant corn again.

3. Have small group discussions by providing the following questions:

What kinds of relationships were in the story?
How did the three sisters (plants) help each other?
What is the message in this story?



Prior to the conclusion of each of the activities, conduct a whole class discussion to summarize the key learnings. You may wish to document these learnings on an anchor chart for reference throughout the exploration to make the ongoing learning visible to students.

> "Some native harvesting practices have been shown to improve the health of the population. In Braiding Sweetgrass (Robin Wall Kimmerer), the author discusses the harvesting of leeks. In keeping with her teachings, she harvests from the centre of the crop. Using the plant in this way helps new plants grow as she thins out the older plants and allows the younger plants more access to sun and soil nutrients. Harvesting older maple trees also allows more light into the canopy and helps younger trees to grow straight and strong."
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> (From Braiding Sweetgrass by Dr Robin Wall Kimmerer. Used with permission from the author)

ACTIVITY ONE: GARDENS

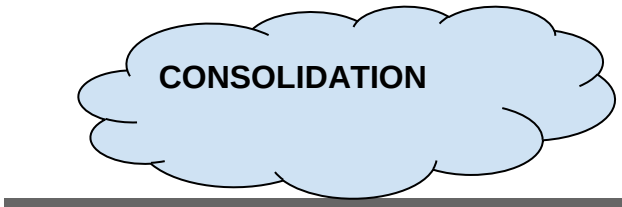
Create a garden from "garbage". Much of what we throw into the compost bin during food preparation can be used to make new plants. In groups, try one of these activities:

- take the top of a pineapple with the spiky leaves and cut off any remaining fruit. Suspend the base of the leaves into water. Change the water every other day. When roots develop, plant the pineapple plant in soil.
- put the end of a romaine lettuce in a shallow dish of water. New lettuce leaves will sprout from the centre. Once roots develop, transplant in soil. The new leaves need nitrogen, which isn't in the water alone. (Inquiry option: does organic matter?)
- take the white base of a celery plant. Cut a small slice off the very bottom to allow water to be absorbed more easily. Place it in a shallow dish of water.

Leaves will sprout from the centre and eventually new celery stalks. Once roots develop, plant in soil.

- grow sweet potatoes from half a sweet potato. Instructions are here: http://www.diynetwork.com/how-to/outdoors/gardening/how-to-plant-and-grow-sweet-potatoes
- sprout an orange tree from an orange seed. Instructions are here: http://www.wikihow.com/Germinate-Orange-Seeds
- grow green onions by suspending the white base in water and placing in a sunny window. Plant in soil once leaves begin to grow.

How is the plant getting what it needs to grow well? How could we give it nitrogen and other minerals? If we plant it in a garden, which plants have to be supported with stakes or tall plants? Which plants have thin, wide leaves which would stop the soil from drying out so fast and add to the nutrients in the soil when they decompose? Which plants have deep, wide roots? Which have shallow roots? Why do plants have differently shaped root systems? Why would it be better for us to plant many different types of plants than a whole garden of one plant?
How does sprouting food from kitchen scraps show respect for what we're given? How could we use the products of our classroom garden? How could we share our knowledge with our parents?



Now that students have had an opportunity to explore these concepts, they should be able to demonstrate their ability to answer the inquiry question. Prior to any assessment or evaluation, teachers are encouraged to co-construct the success criteria with their students in order for them to demonstrate their new learnings.

INQUIRY QUESTION:

In order to live in a responsible and sustainable way, why is it important for us to know about the many different relationships that exist between plants and other living things, including ourselves?

Guiding Questions:

How can Indigenous Knowledge help us?
Can Science and Indigenous Knowledge work together to better our understanding?
What can we learn from the natural environment about relationships?
What is our relationship with plants?
How can we improve our relationship with plants?

ADDITIONAL RESOURCES

The following is a list of supplementary resources to support this topic:

VIDEO:

WEBSITES:

The Story of Stuff http://storyofstuff.org/
The Story of Stuff exposes the connections between a huge number of environmental and social issues, and calls us together to create a more sustainable and just world.

Website for Sustainable Agriculture, Research, and Education:
http://www.sare.org/Learning-Center/Books/Crop-Rotation-on-Organic-Farms/Text-Version/Physical-and-Biological-Processes-In-Crop-Production/Crop-Rotation-Effects-on-Soil-Fertility-and-Plant-Nutrition
Give information on nitrogen fixation and crop rotation. Meant for an adult audience.

New Mexico State University study on crop rotation http://aces.nmsu.edu/pubs/_a/A129/
Great colour pictures of roots showing nodules with nitrogen-fixing bacteria.

TEXT:

Waldbauer, Gilbert, *Insights From Insects: What Bad Bugs Can Teach Us* 2005, Prometheus Books, New York. ISBN: 1-59102-277-0
The author uses short chapters to explore natural selection, synchronicity with seasonal cycles, and balance in the world of 20 insects from house flies to gypsy moths.

Peterson, Deborah, *Don't Throw It, Grow It!* https://www.amazon.ca/Dont-Throw-Grow-windowsill-kitchen/dp/1603420649

This shows how to grow plants from kitchen scraps. "With clear illustrations and step-by-step instructions, this innovative guide shows you how to cultivate 68 common shoots, seeds, pits, roots, and tubers that might otherwise end up in the compost bin. " Also available in a kindle edition.

Bruton-Seal, Julie and Matthew Seal, *Backyard Medicine:Harvest and Make Your Own Herbal Remedies* . 2009, Skyhorse Publishing, New York

Written by a practicing medical herbalist, this book explores the treatments of ailments using plants found in North American gardens and roadsides. The book contains full colour photographs and indications of similar species to help in identification.

Li, Judith L., *Ellies's Log: Exploring the Forest Where the Great Tree Fell*. 2013, Oregon State University Press
Written in chapter book format, this book explores succession starting with a tree falling in the winter. Two children, Ellie and Ricky, keep a journal of discoveries throughout the winter and spring showing plants, lichen, insects, and other animals they encounter. An online teacher's guide and reading activities can be found at the companion website: ellieslog.org

Wall Kimmerer, Robin, *Braiding Sweetgrass*. 2013, Milkweed Editions, Canada. ISBN: 978-1-57131-356-0
A highly recommended book. Dr Kimmerer blends Indigenous wisdom with life as a botanist, mother, and teacher to create a highly accessible collection of teachings about plants, fungi, honourable harvesting, and sustainability.

Densmore, Frances, *Strength of the Earth: The Classic Guide to Ojibwe Uses of Native Plants* 2005, Minnesota Historical Society.
Chippewa teachings on the traditional harvest are explored. Information is provided on medicinal uses of plants and in-depth descriptions in words and pictures of wild rice harvesting and tapping maple trees for the production of syrup.

Articles:
Wikwemikong's Joseph Pitawanakwat teaches plants can heal. 2015
http://www.cbc.ca/news/canada/sudbury/wikwemikong-s-joseph-pitawanakwat-teaches-plants-can-heal-1.2940249