Inquiries in Nature

KINDERGARTEN — GRADE 2

HCTF Education

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Curriculum Connections

Kindergarten Science

- Plants and animals have observable features
- Daily and seasonal changes affect all living things

Grade 1 Science

- Living things have features and behaviours that help them survive in their environment
- Observable patterns and cycles occur in the local sky and landscape

Grade 2 Science

- Living things have life cycles adapted to their environment.
- Water is essential to all living things and it cycles through the environment

Grade K—2 Science Competencies

- Demonstrate curiosity and sense of wonder
- Make observations; collect & sort data
- Experience and interpret the local environment

Kindergarten: Patterns in Nature

Grade 1: Properties in Nature

Grade 2: Cycles in Nature

Amazing Ants

Students go outdoors to observe and conduct simple experiments to discover the amazing world of ants.

Inquire

- How is an ant community like a human community?
- What roles do different types of ants play in their homes (colonies)?
- How do ants communicate with each other and what types of information do they share?
- What can ants teach us about how to work as a team?

Teaching Ideas

Play (ant) house

Assign students into groups representing different life stages and adult roles (castes) of ants: eggs, larvae, pupae, queen, males, and female workers. Try on your new bodies (how many legs do you have? Where are your antennae? If you are a male you have wings!) and role play life in an ant colony. Release chemical signals (pheromones) to communicate with other ants and receive signals with your antennae. Practice moving and making ant trails by following the leader, or have students get into two lines facing each other along a narrow space- the "twig" (on a log or along a line), and have the students try to pass each other without falling off the "twig".

Some questions to consider to guide the playtime:

- Where will you build your nest?
- Who will take care of the young and the queen?
- Where will you find food and water?
- Who will protect the colony from animal invaders?

Enjoy a day in the life of the ants!

In Nature

Ants are one of the most abundant and successful creatures on the planet, with more than 12,000 described species and an estimated population of 10 billion billion! Although they often have a reputation as being pests, ants also help disperse seeds, aerate soils, keep invertebrate populations (including pest species) in check, and they, in turn, are important sources of food for many other animals, from beetles to birds and bears.

An ant hill is the opening to the underground colony. Below ground, the colony may have many rooms (chambers) for different purposes, such as for food storage, a nursery for the young, and even a graveyard.

Ants are social animals, living in colonies of up to thousands of individuals, where everyone has a role to play. The queen mates with males and lays eggs; the males die after mating, becoming food for birds and insects. An egg hatches into a maggot-like larva, which then spins a silk cocoon around itself to become a pupa, and then the adult emerges. Workers are all female and have different jobs, such as protecting the colony, looking for food, and taking care of the young and queen. Ants that you see outdoors are usually workers. Ants communicate using chemical signals (pheromones) that they sense with their antennae.

Get Outdoors!

Go outdoors to look for ants. Tree trunks and sidewalk cracks are good places to start looking. Try to figure out where they are going and what they are doing. Follow their trail. Watch to see what they do when they pass each other and look for them touching each others' antennae. Look for ants carrying things, even items that are larger than themselves.

Try some experiments to learn more about ants:

- Do ants drink water? Put out a small dish of water and a small piece of bread soaked in water near some ants and watch what happens.

- Make an "ant picnic" with various types of foods, such as ripe fruit, bread, meat, cheese, chips, and leaves. Time how long it takes for the first ant to discover the picnic and how long it takes for 10 ants to arrive. Hypothesize which food they will prefer and observe to see what foods they go to. Make a data sheet with names or pictures of each type of food. Count how many ants go to each type of food and tally them with a check mark on the data sheet.
- If you find a trail of ants on the sidewalk, make a line across the trail with chalk. Watch what happens and how the ants' behaviour changes. (The chalk line will temporarily disrupt the chemical trail that ants use to communicate with each other.)

Try This

How do ants walk?

Make model ants out of play dough, standing up on six toothpicks as legs. Try removing some toothpicks to see how many are needed to keep the ant balanced. (Keep the middle on one side along with the front & back on the other side; That is how an ant balances when they walk. They pull up those legs, balance, move forward, and repeat on the opposite legs.)

Materials

For the ant picnic

- A variety of foods
- Paper plates or cardboard
- **Optional:** Magnifiers, data sheet

More Ideas and Resources

- *Growing Up Wild, Ants on Parade*
- *Dive into Ants: Ant Teaching Resources*
- *Ant Picnic*, Citizen Science Project to contribute to data on ant biodiversity and their diets around the world
- *Dr. Eleanor's Book of Common Ants*

Spiders and Their Webs

Students develop an appreciation for spiders by going on a spider web hunt to look at web types and patterns. Then they try "spinning" their own webs.

Inquire

- Why do spiders have webs?
- Is there a pattern to their webs?
- Are all webs the same design?
- What role do spiders play in the environment?

Teaching Ideas

Many children and adults have a real fear of spiders. This is an opportunity to talk and share among your students about feelings and attitudes, perhaps bust some myths about spiders, and to better appreciate them as "web artisans" and "pest control experts". Try reading a storybook that has spiders as positive role models, such as *Charlotte's Web* by E.B. White, or *Diary of a Spider*, by Doreen Cronin. Then make up your own diary entries as if you were a spider.

In Nature

In B.C. there are over 890 species of spiders. (Only the western black widow is harmful to people.) Spiders have an important role in ecosystems as food for birds and other animals, and by keep insect populations in check, that would otherwise impact agriculture, forests, and human health.

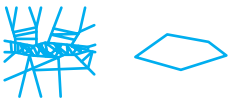
All spiders produce silk, but not all make webs. Silk is produced in organs called spinnerets, located in the spider's abdomen. Spiders can produce up to seven types of silk, each with different properties and uses. Some silk is sticky and some is not. Spider silk is five times stronger than steel!

Spiders can be identified by the type of web they spin—or if they spin one at all. Some spiders, such as the common wolf spider, catch their insect prey by running after them. Spiders use silk to make webs as well as to line burrows, to make "parachutes" that help with dispersal by wind, and to communicate.

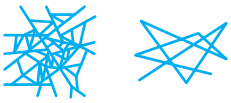
Four main types of spider webs:

- **Orb webs:** Round, spiral, wheel-shaped

- **Sheet webs:** Shaped like flat sheets, domes, or bowls



- **Cobwebs:** Also called tangle webs. Irregularly shaped webs that are often found in the corners of homes



- **Funnel webs:** Flat sheet webs with a funnel-shaped tube within which the spider often hides

Get Outdoors!

Go outside and search for spider webs. Look in tall grasses, on thick tree bark, between branches, in corners of structures, or on or under rotting logs. When you find a web, look for spiders on it or for "spider food" trapped in the web. Bring along spray bottles filled with water and try spraying the webs found with a light layer of mist to help you see the web patterns. Where did you find the most webs? What forms and patterns were noticed?

Try This

Craft your own web

Weave, build or lace a web using yarn or old shoelaces on a recyclable paper plate, or draw different types of webs with chalk or in the sand. Then eat a spider snack made of a piece of fruit for a body and 8 legs made from cut carrots or pretzel sticks.

Materials

- Magnifiers
- Spray bottles
- Collecting jars if you plan to temporarily collect spiders and look at them up close
- Paper plates, yarn or string and blunt darning needles to make your own webs

More Ideas and Resources

- *Habitats at Home: Get to Know Spiders and their Webs*
- *Spider Web Matching Game*—Discover shapes of spider webs and play a matching game connecting the spider to the type of web it makes
- *Spider Web Lacing Cards* (Orb, Tangle and Sheet Webs)
- *Watch a spider spin its web*. Amazing Spider Baffles Scientists with Huge Web, David Attenborough, BBC. (3:14)
- *Identify Spiders of BC by Web Type* (in English and French)

Discovering Patterns in Nature

By using simple tools, observation, and analytical skills, students can discover patterns while developing a deeper connection to nature.

Inquire

- What makes a pattern a pattern?
- What patterns can we find here?
- Where are patterns found in the world around us and how do they change over time?
- How do patterns tell a story of this place?
- How does discovering patterns help us to connect to this place?

Teaching Ideas

Review what students know about patterns and create and share patterns made with natural objects, such as repeating object types, colours, shapes, and sizes.

Questions to ask when discovering patterns:

- What do you notice?
- What stays the same? What changes?
- What comes next? How do you know?

Bring sorting tools outdoors to help notice and explore patterns. Some useful tools to make or gather include:

- **Treasure hunt sorters:** Use clean egg cartons to sort small, natural objects on outdoor treasure hunts.
- **View finders:** Help focus observations using picture frames—you can make your own out of pieces of cardboard with the centre cut out.
- **Sorting stations:** Delineate areas to sort natural objects with sidewalk chalk, rope, or sticks

In Nature

The foundation of mathematics is in the science of patterns—and patterns are everywhere in nature. A definition of a pattern may be "…repeating sequences or arrangements of objects, numbers, actions and events that systematically follow a given rule." (Juliet Robertson, Messy Maths) Patterns in size, colour, shape, symmetry and even sound help us to appreciate, connect to, and categorize the diversity of life and the world around us. Scientists classify and identify living organisms based on patterns, such as the number of legs and body parts of an invertebrate, the colour and size of a mammal, the number of petals on a flower, or the arrangement of leaves on a stem (opposite, alternate, or spiraled). There are also patterns that change over time in the life cycle of an organism—daily, seasonally or with the weather, with lunar cycles (tides) and more.

Nature is efficient and this reveals itself in patterns such as in the way plants grow to maximize the amount of sunlight their leaves receive, or the way they arrange as many seeds as possible onto a seed head. This efficient growth pattern is often expressed in the Fibonacci sequence (the sequence of numbers where each number is the sum of the two previous ones, e.g. 0, 1, 2, 3, 5, 8…) and is observed in spiral patterns seen in many flower petal arrangements, pine cones, seedheads, branching patterns off a tree trunk and more.

Get Outdoors!

Go outside on a nature pattern treasure hunt. Look for patterns in the ways leaves are arranged on a branch, petals on a flower, colours on a bird, insect or a shell, patterns of light/shadow/reflection, and in the colour and texture of the soil. Notice patterns in your neighbourhood, such as hedge size/shape/spacing, tree silhouettes, lines on sidewalks, light posts along the street, tree roots, the timing of traffic lights, etc. Listen for sound patterns including bird songs, traffic noises, the wind, and dog barks.

Make your own patterns with natural found objects. Try making patterns with different numbers and types of objects. Try making increasing, decreasing, and repeating patterns.

Outdoor etiquette reminders:

- Respect nature by only collecting items off of the ground and not picking anything that is still growing on a plant.
- Be cautious of poisonous and spiny plants, and be mindful of others nearby.

- "Take nothing and leave nothing". Collected items should go back to the same area in which they were collected when the activity is over.

Try This

Make pattern booklets

Use a peeled crayon and gently rub it lengthwise along an object, like leaves, stones, or tree bark to create rubbings. Swap booklets with a buddy and have them try to find the objects that made the pattern.

Find your 'Tree Buddy'

Look at the pattern of lines on the palm of your hand. Outline 2 or 3 intersecting lines with a water soluble marker. Then go outdoors to try to find a tree whose branch pattern closely matches your palm lines. Get to know your tree.

Make seasonal tally charts

Look for and tally patterns through the seasons. For example, in fall, tally colours or shapes of fallen leaves. In winter, count the number of deciduous and evergreen trees. In spring, tally the number of petals on different types of flowers; and in summer, tally flower colours.

Materials

- Paper and peeled crayons for tree rubbings
- Sorting and observation tools, such as egg cartons, rope, and home-made picture frames
- Water soluble markers for 'Tree Buddy' activity

More Ideas and Resources

Children's Books

- *Wings, Waves & Webs: Patterns in Nature* by Robin Mitchell Cranfield. Greystone Kids, 2023.
- *Flow, Spin, Grow: Looking for Patterns in Nature* by Patchen Barss and Todd Stewart. Owlkids, 2018.
- *Shapes and Patterns in Nature* by Stepanka Sekaninova and Jana Sedlackova. Albatros, 2021.
- *Math in Nature Series (Counting up Fall, Sizing up Winter, Sorting through Spring, Shaping up Summer)* by Lizann Flatt. Owlkids, 2017-2018.
- *Growing Patterns in Nature: Fibonacci Numbers in Nature* by Sarah C. Campbell. Astra Young Readers, 2010.
- *I See a Pattern Here* by Bruce Goldstone. Henry Holt and Co., 2015.
- *Pitter Pattern* by Joyce Hesselberth. Greenwillow books, 2020.
- *Swirl by Swirl: Spirals in Nature* by Joyce Sidman. Clarion books, 2011.
- *Bees, Snails, and Peacock Tails. Patterns and Shapes…Naturally* by Betsy Franco. Margaret K. McElderry Books, 2008.

Educator Resources

- *Looking for Patterns Lesson* (K-7)—Wildsight
- Messy Maths: A Playful, Outdoor Approach for Early Years by Juliet Robertson. Crown House Publishing, 2017.
- *Outdoor Learning Through Patterns in Nature*, Recorded workshop with Janice Novakowski and Megan Zeni (Outdoor Learning Store)

Now You See Me, Now You Don't

Students discover how animal colouration and patterns help them to survive by playing an active game of Camouflage and by making observations of insects outdoors.

Inquire

- How do animals' colours and patterns help them to survive?
- When is it better to blend in or to stand out?

Teaching Ideas

Gather images of wildlife in their habitat from calendars, magazines, field guides or nature websites.

Include smaller animals such as spiders, insects, fish, and aquatic invertebrates. Have students sort the images into two piles: "Now You See Me" and "Now You Don't" based on whether the animal is camouflaged or stands out. Discuss the colours and patterns that help animals to blend in or stand out in their habitat. Also discuss what eats the animal and what they eat.

- Which of the piles has more predators? Which has more prey?
- Are any of them poisonous—or mimicking other animals that are?

In Nature

Whether predator or prey, animal patterns and colours are a matter of life and death. Some animals, like many female birds sitting on their nest, blend into their surroundings with camouflage to hide from predators. While some predators, like cougars, blend into their surroundings so that they can more successfully stalk their prey. Some animals, such as salmon, change colours during their life cycle when it is time to attract a mate or fight other males for one. Some animals have bright colours, such as the red belly of the rough-skinned newt, ladybird beetles, or the yellow and black stripes of wasps and bees, which is a warning advertisement that says "don't eat me: I'm dangerous". And other animals—such as flies that mimic bees and wasps—have evolved to "cheat the system" and trick potential predators; they have warning colouration to protect them from being eaten, even though they aren't poisonous or venomous.

Get Outdoors!

Go on a bug hunt. Insects and spiders are all around us but we often don't see them without careful observation. Look for camouflaged critters on leaves or the bark of trees. Try gently shaking branches of plants or trees over a white pillowcase to discover what insects are hidden out of sight. Watch for pollinators and other flower visitors, such as butterflies, honeybees, native bees, flies, or wasps. Although many flower visitors may have yellow and black stripes, some of them, such as hoverflies, tachinid flies, clearwing moths, or native bees, are harmless and mimic stinging bees or wasps.

Hide colourful toy bugs along the trail or garden edges. Pretend to be birds looking for bugs to eat. See how many can be found and which colours are hardest/easiest to see.

Try This

Play Camouflage

One person is "It" and everyone else hides. Those who hide have to be able to see the person who is "It" (e.g. they can be behind trees or bushes, but could peek out to see). "It" opens their eyes and looks for those who are hidden without moving—just by looking with their eyes. "It" calls out the name of anyone that they see or identifies them based on their clothing. (These people are out.) When the person who is "It" can't find anyone else, they close their eyes and count to 15. During this time, players must find a new hiding spot closer to the person who is "It". "It" opens their eyes to look for players without moving. Play another round where anyone remaining hidden must find another hiding place closer to "It" while "It" counts to 10. After the 10-second round, "It" can call out "Scatter!" and all the players who are still hidden run to try to tag "It". The first person to tag "It" becomes "It" for the next game.

Materials

- Images of animals in their habitat
- Toy insects to hide along trail
- Magnifiers (optional)
- Optional: White sheet or pillowcase, magnifiers

More Ideas and Resources

- *Blending In and Standing Out Lesson Plan (Beetles Project)*—includes animal photographs
- *Life in the Flowers ID Card* (NatureKids BC)
- *Bees and Other Pollinators*—Field Guide
- *Find the Fish, by The Marine Detective* ("Eye-Spy" book with photographs from northern Vancouver Island). Marine Matters Publishing.
- *Hives, Webs and Slime*—Field ID Cards, English and French

Our Feathered Friends

Discover local birds to learn about their features and behaviours that help them to survive in their environment.

Inquire

- What can we learn about the environment by watching and listening to birds?
- What birds live near me?
- What adaptations do birds have that help them to survive?

Teaching Ideas

Create a Dawn Chorus

Listen to recordings of local bird songs and try to imitate their calls. People sometimes make up phrases to help remember bird calls, such as "Cheer-Up, Cheerily" for American robin, "Who Cooks for You" for Barred owl, and "Po-ta-to chip!" for American goldfinch. Make up some of your own! Assign groups to one of several bird calls then have everyone take part in a dawn chorus. First have everyone sing their song slowly and quietly and then become louder, as you conduct the "Bird Symphony". Share that birds sometimes freeze and go silent when a predator is nearby. Reveal/hide a photo of a predator to stop and start the dawn chorus.

In Nature

Over 500 species of birds have been recorded in BC; over 300 species breed in the province. Whether you are in the city, near a forest or a body of water, birds are all around us and offer opportunities to discover their sounds, behaviours, and adaptations. Birds use calls and songs to communicate. During the breeding season, males sing to attract a mate and to defend their territories. Birds also have calls that keep a flock together, and alarm calls to warn other birds of a nearby predator, like an eagle, owl, cat, or dog. Birds don't have teeth; their bill size and shape is adapted to enable them to eat their particular food; for example, stout short bills to crack open seeds, elongated bills to probe into mud and sand for invertebrates, long thin bills that fit perfectly into flower tubes to reach nectar, or chisel-like bills that can hammer into bark to find wood-boring insects.

Get Outdoors!

Go outside to look for and listen to birds. Don't worry about identification at first. Gather in a circle and do a "Finger Listen": have everyone silently focus on listening to the sounds around them and hold up a finger for each new sound they hear, especially listening for sounds they think are coming from birds. Each time you hear a new sound, put one finger up.

Notice bird behaviours, like preening, feeding, swimming, or flying (try using the Bird Behaviour Bingo). Start to differentiate types of birds to help with basic identification, using the **"5 S's"** and then use a field guide or ID app to help narrow down what bird it might be.

1. **Shape:** What general shape does the bird have? Do any parts of the bird stand out as big or small? How long is the bill compared to the size of the head? How long is its tail compared to its body?
2. **Shade:** What major colours and patterns do you see on the bird? Are there different colours on different parts of the bird (head, bill, legs, wings, etc.)? Are there stripes or spots on any part of the bird?
3. **Size:** How big is it? Compare its size to a bird you know. "Is it larger or smaller than a robin?"
4. **Sound:** What sounds is it making? Is it a long, complicated song or a single short note? What is the quality of the sound (nasal, flute-like, trilly)?
5. **Space:** What sort of habitat is the bird in? Is it perching high in a tree? Swimming and diving in the water? Walking on mud flats? Hopping on the ground? Hiding in the bushes?

Try This

Create a "Bird Beak Buffet" to explore how different birds are adapted to eat specific foods in their habitat. Use common household tools, such as tongs, nutcrackers, and eye droppers to represent different bird beaks and put out a "buffet" of items representing bird food (seeds and

nuts, pretend insects in rotting wood, water/nectar in a vase). Try using the different tools to see which one works best to grasp or open the different foods.

Look at photos of birds, such as hummingbirds, eagles, owls, herons, and sparrows, to notice their beak shape and how it helps them to eat their preferred foods. See *Bird Beak Buffet* activity for photos and more information.

Materials

- Binoculars (optional) or make your own as focusing tools using toilet paper rolls.
- Food items and tools representing beaks and photos of birds for the bird beak buffet.

More Ideas and Resources

- Checkout HCTF Education's collection of *resources on birds*.

Curriculum Guides

- *Together for Birds* (Project Learning Tree)
- *Cornell Lab of Ornithology*, K–2 Curriculum

Activities

- *Bird Behaviour Bingo* (HCTF Education)
- *Bird Sound Map* (Wildsight)
- *Bird Language Exploration* (BEETLES Project)

Bird Identification Tools

- *Backyard Birds of BC*— ID Cards
- *Merlin Bird ID App*—Identify birds by sight or sound
- *Introduction to the Birds of BC*—eFauna
- *How to use binoculars*

Cloud Watching

Become a weather forecaster by learning about different types of clouds and observing patterns in the sky.

Inquire

- Why do clouds form?
- What can I learn about the weather by observing clouds?
- How do clouds change over time?
- What cues are in nature that help people or other animals to predict the weather?

Teaching Ideas

Create indoor "sky study plots" through a classroom window

Have students look out the window and find an area of the sky to observe over several days or longer. Trace boxes ("study plots") on the window using dry erase markers or tape, using sheets of paper as a template. Have students write their name just outside the box so that they can come back to it for repeated observations. Have students observe the sky through the window within their study plot, drawing on paper what the clouds look like, noting the cloud shapes and the area covered by clouds. Be sure to label drawings with name, date, and time.

In Nature

Clouds write a "weather journal" in the sky that helps us to understand patterns of weather and climate. Cloud types can be categorised based on their height and structure.

The three basic forms are:

- **Cirrus**: Feathery, very high elevation and made of ice crystals
- **Stratus**: Flat sheets or layers
- **Cumulus**: Resembling fluffy cotton balls

Intermediate forms are a mixture of cloud types. Clouds are also named (with a prefix) for the altitude at which they form:

- **Cirro:** For the highest elevations
- **Alto:** For mid-elevations
- **Nimbo:** For low elevations

Some of the common cloud types and the weather that they typically forecast include the following.

- **Cirrus:** High altitude, wispy clouds. Indicate fair weather
- **Cirrocumulus:** Appear like ripples of water on a smooth lake surface, high in the sky. Indicate good weather.
- **Cumulus:** Large, white, puffy clouds. Indicate fair weather when widely separated. When they converge or are large with many "heads" they can bring intense showers.
- **Stratus:** Low, overcast and dense fog-like layers of clouds. Often produces drizzle.
- **Nimbostratus:** Low, thick blankets of cloud indicating rain or snow.
- **Altostratus:** Horizontal sheets of clouds at mid-levels, with a flat and uniform texture. They often indicate a change in the weather is coming that could lead to different cloud types bringing rain or snow.
- **Stratocumulus:** Thick lumpy masses of clouds covering the sky. May produce light rain.
- **Cumulonimbus:** Multi-level, towering clouds that extend vertically high up into the sky. Also called Thunderheads. They often have a flat-top due to high winds at higher elevations. They form with powerful air currents and are associated with hail, lightning and thunder, and heavy rainstorms.

Get Outdoors!

Make and use weather journals for outdoor observations and data collection on clouds and weather. Make a cloud viewer to help identify clouds that you see. First make a frame using cardboard or large popsicle sticks. Then glue images of basic cloud types onto the frame. Use your cloud viewer to help focus outdoor cloud observations,

to identify cloud types, and to help predict the weather. You can complement your cloud watching by making a weather station with homemade weathervane, rain gauge, wind gauge. Compare your own weather forecast with official forecasts for your area.

Try This

Make a cloud in a jar

Put a small (~5 cm high) of warm water in a glass jar. Strike a match and swirl the lit match inside the jar for a moment, before dropping it into the water. Quickly cover the jar top with the cut off top of a balloon, that can snugly fit over the jar. Press on the balloon/lid of the jar to increase the air pressure. When you release the balloon it decreases the pressure inside the jar, and a cloud will form because the water vapour from the warm water will cling to the smoke particles in the jar.

Materials

Cloud viewers

- Frames (popsicle sticks or cardboard)
- Glue
- Scissors
- Photos of cloud types

Cloud in a jar

- Glass jar
- Match
- Balloon

Weather station

- Thermometers
- Ruler and bottle for rain gauge
- Pencil
- Pin
- Paper for pinwheel and weathervane

More Ideas and Resources

- *Weather Where We Live*—Lesson Plan
- *How to Make Nature Exploration Tools*:
  - *How to Make a Pinwheel*
  - *How to Make a Rain Gauge*
  - *How to Make a Cloud Viewer*
- *Field Guide to Clouds*—Mobile App
- *National Weather Service Cloud Chart*—Full size poster with 27 cloud types

Tree-Cycles

By role-playing and investigating trees, students learn that trees have a life cycle and play important roles in their habitat at each stage.

Inquire

- Is this tree alive or dead and how can you tell?
- What is the life cycle of a tree?
- How are living and dead trees important in a forest?
- How is a tree's life cycle similar to and different from our own?

Teaching Ideas

Role-play the life cycle of a tree.

Start by curling up as a seed. Uncurl to germinate and start to grow. Sprout and become a seedling and sapling by kneeling and extending arms out like branches. Spread and wiggle fingers for leaves, stand up to grow tall and spread feet to show roots. Narrate the role-play with different events that cause the tree to grow or change throughout the seasons and interact with the environment (rain and sun that helps the tree to grow, drought that slows growth, wind that makes a branch fall off, autumn that causes deciduous leaves to fall, animals that make homes in the tree, insects that eat the leaves, people using the tree in different ways, etc.). As the tree weakens with age or other factors, role-play fungi, insects and woodpeckers that visit the tree. Eventually the tree dies by falling over, nourishing the soil and forest life as it decomposes, and helping new seeds to germinate, beginning the cycle again.

In Nature

Tree Life Cycle Stages

- **Seed:** Tree seeds are produced by cones of coniferous (evergreen) trees, such as spruce, fir, and pine. Deciduous trees have flowers, which when pollinated, produce fruits that contain seeds. Some examples include acorns (from oak trees), samaras (winged seeds, also called keys or "helicopters" from maple trees), apple seeds, alder cones, and chestnuts.
- **Sprout:** When a seed sprouts (germinates), it has a shoot that grows upwards out of the ground and a root that grows downwards in the soil.
- **Seedling:** Trees are called seedlings when the shoot emerges out of the ground. Seedlings are young trees, typically under 1 metre in height.
- **Sapling:** When the seedling grows taller than 1 metre in height or so (depending on the species), it is called a sapling. Saplings have flexible trunks and smoother bark than mature trees. Saplings have leaves but do not produce flowers or fruit.
- **Mature Tree:** A tree is mature when it starts to produce flowers and fruits or cones. Mature trees often develop thicker and rough bark and grow both taller and thicker (adding on a growth ring) each year. The lifespan of a tree depends upon environmental factors as well as the species. Red alders are relatively short-lived, usually living less than 100 years, whereas Douglas fir, Western red-cedar and Yellow-cedar can live over 1,000 years.
- **Dead Tree:** When a tree dies, it continues to be an important part of the forest. Standing dead trees are often called snags or "wildlife trees" and many animals rely on them for food and shelter. When trees fall, they go through the process of decomposition, attracting insects, slugs, fungi, and many other organisms. When they decompose, the nutrients in the tree are cycled back into the soil. Decomposing tree logs and stumps can provide a safe place for new tree seeds to germinate and grow and are often called "nurse logs".

Get Outdoors!

Go on a tree life cycle hunt. Look for trees in different stages of development, from seedlings to saplings, mature trees, and trees that are decaying or dead. Can you find any tree seedlings or saplings growing on "nurse logs" (dead trees)? Also look for tree fruits or seeds in the trees or on the ground (such as acorns, chestnuts, maple

"keys", fir cones, and pinecones). Tally how many trees you can find in each life cycle stage and draw what you found.

Try This

Adopt-a-tree

Have each student find a tree in the schoolyard or nearby to visit regularly through the seasons. If possible, plant a tree that you can care for and monitor how it grows and changes over time. Observe closely and record findings in a Tree Journal so that you can track changes over time. Use your sense of sight, touch, hearing, and smell to discover the tree. Some questions to pose:

- Is this tree alive? How do you know?
- What stage of life is this tree in?
- How does this tree help the environment around it?
- How is this tree different than the last time you visited it?

Some activities to get to know "your" tree could include:

- Measure the tree girth,
- Estimate its height,
- Draw an outline of its leaves,
- Make a bark rubbing (use a peeled crayon rubbed horizontally over the surface of a piece of paper on the tree),
- Smell its bark and leaves.
- Look for interactions that it has in its environment (are there any signs of animals in/on the tree, such as leaves that have been eaten, spiderwebs on the bark, birds in the branches).
- Try to identify what type of tree it is.

Materials

Optional

- Tree identification field guides
- Magnifying glasses
- Peeled crayons and paper (for tree bark rubbings)
- Tree life cycle tally sheets

More Ideas and Resources

- *Wildlife Trees of British Columbia*—Learn about the importance of dead trees and decomposition in the forest with a Wildlife Tree Scavenger Hunt or The Case of the Disappearing Log lesson plan
- *Plant a Tree*—Lesson Plan
- *Adopt a Tree Activity*—ideas for repeated visits to a tree
- Tree Identification:
  - *Trees of BC ID Card—Vol. 1*, Needles and Scaled Leaves
  - *Trees of BC ID Cards—Vol. 2*, Broad Leaves
- *Treemendous Science K-2 E-Unit Educator Guide* (Project Learning Tree)

Seasonal Change

By going on outdoor sensory walks and contributing to a Seasonal Wheel, students notice how plants and animals in the local environment change as daylight and temperature change through the seasons.

Inquire

- Why do we have seasons?
- How do seasonal changes affect living organisms?
- How do animals prepare for and survive winter?
- What seasonal changes can I observe in my local environment?

Teaching Ideas

Source pictures of local animals from magazines, websites, or ID cards and distribute them among the group. Role-play what that animal does throughout the seasons: how it moves or is active, what it eats in the spring and summer, how it prepares for winter and what it does to survive winter. Does it migrate, hibernate or tolerate winter? Act out what the animal does, such as make a den, store some food, and go to sleep. Or eat a lot to store energy then go on a long migration. You could mark off an area in the sunshine and another area in the shade and pretend to be migrating birds moving between summer and winter habitats. Once it is spring, have everyone wake up from hibernation, return from migration, or shed that winter fur coat.

In Nature

Seasons occur because the Earth is tilted on its axis as it revolves around the sun. When the Northern Hemisphere is tilted towards the sun, we experience longer periods of daylight and more direct solar radiation. This is summer. Winter occurs when we are tilted away from the sun, experiencing shorter day lengths and colder weather.

Living organisms respond to these seasonal changes in many ways. Plants respond to changes in temperature and day length, which cue growth and other life cycle changes, such as producing flowers and fruits. Adult insects are abundant in the warmer months and overwinter in certain life stages (often as eggs or pupae) that can survive freezing temperatures. As the day length shortens through summer to autumn and winter, plants get ready for a dormant period. Less sunlight means reduced ability to photosynthesize, so deciduous trees resorb chlorophyll, causing other pigments- the yellows and reds, which are usually masked by green chlorophyll- to become visible in beautiful fall colour displays. Because plants are the base of the food chain, when they are dormant it affects animals. For example, after wildflowers and other annual plants complete their life cycle in the fall, there are fewer plants to eat so there are fewer herbivorous insects; with fewer insects available insect-eating birds must migrate to other parts of the world where food is still abundant. Some insects, like monarch butterflies and some dragonflies, make incredible long-distance migrations.

As the day length shortens through summer to autumn, plants and animals have a lot to do to get ready for the colder, darker season. Strategies to survive winter are to migrate, (travel to areas where preferred foods are still available in winter) hibernate (go into a dormant state until daylight and temperatures increase) or tolerate (have behaviours or special adaptations, such as by storing food or growing a thick fur coat, to survive the winter months).

Get Outdoors!

Go on outdoor sense walks

What can you see, smell, hear, and feel? Use a Sensory Observation Sheet to focus the group and take notes or make sketches. Do this throughout the seasons to track seasonal changes in the local environment (as winter approaches: less food, colder temperatures, long shadows because sun is at an angle to the Earth, fewer birds and bugs). Look and listen for signs of animals to see who is active and what they are doing at this time of year.

Seasonal time lapse photos

Find a spot that your group visits each time you go outdoors (such as a tree or a landscape view) to see how it changes over time. Notice changes from one visit to another. Take a photo of it regularly and have a slideshow to see how it changes over time.

Explore shadows

Select a vertical object in the schoolyard, like a fence post, a tree, or a flagpole, with a clear area to the north to allow for shadow measurement. Or measure one's own shadow from a marked location. Have students hypothesise how the shadow will change over the course of the year through the seasons. They could predict where the shadow will land at different times of year and measure that length. Measure the shadow of the object on sunny days at the same time of day in different seasons (on the fall equinox, winter solstice, spring equinox, etc.) What changes are observed and why? You should find that shadows lengthen from fall to winter and get shorter from winter to spring and even shorter in summer. This is because of the tilt of the Earth towards or away from the sun, where the sun rays are most direct in summer.

Try This

Make a group Seasonal Wheel

Create a large circular space or mural divided into months or seasons where everyone can contribute their observations of local seasonal changes in plants, animals, and weather. Gather found /fallen natural objects such as leaves, feathers, and flowers to add to the Seasonal Wheel. Include the temperature averages and the time of sunrise and sunset (to calculate the day length) at the start of each month.

Materials

- *Sensory Observation Sheet*
- Thermometer to track temperature
- Measuring tape to measure shadows
- Images of local animals for role play

More Ideas and Resources

- *Outdoor Learning Through the Seasons*: Educator's Guide, Thompson-Nicola Conservation Collaborative
- *Secwépemc Seasonal Round*
- *Notice Nature Collection*:
  - *Signs of Autumn*
  - *Winter Animal Signs*
  - *Signs of Spring*
  - *Signs of Summer*
- *Sense Walk Activity*
- *Winter Resources*

Water Cycling in Our Community

Students learn about the connection between the water cycle and their watershed by going on a rainy day walk to see where water flows and pools in the schoolyard and surroundings.

Inquire

- Where does the water go when it rains?
- How does water cycle through the environment?
- What is a watershed?
- How can I help protect my watershed?

Teaching Ideas

Sing a song to learn about the water cycle. Try this song and video *The Water Cycle Song (by Hopscotch)*, or sing the following to the tune of "She'll be Coming Round the Mountain", using hand and body motions.

- Water travels in a cycle, yes it does (trace a big circle in the air with one raised finger)
- Water travels in a cycle, yes it does (continue to trace a circle in the air)
- It goes up as evaporation (crouch to the ground with hands outstretched, facing upwards, and stand up, raising hands up to the sky)
- Forms clouds as condensation (with arms raised up above head, move hands towards each other and apart as if forming puffy clouds)
- Then falls down as precipitation (Wiggle fingers and bring hands from above, down to the ground, as if making raindrops falling from the sky)
- Yes it does! (Cheer or dancing motion)
- (Repeat!)

In Nature

Liquid water and an atmosphere have existed on Earth since soon after our planet formed, about 4.5 billion years ago. This water has been continually cycling and shifting states (solid, liquid, and gas forms), as water vapour in clouds, falling as rain or snow, trapped in solid form as glaciers and ice, flowing or pooling underground, or as surface water in lakes, rivers, wetlands, and in the ocean. The water that we drink could have also been lapped up by a sabre-toothed cat 20 million years ago or might have once been part of ancient seas where Megalodons swam. Imagine the story a water droplet could tell! Freshwater is a precious resource that must be managed appropriately and protected for human and ecosystem health.

The water cycle is made up of four main parts: evaporation, condensation, precipitation, and collection.

- **Evaporation** occurs when water moves from a liquid to gaseous state. Liquid water heats up and turns into water vapour. Water evaporates off our skin when we sweat, off plants when they transpire, and up out of lakes, rivers, the ocean surface, and puddles. Water vapour can rise into the sky or remain lower in the air we breathe, which is felt as humidity.
- **Condensation** is when water vapour becomes cold and turns back into liquid form. Water vapour that condenses forms clouds. You can observe condensation by pouring a glass of cold water on a warm day. Beads of water form on the outside of the glass caused by water vapour in the air condensing on the cold glass.
- **Precipitation** occurs when clouds are so full that they can't hold, and the water falls back down to Earth in liquid or solid form as rain, sleet, hail or snow.
- **Collection** is the stage when water is temporarily collected and stored on the surface or underground (also called run-off). As water returns to the earth's surface through precipitation, it will run-off into waterbodies such as streams, lakes, glaciers, the ocean, or infiltrate underground where it is stored as groundwater.

No matter where you are—in a city, a forest, along the coast or in a grassland—you are in a watershed. A watershed is an area of land that drains or "sheds" water into a specific waterbody. All water that falls within a watershed goes to a common outlet. Topography determines watershed boundaries, whereby water falling on one side of a ridge would be in one watershed, and that falling on the other side would flow within

a different watershed. Water flows from high points to low points through the force of gravity. While it flows through our communities—our lawns, parks, farms, and roads—the water can pick up pollutants such as fertilizer, soap, dirt, oil, litter, and even invasive species, transporting them to lakes, streams, or to the ocean. Wetlands help to purify water by removing sediments and pollutants. We can all help to protect aquatic habitats by taking care of our watershed.

Get Outdoors!

Go outside to observe the water cycle, such as by:

- Noticing dew on plants in the morning (condensation)
- Steam coming off rocks or trees when the sun comes out after a rainfall or cold morning (evaporation)
- Rain or snow (precipitation)
- As water runs over surfaces like a roof or driveway and collects in puddles

You can also go on a rainy day walk in the schoolyard to observe the water cycle and connect to how water flows in your watershed. First go out on a clear day to predict where the water will flow when it rains.

- Where will water travel from the rooftops?
- In which direction will it flow or where will it pool on impervious surfaces like parking lots and the basketball court?

Find the storm drains in the neighbourhood and consider why they are there, where they lead, and what would happen if they were blocked by leaves or other debris. Where are the high points and low points in the schoolyard and surrounding landscapes? Place a ball on these surfaces to observe in which direction it rolls. Is there any litter that could be moved from one place to another if it were to rain? (Pick it up!). On a rainy day, go outdoors again to see where the water is flowing and pooling and if your predictions were correct. Investigate areas of flowing water.

- Which way is the water flowing?
- How fast is it travelling?

Make miniature boats out of leaves and sticks and have boat races to see how far and where the boats travel. If there is a safe route, go on a watershed walk to follow where the water travels from the schoolyard and beyond. Discuss ways that you can help protect your watershed.

Try This

Make a water cycle in a bag

Draw the sun, a cloud, and raindrops on a ziplock bag. Add some water (optional to add a drop of blue food colouring) and tape the bag to the inside of a sunny window or outdoors. Watch as the water evaporates, condenses, and collects inside the bag!

Create a simple model to demonstrate how we are all located in a watershed

Crumple a piece of parchment paper or a piece of clear plastic, like a shower curtain, and then gently open it but don't completely flatten it out. Explain that this is like the surface of the land. The high points are hills or mountains, and the low points are the valleys. You could draw and name some landmarks on your model, such as towns or the school location, and some nearby natural features, such as lakes and mountains. To determine the watershed boundaries, ask which way a drop of water would flow if it fell on a mountain ridge on your model. The bowl-like drainage area where the imaginary drop would flow is the boundary of the watershed. Use a watering can or spray bottle to demonstrate how water flows and pools through the watershed.

Materials

Water cycle in a bag

- Zip-lock baggies
- Permanent markers
- Tape

Watershed model

- Parchment paper or shower curtain/plastic
- Watering can or spray bottle

More Ideas and Resources

- *Grade 2 Place-Based Learning Example*. Integrates all science big ideas with a First Nations perspective, focusing on the life cycle of salmon and the water cycle, supplemented with examples of chemical and physical processes and the force of gravity.
- *What in the World is a Watershed*—Lesson. Build model watersheds to understand the connection between the water cycle and your watershed.
- *The Incredible Journey Activity* (Project WET)
- *The Water Cycle*—Grade 2 Lesson Plan from BC Hydro with visuals and related activities, like making a water cycle mobile
- *Getting Little Feet WET*—Curriculum guide for purchase with 11 lessons for young learners (PreK to Grade 2) to explore different aspects of water
- *Water for Us*— BC Teachers' Federation. Lessons to help young children become aware of the scarcity of clean water, where water comes from, and the need to protect it. Includes activities and suggested children's books.
- *Discover Water*-—Project WET. Interactive videos and online games to learn about the water cycle, watersheds, water conservation and other topics that connect us to water.
- Water Cycle Poster (*English* and *French*)