



Nebraska Forestry Connections Curriculum

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Nebraska Conservation Education

Dear Educator,

I am so glad that you found this resource for educating children about the natural wonders of Nebraska! Whether you are a formal educator, a nature center interpreter, an after school programmer, a home schooling parent, or anyone else, all of us here at the Nebraska Forest Service sincerely hope you find these lessons and resources useful. Throughout these lessons you will find new ways to guide children in Pre K-12th grade in their learning about trees and forests in Nebraska. From the animals who depend on forests, to the changing colors of leaves in the fall, to using fire as a management technique, there are so many things to learn about trees in the "Tree Planters State"! Along the way students will practice their math skills, build their language and communication knowledge, and be scientists. These lessons are hands-on and designed to engage the whole student through critical thinking, decision making, and physical movement.

As you become more familiar with these lessons you will notice a few things. First- the lessons are arranged in grade order, so Pre K lessons are at the beginning and secondary lessons are towards the end. The last five lessons are designed to be used with a variety of age groups and are ideal for non-formal settings. Second- most of the lessons are aligned with Nebraska State Educational Standards, specifically the standards in place in August of 2018. Third- there may be some concepts you are unfamiliar with. Don't worry! Each lesson contains comprehensive background information. However, if you still aren't quite sure, the Nebraska Forest Service staff are here to help. Do not hesitate to contact us with questions, class visit requests, or field trip requests at trees@unl.edu.

Thank you for using this resource to support forestry education in Nebraska. You are raising and teaching the next foresters, and we can't think of a better job in the world.

Sincerely,

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Nebraska Forest Service
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The Nebraska Forest Service: Enriching lives by protecting, restoring and utilizing Nebraska's tree and forest resources.



Thank you

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Forests in Winter

Summary: An abundance of life calls the forest home even in the winter. Animals of all kind depend on the trees, plants, and even the snow to survive cold and long winters. In this activity students will listen to the book *Over and Under the Snow*, create their own winter forest, and explore outside for signs of wildlife.

Objectives: 1. Students will be able to explain that some animals hibernate, some migrate, and some live normally during the winter. 2. Students will be able to identify adaptations animals make to live in the winter.

Grade Levels: Early Childhood-Kindergarten

Time Consideration:

10 Minutes to prepare

30 Minutes for the reading and art activity

30 Minutes for the nature walk

Background Information:

It can be easy to think, when it is bitterly cold out, that nothing could survive the winter. However, just as humans have adapted to living in cold climates, so have animals that inhabit the area. Animals have three main methods for surviving winter: leave (migrate), sleep (hibernate), or bulk up and burrow in (insulate). For some smaller rodents, snow is not a hindrance, it is key in surviving the winter. When snow piles up to at least 6 inches, animals like field mice and voles will create elaborate tunnels and chambers in the ground and in the snow next to the ground. This is the subnivean zone. These tunnels and chambers give them access to grasses and nuts for food, and although they are surrounded by ice, it usually sits at around a balmy 32°F. While that may still seem cold, as anyone can tell you who spends any amount of time outside in the winter in the northern part of North America, that is significantly warmer than it is on top of the snow pack in the wind.

Not only do small creatures depend on the subnivean zone, so do various carnivores, not for shelter, but for food! Owls can hear the rodents scuttling beneath the snow. The owls ball up their feet and swoop down to penetrate into the tunnels at just the right moment for a warm winter meal. Foxes use their noses to find the tasty morsels pouncing with their full weight right on top of where they smell the animals, hoping to pierce through the snow pack and catch their prey quickly. For so many in the forest, snowfall, and lots of it, is very important for their winter survival.

For more information about the subnivean zone, visit the following websites:

https://northernwoodlands.org/outside_story/article/subnivean-shelter-snow

http://msue.anr.msu.edu/news/the_subnivean_zone_life_under_the_snow_part_1

Preparation: Review the background information, gather the supplies.

Materials:

Over and Under the Snow by Kate Messner and Christopher Silas Neal

White Paper

Cut out picture of a mouse or vole for each student

Crayons or Markers

Glue

Procedure:**PART A:**

1. Bring the students together to read the book. Before you read, ask: what do you think animals who live in the forest do in the winter? Once you've received and discussed a few answers, explain that you are going to read a book about how some animals have adapted to be able to live in the forest in the winter.
2. Read the book *Over and Under the Snow*.
3. When you finish reading ask the students: How did the animals in the book survive winter? Use the background information and the information at the end of the book to explain more about the subnivean zone and how animals use it. Also, make sure to discuss the animals in the book that were seen hibernating.
4. Ask the students: What are other ways that other animals survive the winter? Make sure to discuss migration as a way that some animals survive through winter.
5. Explain that each student is going to build a home in the snow for their own field mouse or vole. When each student receives their supplies, they should draw tunnels and chambers in the ground (sleeping area, eating area, etc.) for their animals, as well as tunnels in snow to move around. Then they should glue their animal on the paper
6. Hand out the paper, crayons/markers, and mice/vole cutouts and let them build their own subnivean zone.

PART B:

1. A day or two after snow reaches 6 inches (if that happens in your area) arrange to take a walk with your students.
2. Take all of the students outside and be sure to explain any necessary safety expectations.
3. Ask the students to look for signs of wildlife. Do they see footprints, entrances to tunnels, snow that appears to have been rolled in and patted down under a tree?
4. Note: You could also do this walk when the snow starts to thaw and melt. Before the snow melts completely the top of the tunnels will melt exposing the complete subnivean zone.



Night and Day

Summary: When we go to sleep, does the forest go to sleep too? Nocturnal, diurnal, and crepuscular animals call the forest home, but since we explore the forest mostly during the day, we don't often see who comes out at night. In this activity the students will discover who is awake when and what some of the advantages to being an "early bird" or a "night owl" are!

Objectives: 1. Students will be able to explain the meaning of diurnal and nocturnal 2. Students will be able to identify adaptations animals make depending on if they are nocturnal or diurnal.

Grade Levels: Early Childhood-Kindergarten

Time Consideration:

30 Minutes to prepare

15 Minutes for Part A

20 Minutes for Part B

Background Information:

Animals around the world have adapted to be active mostly in the day (diurnal), mostly at night (nocturnal), or even mostly during dawn and dusk (crepuscular), forest dwellers are no exception. At night the forest comes alive with a whole new set of creatures, waking up to search for food, water, shelter, and mates all while trying to avoid predators. Animals who thrive at night have adaptations that help them find food and sense predators closing in. When it comes to sight, nocturnal animals can go one of two ways. Foxes and raccoons have smaller eyes, but big, probing noses. Since it is harder to see at night, they utilize their sense of smell more than their eyesight. Other animals, like owls, have much larger eyes so that they can take in all available light to see their prey from a long distance. The variance in the two adaptations has a lot to do with how the animals hunt and what they eat. Owls sit up high and need to swoop in on prey quickly, as soon as they can hear or see them. Foxes and raccoons can smell and hear small animals scurrying under the ground, helping them figure out right where to dig. Another common adaptation is large ears, the bigger the ears the better the hearing. When an animal essentially can't use their sight, the other senses must be heightened. All of these adaptations are essential for the survival of nocturnal animals.

Preparation: Review the background information, gather the supplies.

Materials:

Forest Bright, Forest Night By Jennifer Ward and Jamichael Henterly

Pictures of animals seen in the book, enough for each group of 2-3 students to have a set as well as a teacher set. Make sure to have the same amount of diurnal and nocturnal animals.

Procedure:

PART A:

1. Bring the students together to read the book. Before you read, ask: Have any of you ever gone for a walk in the forest? Was it during the day or at night? What did you see? What do you do at night? Do all animals sleep at night? What animals can you think of who wake up at night? Read the book aloud. You can start with either day or night.
2. Ask the students: What animals did you see in the book during the day time? Keep track of a

class list on a board or flip chart. Ask: What animals did you see in the book during the night time? Track these as well.

3. Ask the students if they know what it is called when animals are awake at night. Teach them the word “nocturnal”. Ask the students if they know what it is called when animals are awake during the day. Teach them the word “diurnal”.

PART B:

1. Remind the students about the Night and Day book and ask them to name a couple of animals that come out at night and during the day.
2. Split the students into groups and give each group a set of the diurnal animal pictures you prepared. Hold up and go over each card with the students so they know what each animal is. Then ask them to sort or categorize the animals in anyway they would like. Do the same with the nocturnal animal pictures.
3. Ask the students to sort their animals back into nocturnal and diurnal categories.
4. Ask the students: Do you see anything that looks similar between the diurnal animals? Discuss what they notice. Ask: Do you see anything that looks similar between the nocturnal animals? Discuss what they notice. Ask: When you look at the pictures of the animals, do you see anything that could help you figure out if they are awake during the day or at night?
5. Discuss the answers that the students give and ask them how the things they notice (like larger eyes or bigger ears) could help an animal that is awake at night or why an animal who is awake during the day may not need that.

Extension:

Provide the students with a felt board forest background and many different types of nocturnal and diurnal animals (both those you discussed and those you didn't). The students can practice switching the animals between night and day and try to figure out when the new animals might be awake.



A Home on Many Levels

Summary: Trees are a home to many different animals. Not all of those animals live at the top of the tree. In this activity, the students will investigate a tree to discover what types of animals live in all parts of a tree.

NE CCR-Science Standards:

SC.K.7.2

SC.2.7.2

Objectives: 1. Students will be able to identify animals that live in/on trees. 2. Students will be able to discuss why some animals need trees.

Grade Levels: Kindergarten-2nd grade

Time Consideration:

10-45 Minutes to prepare, depending on how long it takes you to find a suitable tree

45 Minutes for the activity

Background Information:

Animals of all kinds depend on and live in trees. Birds and squirrels are often the first animals that come to mind when asked what animals live in trees. While birds and squirrels are the most visible, many, many creatures inhabit trees. If you take the time to find a tree and do a search you might see spiders building webs between branches, cicadas shedding their skins on the trunks, katydids looking for leaves to chomp, skipper butterflies drinking nectar and spreading pollen, and raccoons slumbering in a hole. All of these animals need this tree for food, shelter, and even water.

This lesson focuses on three basic levels of a tree. The base is where the trunk meets the ground. At this level you will find animals scavenging on the ground, looking for seeds or nuts. You will also find animals in the dirt at the base, helping to decompose collected leaves and turn them into nutrient rich soil for the tree and other plants. The trunk of the tree usually doesn't have any branches, but can still serve as a good home for animals, including burrowing bugs that make their home beneath the bark. The crown of the tree is the top, where the branches spread and the leaves grow, providing great shelter to many animals.

Preparation: Review the background information, gather the supplies, and find a tree (or 2-3 trees) within walking distance of your classroom that shows signs of animals living on it at many levels.

Materials:

Printed photo or poster of a tree

Trowels or other digging supplies

Magnifying lenses

Binoculars (optional)

Chart or Poster Paper

Drawing paper for each student

Crayons or markers for drawing

Tree Trunk Traffic by Bianca Lavies (Optional)

Procedure:

1. Gather the students for a discussion about their homes. Ask: Who lives in a house with just their family? Who lives in a house with multiple families? Who lives in apartments with multiple levels? Explain that trees are like apartments, providing animals that depend on trees with a home on every level of the tree. If necessary, review what all animals need in order to survive (food, shelter, water, space).
2. Next discuss the levels of a tree, explain that today they will look for animals at three main levels (base, trunk, and crown). Use a photo or poster of a tree to help the students identify each of these levels.
3. Prepare to go outside. Explain or review any necessary safety measures before going out.
4. Once at the pre-selected tree(s) explain to the students that they will have 5 minutes to look around the base of the tree and into the ground. Provide them with the trowels or other items you collected for digging and the magnifying lenses. Remind them that they are looking for different animals that live at the base level.
5. After 5 minutes, bring the students back together and write down what the students found at that level of the tree on the chart or poster paper.
6. Repeat this process with the two other levels of the tree (trunk and crown) bringing the students together after each observation time to discuss what they saw.
7. Head back to the classroom or find a place outside where you can display the poster you used to record their findings.
8. Review the findings for each area and ask: Do you see any patterns? Did you see any animals that were using more than one level? Why do you think certain animals live at specific levels of the trees? Do some animals have adaptations that help them live somewhere that other animals couldn't?
9. Optional: Read the book *Tree Trunk Traffic* by Bianca Lavies. Help the students compare what animals are found on the maple tree in the book and the tree(s) the class investigated.
10. To finish up, have students draw a picture of their tree and draw at least one animal that they found at each level.



Growing Every Day

Summary: Different plants grow at different rates and have different structures while growing. During this lesson students will track the growth of multiple plants and compare and contrast their growth using picture graphs and simple math operations.

NE CCR Math Standards:

- MA 1.2.3
- MA 1.3.3
- MA 1.4.1
- MA 1.4.2

Objectives: 1. Students will be able to compare multiple plants to each other and place in order by height. 2. Students will be able to create a picture graph that shows how tall each of the plants is. 3. Students will be able to compare the growth of plants using addition and subtraction.

Grade Levels: 1st grade

Time Consideration:

- 10-20 minutes to gather supplies
- 15-20 minutes to plant
- 1.5-2 Weeks for the plants to grow
- 20-30 minutes to take measurements and complete activity

Background Information:

Most plants tend to grow a bit differently than other plants. This can be due to genetic factors and adaptations made by the plant, but it can also be due to external factors such as soil quality, access to water, and access to sunlight. While some plants clearly grow very differently, others take close observation in order to see the difference. Botanists, or scientists who study plants, often closely observe and measure plants to find similarities and differences and learn more about the growth of certain plants. This activity allows your students to be like botanists while they care for plants, observe, and measure them.

Preparation: Review the background information, gather the supplies, and decide what data sets you will measure.

Materials:

- Pumpkin seeds, enough for each student to have one or two
- Sunflower seeds, enough for each student to have one or two
- Watermelon seeds, enough for each student to have one or two
- Seed Start cups (egg cartons work well!)
- Copies of student sheet
- Popsicle sticks or something else labeled with each plant name
- Rulers

Procedure:

1. (If time is limited, you can plant the seeds without the students and skip to step 4 with the students.) Gather your students, ask them: Have you ever planted a garden or maybe planted some flowers in a pot? When you did, did you track the growth? Did you watch them to see how they were growing?
2. Explain that today each of them are going to plant three seeds and take care of them for a few days to watch them grow. Then, once they have sprouted and are growing well we are going to measure and compare their growth.
3. Provide the students with the supplies you gathered and show them how to plant their seeds, making sure they mark each cup so they know which plants are in each cup. Find a warm spot to put the seeds and remember to water them each day.
4. After the plants have grown a few inches, review the concepts covered on the student page. Hand out the student page and the rulers and ask the students to complete the student page.
5. After the students have finished their worksheets, use the data they gathered to create a class picture graph. Create a picture graph to show which of each of the students' plants grew the most, and which grew the least.
6. If you have a school garden, ask if you can transplant the seedlings to the garden.

Growing Every Day

Name: _____

1. What is the length of each of your plants?



Sunflower plant: _____



Pumpkin Plant: _____



Watermelon Plant: _____

2 Circle the plant is the longest?



3. Circle the plant is the shortest?



4. What is the difference between the shortest and longest plants?

$$\begin{array}{r} \underline{\hspace{2cm}} \\ \text{Longest Plant} \end{array} - \begin{array}{r} \underline{\hspace{2cm}} \\ \text{Shortest plant} \end{array} = \begin{array}{r} \underline{\hspace{2cm}} \\ \text{difference} \end{array}$$

5. How long would the shortest plant be if you added the difference to it?

$$\begin{array}{r} \underline{\hspace{2cm}} \\ \text{Shortest plant} \end{array} + \begin{array}{r} \underline{\hspace{2cm}} \\ \text{Difference} \end{array} = \begin{array}{r} \underline{\hspace{2cm}} \\ \text{Length} \end{array}$$

6. Make a picture graph showing how tall in inches each plant is.





Seeds to Trees

Summary: Many trees and all kinds of plants start out as small seeds. It is hard to imagine that an oak tree you can't wrap your arms around was once small enough to fit in your pocket. In this activity, students will hear about an acorn that became a tree, go on a scavenger hunt to find other seeds, and take a closer look at tree seeds.

NE CCR-Science Standards:

SC.2.7.2

Objectives: 1. Students will be able to explain that trees grow from seeds. 2. Students will be able to compare different seeds and trees.

Grade Levels: Pre K- Kindergarten

Time Consideration:

10 Minutes to prepare

30-60 minutes for the activity

Background Information:

Most of us know that many plants (including trees) start out as a little seed. But have you given much thought about what just one seed can provide to a forest? Seeds play an integral role in keeping forests healthy and alive. Without them, once a tree died we would have no more trees! Without seeds many animals would go hungry! The seed is a small, and often forgotten, hero of the forest.

Seeds also come in all kinds of shapes and sizes depending on the tree and the environment. Some seeds have delectable fruit surrounding them (apples, oranges, bananas, etc.), others have hard shells (walnuts and acorns), and still others are light enough to float on air (cottonwood and maple seeds). The key here is that seeds are of no use if they don't get dispersed. Some spread thanks to animals eating the fruit and passing the seeds, others count on squirrels to carry them around and bury them, and others use the wind to go as far away as possible.

Preparation: Review the background information, gather the supplies.

Materials:

Because of an Acorn by Lola Schaefer, Adam Schaefer, and Frann Preston-Gannon

Magnifying lenses

Collected seeds (collect some from trees outside, but you could also collect seeds from fruit like apples, oranges, and lemons. A coconut is also fun!)

Sharp knife to cut open seeds

Procedure:

1. Ask the students: Have you ever planted a seed and watched it grow? What did it become? Is it still alive? Have you ever found or collected acorns? What does an acorn become if it has the right growing conditions?
2. Read the book *Because of an Acorn*.
3. Ask the students: What happened all because one acorn was able to grow?

4. Explain that the students will be going on a scavenger hunt for other seeds. (If it is the wrong time of year, or if you don't have the space available to do a scavenger hunt, collect tree seeds on your own to bring in.)
5. Take all the students outside for the scavenger hunt. Make sure to explain any safety expectations ahead of time. Give the students time to explore and complete their hunt, then take the seeds back inside.
6. Once back inside, let the students take a closer look at the seeds. At this point you could also pass out other seeds you have collected. Ask them to sort the seeds and to compare the acorn in the book to the seeds they found or you brought in.
7. Once the students have had enough time to take a closer look at their seeds, bring them together and cut open a few of the larger seeds (such as acorns or black walnuts or honeylocust pods) for the students to look at and see what seeds look like on the inside.
8. Ask the students: Why do you think these seeds are different? Why do you think one tree will have one type of seed while another will have a seed that looks completely different?
9. Once you have explored all the seeds, ask the students to draw one thing that happens "because of a seed..."

Extension opportunity:

Plant one or more of the seeds you collected and discuss what it takes to keep a tree alive. If you keep repotting it and take good care of it, you may be able to plant it outside eventually!



The Colors are Changing!

Summary: Why and how do some trees change the colors of their leaves? Many of us enjoy seeing the changing, beautiful colors of the trees in the fall, but we don't think about why and how that is happening. In this lesson the students will do an experiment to find the colors in tree leaves and will learn the science behind this beautiful phenomenon.

NE CCR-Science Standards:

SC.2.7.2
SC.3.9.3
SC.4.6.3

Objectives: 1. Students will be able to describe why and how leaves change color. 2. Students will be able to show that the colors are or aren't in the leaves already through an experiment.

Grade Levels: 2nd-4th grade

Time Consideration:

20-30 minutes to prepare
1.5-3 hours for the activity, but other lessons and things could be done while the leaves are sitting for 60-90 minutes.

Background Information:

As the days get shorter going into autumn, trees begin to prepare for winter. The shorter length of daylight is what stimulates trees to begin to cut off the leaves from the rest of the tree. They do this mostly to prevent the loss of water throughout the winter. Once the veins between the tree and the leaves close, chlorophyll is no longer made and as it dies off the green color goes with it. That is when we begin to see the carotenoids that were there all along. This yellow to orange pigment is always in the leaves and is usually the first new color we begin to see. Then we begin to see the red of the anthocyanins. This pigment is actively made by the tree in the sap as sugars begin to break down towards the end of summer. The production of anthocyanins is greatly dependent on the temperature and precipitation throughout the end of summer into autumn. This is why you may notice the same individual tree will look different from year to year in autumn.

To explain this to your students, we suggest you pick one or both of these short videos to show them.

<https://www.youtube.com/watch?v=IPvbl1mu7kM>
<https://www.youtube.com/watch?v=s7qTx2l7bvo>

Preparation: Review the background information, pick one (or both) of the videos for your students to watch, gather the materials.

Materials:

Different types of tree leaves, 2-3 from the same tree per pair/group of students
Small jars (baby food jars work well), 1 per pair/group
Aluminum foil or plastic wrap to cover the jars
Rubbing alcohol

Paper coffee filters

Shallow pan (tin pie pans work well), 1 per pair/group

Hot tap water

Plastic knives or spoons

Projector or way to show the videos

White board or poster for recording and displaying answers.

1. Ask the students: Why do you think leaves change colors in the fall? Record these answers on a poster or white board to reference later. Ask: What leaf colors have you seen in the fall? Also record these answers.
2. Let the students watch one or both of the videos from the background information. You will likely need to discuss some of the scientific concepts and review them if the students are unfamiliar or have forgotten. You may also need to review some of the vocabulary used. This will be dependent upon your students.
3. Review the reasons the class had brainstormed and compare them to what you know is the scientific reason behind leaves changing colors.
4. Explain that the students will now be doing an experiment to see the colors in the leaves.
5. Pass out the supplies and post the instructions.
6. Walk through the student page and the procedures with all of the students to make sure they understand. Safety Note: Rubbing alcohol can be harmful if mishandled or misused. Use in a well-ventilated area, and avoid contact with skin. You may want to pour the alcohol for the students.
 - a. Tear or chop the leaves into very small pieces and place them into the jars.
 - b. Add the rubbing alcohol to the jar, just enough to cover the leaves. Using the plastic knife or spoon, carefully chop and grind the leaves into the rubbing alcohol.
 - c. Cover the jar loosely and transfer it to a shallow tray containing one inch of hot tap water.
 - d. Let the jar sit for at least a half-hour, or until the alcohol has become colored. Twirl the jars about every five minutes and replace the water if it cools.
 - e. Cut a long thin strip of coffee filter paper. Remove the jar from the water and uncover it. Place the strip of filter paper into the jar so that one end is in the alcohol and the other side can bend over the top of the jar. Tape the filter paper to the jar.
 - f. Let the jar sit for another 30-90 minutes. You will notice that the color will travel up the paper and you should be able to see the different colors in the leaf.
7. Discuss with the students what they found during their experiment. Depending on the time of the year they probably didn't see any reds or purples. Do they remember why that is?



Measuring Your Trees

Summary: There are many ways to measure how tall a tree is. In this lesson, students will use their own height and shadows to create a fraction to figure out how tall their trees are.

NE Math Standards:

MA 4.2.3

Objectives: 1. Students will be able to create an equation using fractions which solves for the height of a tree. 2. Students will be able to solve an equation using fractions to determine the height of a tree

Grade Levels: 4th-6th grade

Time Consideration:

10 minutes to prepare

30 minutes for the activity

Background Information:

Measuring trees is an important part of being a forester or managing a forest or tree farm. From the height and diameter of a tree, one can determine how much usable wood could be harvested. There are many, many ways to measure the height of a tree. From technical devices to simple math, everyone can measure a tree. In this lesson the students will use their own height and the length of their shadow, along with the length of the tree's shadow to determine the height of the tree. Ultimately the equation can look like either of the following options

$$\frac{\text{Tree's Height}}{\text{Tree's Shadow}} = \frac{\text{Student's Height}}{\text{Student's Shadow}}$$

OR

$$\frac{\text{Tree's Height}}{\text{Student's Shadow}} = \text{Student's Height} \times \text{Tree's Shadow}$$

Preparation: Review the background information, gather the materials.

Materials:

Clipboards

Scratch Paper

Writing Utensils

Measuring tape (1 for every 2 students)

Procedure:

1. Ask the students: Have you ever tried to measure something that you didn't have a ruler or measuring tape long enough to measure? How did you do it? Did you estimate or did you figure out another way?
2. Explain that today they are going to measure trees. Often trees are too large to be able to measure with standard measuring tapes, so foresters and tree farm managers have other ways to measure the height of the tree.
3. Give students the following scenario: You are working on a tree farm and the manager needs to know how tall the trees are so he can calculate how much wood could be harvested. The manager has asked your team (class) to measure the height of all the trees using your height, the length of your shadow, and the length of the trees' shadow. She explains that you should be able to set up an equation using fractions to solve for the height of the tree.
4. Ask the students to split into pairs and to collect a clipboard, measuring tape, scratch paper, and writing utensil to prepare to go outside. Before going outside, explain any safety measures the students need to be aware of.
5. Once outside, demonstrate how to use the measuring tape.
6. Provide the students with enough time to measure their height, the length of their shadows, and the length of a shadow from a tree.
7. Once all data is collected you can continue the lesson inside or outside.
8. Ask the students to work with their partners to create an equation using ratios/fractions to solve for the tree's height. Provide guidance as needed.
9. Once everyone has solved the problem, compare results for the same tree. Discuss any discrepancies you find.
10. Explain that the manager can now take all of the measurements and use that along with the diameter of the trunk to determine how much wood is in each tree.

Extension:

1. For more options for measuring trees (height, crown spread, and diameter) see Lesson 67: How Big Is Your Tree? In Project Learning Tree's PreK-8 Environmental Education Activity Guide.
2. Contact us at trees@unl.edu to schedule a presentation by a forester to talk about and show the students all the different ways they measure trees and why they need to measure them.



Will Clean

Summary: The biosphere and hydrosphere interact in a variety of ways. In the activity the students will build a model to demonstrate some of the ways water, soil, and plants interact.

NE CCR-Science Standards:

SC.5.13.4

Objectives: 1. Students will be able to explain how the biosphere and hydrosphere interact. 2. Students will be able to demonstrate how the biosphere can help clean contaminants out of water using a model they construct.

Grade Levels: 5th-6th grades

Time Consideration:

30-60 Minutes to prepare

45 Minutes for the first part of the activity

1.5-2 Weeks for the plants to grow

30 Minutes to finish the activity

Background Information:

Nebraska's streams and rivers lace the entire state and offer us a border on one side of the state, in fact, Nebraska has more miles of streams and rivers than any other state. That means that we have more miles than any other state of the ecological systems that accompany streams and rivers. A riparian forest is the wooded area adjacent to a river or stream and is ground zero for the interaction between the hydrosphere and biosphere.

Riparian forests, or buffers, interact with the bodies of water around them in various ways. When it rains the vegetation around the streams helps absorb some of the water, slows it down as it reaches the streams, and holds the soil in place. This helps prevent flooding and erosion. As water moves through the streams, surrounding vegetation draws on it for their own water needs, helping to filter water as it moves through the entire system.

When the biosphere is severely disrupted (whether it be caused by humans or natural, like after a wildfire) a change in the hydrosphere will be noticeable. Often the occurrence of erosion, landslides, and flooding can increase and the water will require more filtration for human use.

Preparation: Review the background information, gather and prepare supplies. Prepare one tray with just soil for a demonstration.

Materials:

Disposable casserole trays, one per student. Each tray should have holes punched in the short side near the bottom on one end. The holes will allow the water to spill out but should not cause the contents to spill out.

Playdoh or clay

Gravel

Sand

Soil, enough to fill each tray

Grass seed

Seedlings or other plant seeds
Blocks or books for propping one side of the tray up
Clear cups or graduated cylinders
Water
Powdered drink mix, no need to add the sugar.

Procedure:

1. Ask the students: Where does water go when it rains? Does the water find its way into the water system untouched or unaffected by plants, animals, or humans?
2. Bring out one of your prepared trays and a cup of water with the drink powder mixed in. Ask the students: What will happen if I pour this cup at the top of the tray? (The water will flow down the tray and out the holes mostly unaffected.) Demonstrate.
3. Bring out a second prepared tray filled with soil. Ask the students: What will happen with the water this time? Demonstrate. Some of the color and particles should have filtered out, but the water will still clearly contain the drink mix.
4. Ask the students: What are some things that we could add to the tray to help get the water cleaner?
5. Explain that each student will be building a model to show how the biosphere can help clean water as it rains and ends up in groundwater, rivers, streams, etc. Explain that each student will be given a tray, gravel, sand, clay, and grass and plant seeds to create a landscape to help filter the water.
6. Provide the students with the materials and the time to construct their landscape.
7. Place all of these on an incline in a sunny place so the plants can grow. You will need to water these over the next 1.5-2 weeks while the plants grow, so make sure to block the holes or place something underneath them to catch the water.
8. After the landscapes have had enough time for the plants to grow and become rooted (1.5-2 weeks depending on the seeds you used, check packaging) each student should be provided with a cup or graduated cylinder of the drink mix and another empty cup or cylinder. (Using the cylinder allows you to also measure the input and output, discovering how much water is absorbed.)
9. Instruct the students to pour the drink mix slowly and steadily towards the top of the landscape and wait for all of the water to drip into the cup at the bottom of the tray.
10. Once all the water has dripped out the students should investigate how much of the drink mix was filtered out.
11. Lead a class discussion to determine which approaches seemed to work well and which ones didn't work at all. Ask how the landscapes could be made more effective. Ask which changes they would make now.
12. To conclude, ask the students to draw their model in their science notebooks and label everything. They should also write a short report about how well their model worked, which part of the model they think did the most filtering, and what they would change next time.

Expansion Opportunities

1. Visit a rain garden or riparian forest to see how this works on a larger scale.
2. Contact us at trees@unl.edu to set up a time for a landscape designer or architect to talk to the students about how they create water wise landscaping.
3. Re-design and keep building new models with the students' ideas to try to get the water as clean as possible.
4. Use different types of plants and soil to see how that changes the filtration.



With the Help of Fire

Summary: Eastern redcedar, a native tree to Nebraska once controlled by wildfires, are now encroaching on land all across the state. In this activity students will play a tag game to understand the role that fire plays in forest management.

NE CCR-Science Standards:

SC.6.9.3

SC.7.7.3

SC.7.8.4

Objectives: 1. Students will be able to identify the ecological concept of encroachment. 2. Students will be able to discuss the role that fire can play in managing woody encroachment. 3. Students will be able to describe how humans have changed the impact of wildfires over time.

Grade Levels: 6th-7th grades

Time Consideration:

20 Minutes to prepare

50 Minutes for the activity

Background Information:

Woody encroachment is the increase in shrub, bush, and tree cover in grasslands and savannahs. Encroachment can be due to multiple factors, such as increased carbon dioxide in the atmosphere, climate change, and overgrazing (Wigley et al. 2010). Humans also contribute to woody encroachment through systematic fire-suppression (Briggs et al. 2005). Encroachment can be severely detrimental to an established grassland ecosystem and can lessen the biodiversity (species richness) of an area. There will be shifts from herbaceous species to woody species, thus grassland species are more likely to become extinct (Ratajczak et al. 2012).

Eastern redcedar is a native Nebraska tree that is highly susceptible to fire and were mainly confined to canyons and other rugged terrains where fire couldn't reach when wildfires were allowed to burn freely. Eastern redcedar was also planted in large numbers throughout the state for over 100 years because they make great windbreaks, provide shelter to wildlife, and help to reduce soil erosion. Eastern redcedars could be counted on to grow quickly in often difficult conditions. These factors have allowed eastern redcedar to encroach upon areas where they shouldn't be growing across Nebraska. Some refer to eastern redcedar as an invasive species, and while many of the ecological impacts can be the same as an invasive species, since the eastern redcedar is native this phenomenon is instead called encroachment.

This is a current issue very clearly impacting the lives of Nebraskans throughout the state. Land owners, land managers, ecologists, foresters, policy makers, and many other people throughout Nebraska are all working to come up with a management plan. While fire was the original and natural management technique, we now have many other options as well. We can continue to use fire to support healthy grasslands, we can also utilize the wood from eastern redcedars in various ways. No one management technique will hold the answer, but this activity will help explain the role that fire can play in this ongoing issue.

Briggs, J. M., A. K. Knapp, J. M. Blair, J. L. Heisler, G. A. Hoch, M. S. Lett, and J. K. McCarron. 2005. An ecosystem in transition: causes and consequences of the conversion of mesic grassland to shrubland. *BioScience* 55: 243–254.

Ratajczak, Z., Nippert, J. B., & Collins, S. L. (2012). Woody encroachment decreases diversity across North American grasslands and savannas. *Ecology*, 93(4), 697-703.

Wigley, B. J., W. J. Bond, and T. Hoffman. 2010. Thicket expansion in a South African savanna under divergent land use: local vs. global drivers? *Global Change Biology* 16: 964–976.

Preparation: Review the background information, prepare the name tags or flags, find and print the photos of eastern redcedars.

Materials:

2-5 Name tags with “fire” written on them (Instead of the name tags, you could use jerseys or flags to indicate “fire”)

Photos of eastern redcedar trees

White board or poster paper to create a graph

Paper and writing utensils for each student

Procedure:

1. Ask the students if they are familiar with eastern redcedar trees. Show them the photos and then ask if they have seen these trees around their neighborhood, or perhaps in passing fields when riding in the car.
2. Explain that these trees are prevalent across Nebraska as well as the history and benefits of eastern redcedar provided in the background information. Share with the students the term “woody encroachment” and ask them what they think it is. Explain the concept and ask the students if they can think of something that may have helped manage the spread of trees in the past, even before humans were walking the land. Let them think it through, you may have to help them think of a few things that control the population of trees, such as animals, including insects, and fire.
3. Tell the students that everyone is going to play a game to see how wildfires affected the eastern redcedar population.
4. Go to the area where the game will be played and clearly define the playing area and all necessary safety rules. Choose 2-5 students to be fire. (The number of fire players depends on how big your group is, but there should be significantly more trees than fire.) Have all the “trees” start on one side of the playing area with the objective of getting to the other side. When they are running from one side of the area to the other, the “fire” can tag them. Trees who are tagged should sit down where they are tagged.
5. After each round count the number of trees still alive, and keep track for the graph at the end of the game.
6. After the first run across the playing area point out that trees don’t just survive fire, they also reproduce and more trees grow that have the potential to survive fire. So, in the second round any of the trees can high five a tree that was burned (sitting on the ground) representing the tree distributing seeds and one growing. The tree that was sitting has safe passage to the safe side of the playing area.
7. Continue playing for a few rounds. You can change various factors in the game, just make sure to keep track of what changes were made for each round for your graph. For one round you could declare it a “bad fire year” and add more fire taggers, thus taking down more trees. Another round could be declared a year with reduced controlled burn and one or more of the fire taggers could become trees instead.
8. Once you are done with all the rounds you want to do (at least 5 rounds are best for good data),

bring all the students back together for a discussion and to create your graph. Plot the number of trees and fire for each round. Feel free to add notes for rounds where you changed the conditions.

9. Ask the students if they see any patterns in the data. Discuss why patterns may be present. Ask the students what impact the fire has on the tree population. Ask the students how either natural or manmade changes affected the impact fire had.
10. Conclude by having the students write a short paragraph on how fire changes the population of eastern redcedar.

Expansion Opportunities:

1. Write a letter to the editor of the local newspaper, or a letter to one of their state representatives, that explains the importance of prescribed burns in woody encroachment management.
2. Design posters that highlight the benefits of prescribed burns.
3. Split the students into teams and have them research and debate the need for prescribed burns.

This lesson was written by the following students at the University of Nebraska-Lincoln:

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Wood to Biochar

Summary: From trees damaged in storms to lumber production waste to low quality wood we often have a lot of extra wood that needs a use. Biochar is one way to utilize this wood while also solving other ecological problems. In this activity, the students will evaluate the costs and benefits of biochar to determine if it is a worthy solution to a number of real-life complex issues.

NE CCR-Science Standards:

HS 15.5.E

Objectives: 1. Students will be able to evaluate the effectiveness of biochar as a solution to problems surrounding wood waste using three different criteria and levels of priority. 2. The students will be able to identify barriers and possible environmental impacts of utilizing biochar. 3. The students will be able to use evidence to support their decision on if biochar is an effective solution/utilization for waste wood.

Grade Levels: 9th-12th grades

Time Consideration:

20-30 minutes of preparation

20 minutes for introduction

2-3 50-minute class periods for research (could be done as homework)

30-50 minutes for final discussion

Background Information:

Trees are often a casualty of natural disasters. Whether the whole tree falls, or limbs end up thrown all over the neighborhood, there is often a lot of wood left to deal with. Most of the time this is wood that can't be used for lumber. When a pest, such as Emerald Ash Borer, finds its way through a community the community members are left with a lot of dead wood and no idea what to do with it. During routine logging for lumber and pulp wood there is often left-over pieces that are unusable for one reason or another. What is to be done with all of this wood? It could be chipped for landscaping and other uses, and it sometimes is with cities providing free woodchips from downed limbs. It could be burned, releasing all of the carbon the tree sequestered over its lifetime into the atmosphere, something many individuals, companies, and countries are trying to stop doing. It could be left to rot, taking up space and time to do so. So, what's left? Biochar is an ancient practice being brought into modern times with all of these ideas and concerns in mind. Biochar is a pure carbon product made from organic material. It's produced through a process called pyrolysis. Pyrolysis is the decomposition of organic matter at very high temperatures in a limited oxygen environment. It changes the chemical structure of the organic matter (in this case wood) undergoing the process.

Biochar was first created by ancient Amazonian civilizations and was called terra preta, meaning dark earth in Portuguese. Evidence from these ancient civilizations shows that waste material from food, animals, and household items were discarded and burned creating an extremely rich soil. Even today, thousands of years later, the above ground biomass is much greater on terra preta soils than surrounding non-terra preta soils. The presence of terra preta soils after all this time is an indicator of the capacity of biochar to sequester carbon long-term.

Biochar has many uses. People all over the world continue to find new ways to use biochar. In addition to its use in agriculture and horticulture, researchers are studying its uses as an additive to

livestock feed to reduce greenhouse gas emissions, and are determining its effectiveness as an air and water filter. Utilizing the wood waste in this way also reduces burning and landfilling along with the environmental impacts accompanying both of those solutions.

The following sources are recommended for further biochar background information:

The Nebraska Forest Service: nfs.unl.edu/about-biochar

Includes two infographics about biochar

US Biochar Initiative: biochar-us.org

Has multiple introductory videos about biochar

Biochar Journal: www.biochar-journal.org

Has a variety of journal articles about various aspects of biochar

International Biochar Initiative: www.biochar-international.org

Case studies, introductory material

Preparation: Review the background information and decide how you would like to provide introductory information about biochar. Find photos of different types of wood waste (storm damaged trees, lumber waste, logging waste, etc.) and print them to show to students, or prepare to project them.

Materials:

The students will need computers and access to the internet to do the research

If you choose to show a video, you will need a projector

If you choose the extension, the students will need access to design software

Photos of different types of wood waste

Procedure:

1. Show the students the photos of waste wood. Ask them: what do you think some of the problems surrounding wood waste are? (What to do with it, carbon sequestration, utilizing all parts of the tree so none goes to waste, where to put it especially in the case of a natural disaster, disease, or pest.) So, what do we do with wood waste? (Landfill, woodchips, incinerate it, bury it, and more.)
2. Pick a couple of the solutions the students came up with to do a quick analysis. Ask: What are the advantages of the method? What are the disadvantages? Is it safe? Is it cost effective? What kind of social impacts could it have? How about environmental impacts?
3. Explain that the students will be doing their own analysis of a possible solution for waste wood, biochar.
4. Provide the students with basic background information about biochar using the teacher background information above, the provided video links, or other sources you found. Make sure to cover what it is, how it works, and what some of the uses are.
5. Explain to the students that they will now have time to research biochar so they can each provide a report evaluating its use in solving our waste wood problems. Share that they should evaluate biochar using the following criteria listed in order of priority: Cost, Safety, Reliability. They should also consider possible barriers to implementation such as cultural, economic, and environmental impacts. They should then provide a decision, based on evidence, on whether biochar is an optimal solution and what the strengths and weaknesses are as well as barriers to overcome. Finally, the students should determine which issues surrounding waste wood would continue even if biochar were implemented across the board.
6. Once the students are done with their projects, lead a group discussion to share what decision they came to and why, as well as the strengths, weaknesses, and barriers they identified.

Expansion Opportunities:

1. In addition to or instead of a report, the students could create an infographic.



What's Your Slogan?

Summary: Smokey Bear has shared his message with generations of Americans about fire prevention. In this lesson the students will research fire prevention information and then create their own PSA about wildfire prevention.

Objectives: 1. Students will be able to discuss key facts about wildfires and wildfire prevention. 2. Students will be able to design a PSA based on the wildfire prevention information they researched.

Grade Levels: 7th-12th grade

Time Consideration:

10-20 minutes to gather PSA examples

15-20 minutes for discussion

2 50 minute sessions for research

50 minutes for presentations and final discussion

Background Information:

Public Service Announcements, or PSAs are used all over the world to help educate the public about a wide range of topics. We often see them on billboards, during commercial breaks, and next to articles on our favorite news sites. Americans are encouraged every day to recognize the signs of a heart attack, eat our vegetables, buckle our seat belts, and not to text and drive. Since the mid 1900s we have also been reminded that we are the key to preventing wildfires.

Smokey Bear was introduced to the public in 1944 on a poster urging people to be careful with fire. At the time, it was a matter of national importance as most of the able bodied men were away fighting in WWII. After premiering with the cast of *Bambi*, Smokey was an instant hit. Smokey's relevance has remained to this day as we see wildfire season growing into early spring and late fall. As humans push into the wildland-urban interface, our actions are part of what is contributing to more intense wildfires and longer seasons. Kids in particular pose a significant threat as they are more likely to play with and start fires without taking proper precautions. As more fires, and more intense fires, become the norm, public education about wildfires will be key in prevention and response.

Preparation: Review the background information, ensure student access to research supplies and computers, gather examples of Smokey Bear PSAs to show the students.

Materials:

Access to research materials

Simple design software (powerpoint, publisher, etc.)

Examples of Smokey Bear PSAs

Procedure:

1. Ask the students what they know about Smokey Bear. Does anyone know his signature slogan? ("Only you can prevent wildfires" or the older slogan "Only you can prevent forest fires".)
2. Next ask them: What do you know about wildfires? Keep a running list of what they come up with on a board or flip chart. Then ask: What do you want to know about wildfires? Again, keep a list.

3. Tell the students that they are going to have some time to research wildfires and wildfire prevention in general to build their knowledge base. Point out that it will be important that they are well informed for the next part of the project, which will be designing their very own PSA about wildfire prevention. Explain what a PSA is and what they are used for (see “background information”).
4. Provide the students with time to do their research, or assign it as homework.
5. Once the students are done with their research, bring them together for a discussion about what they learned. Ask: Did anyone find the answers to the questions we listed before we did research? What answers did you find? Did anything surprise you about what you learned?
6. Show the students the examples of the Smokey Bear PSAs you gathered during “getting ready”. Ask them what they like and don’t like about each PSA. Ask them which elements of the PSA they think were most effective, and which were not.
7. Explain the parameters of the project, including how much time they will have to complete the research and design, specific elements you want them to include in their information and design, and what type of a PSA they need to produce (poster, infographic, video, etc.) If you have a rubric made, you may want to provide that to the students. Make sure to remind them that they are to create an entirely new PSA, not a new Smokey PSA. Smokey Bear is copyrighted and to use him in a PSA, you must ask permission from the Ad Council and USDA.
8. Give the students time to complete their research and design.
9. Once the students are ready, let each person present their new PSA.
10. Conduct a discussion with the class about the PSAs and which they found the most effective or informative. Why were those the best, what did they learn from the PSA, etc.?



Healthy Trees

Summary: Trees can get sick just like people can, and when they do it makes them more susceptible to pest infestations and diseases. In this activity students will play a tag game that will help them understand how sick trees can get sicker, and how natural and man made conditions can affect the health of trees.

NE CCR-Science Standards:

SC.3.7.2

SC.5.13.4

SC.6.9.3

Objectives: 1. Students will be able to compare how healthy trees and sick trees are affected by the same diseases and pests. 2. Students will be able to explain how natural and man made conditions can affect the health of trees.

Grade Levels: Grades 3-6

Time Consideration:

10 Minutes to prepare

50 Minutes for the activity

Background Information:

Trees are alive, so just like other living things they can get sick and die. Sometimes it can be hard to recognize a sick tree, and they are often sick for some time before they show any outward signs. Just like people, there are a lot of different things that can make trees sick. There are diseases that spread through forests and community trees. Dutch elm disease decimated elm trees throughout North America in the 1980s, taking down healthy and sick trees alike. Now we see emerald ash borer doing much the same thing to ash trees, but as an insect, not a disease. Not all tree pests and diseases will kill a tree though, sometimes they just make the tree weaker. In those cases, the trees are more susceptible to succumbing to other diseases or pests. Just like elderly people, young children, and people with other diseases are more likely to get pneumonia if they have the flu.

To see full and updated reports on tree pests and diseases in Nebraska, please visit: <https://nfs.unl.edu/publications#foresthealth>

Preparation: Review the background information, gather the supplies.

Materials:

Small sheets of paper (1 per student) with one-third marked with a "+", one-third marked with a "=", and one-third marked with a "-".

Small, plastic chips or tokens, enough for half the students

Procedure:

1. Bring the students together for a discussion, ask: What are some things that trees need to be healthy? (Water, sun, room to grow, nutrients). What are some things that may affect tree health? (Insects, diseases, fire, etc.)
2. Explain that the students are going to become trees... trees that can move so they can play a few

rounds of tree health tag.

3. Take the students to playing area (if you're not already there), and make sure to address any necessary safety measures, including the boundaries.
4. Once you have reviewed the safety rules, randomly pass out the sheets of paper you prepared. Explain to the students that if their paper has a plus, they will receive a chip, if they have an equal sign they need nothing, and if they have a minus they are only allowed to hop on one leg during the game. This signifies trees that are very healthy, making them less susceptible, trees that are healthy, and trees that are a little sick, making them more susceptible.
5. Now pick one (or two or more depending on your group size) student to be your pest. Each round you could pick a different type of pest if you desire (emerald ash borer, gypsy moth, forest fire, pine wilt, etc.). Explain that the pest will be trying to tag the trees. The trees with the chips can hand the pest the chip and keep playing, the trees without a chip should hop on one leg when tagged, when the trees who are hopping on one leg get tagged, they become pests as well and can tag the remaining trees.
6. Play a few rounds of the game changing the dynamics with each round. Have more or less exceptionally healthy trees, have more pests to start, make the pests stronger by having trees with chips going straight to hopping on one foot, etc.
7. Once done with the game, lead a group discussion, ask: What happened when there were more healthy trees vs. more unhealthy trees? What happened when the pests were stronger or when there are more of them? What does this tell us about how pests affect our forests? What can forest managers do to help trees survive against some of the specific pests?



Did You Know?

Summary: This activity is designed to help you (the teacher) informally gauge what the students know and give them a chance to get up and move.

Objectives: Students will be able to identify how much knowledge they have about a certain subject.

Grade Levels: Kindergarten-5th Grade

Time Consideration:

10 Minutes to prepare

10-30 Minutes for the Activity

Background Information:

All educators know that it is important to understand how much knowledge your students have about a given topic before you begin teaching. It is equally important to find out if students are learning throughout your teaching. All educators also know that it is sometimes hard for students to sit still all day! This lesson, or more so method, is designed for you to take and cater it to your needs. Not sure how much your students know about the structure of a tree? Want to make sure your students are understanding how life is connected through food webs? Find a place to run around and set up this game!

Preparation:

Prepare a gym or open area where you can post the numbers 1-10 evenly spaced out. Also create a circle in the center of the area big enough for all the students to stand in; this is the home base. You will need to prepare the statements/questions you will use for this activity.

Materials:

Numbers 1-10 printed, one per sheet of paper

Cones or rope to mark boundaries

Written questions/statements for gauging student's knowledge

Procedure:

1. Bring all the students to a prepared area and have them stand in the home base. Explain that you will be reading statements and that they will need to go stand by the number that represents how well they think they understand that statement, with 1 being "I have no idea" and 10 being "I could teach it". Also explain that each time you read a statement you will also say a method of moving to the number (example: bear walk, hopping, lunges) and that that is how the students should move. Explain that you will give a "magic word" when they should move back to the home base.
2. Proceed by reading the statements you have written and giving a movement. Also, make sure that the students return to the home base in between each statement.
3. Keep track of where the students are standing for each statement so you can use the same statements after the lesson/unit to see how much the students have learned. You could also have students track this individually so they could track their learning.



Trees Around the World

Summary: There are trees in almost every part of the world, but do they all look the same? Do they all act the same? In this activity, the students will research trees in other parts of the world and share what they learn through a presentation.

Standards Met:

LA 5.3.1
LA 5.4.1
LA 6.3.1
LA 6.4.1
LA 7.3.1
LA 7.4.1

Objectives: 1. Students will be able to discover different types of trees from around the world. 2. Students will be able to create a presentation using the information they collect during research.

Grade Levels: 5th-7th grade

Time Consideration:

10 minutes to prepare
10-15 minutes to introduce the activity
60-90 minutes for research and poster making (could be a homework assignment)
15-45 minutes for presentations depending on how many pairs/groups you have

Background Information:

Trees grow and look differently around the world because they adapted to the climate and soil conditions of where they are growing. The more unique the conditions, the more unique the trees can be. In Africa the baobab tree is able to go for months without water thanks to a large trunk it stocks full of water during the rainy season. mangrove trees, on the other hand, have adapted to being exposed to a lot of water... a lot of salt water. The monkey puzzle tree, while not resistant to fire, thrives after a volcano takes out an existing forest, as they can settle in nicely to the newly sunny and rocky surface. All of these trees found a way to survive in difficult areas. While not all the trees on the list had to thrive in such adverse conditions, all of these trees are unique and offer people a new way to view and admire trees.

Unique trees that could be studied:

Joshua
Sequoia
Baobab
Mangrove
Palm
Monkey Puzzle
Dragon's Blood
Camel Thorn
Bristlecone Pine

Preparation: Review the background information and prepare the materials

Materials:

White board or poster paper
Copies of student page
Access to tree research materials (computers and books)
Poster board (one per pair/group)
Markers/Crayons
Tape
Scissors

Procedure:

1. Ask the students: Are people from all over the world the exact same? Even in this group we have people who are all different people. Even if people look the same on the outside, there are all types of things that still make them different from one another. So, is nature around the world the same? What about trees, can the trees we have here grow in the rainforest of South America?
2. On the board or a prepared poster paper write "Why trees are different" and ask the students to brainstorm some ideas as to why trees in different parts of the world are different.
3. Explain that the students are going to pair up or get in groups and research a particular type of tree to figure out why it needs to grow where it grows. Assign the groups one of the trees from the list in the background information and hand out the student page. Explain that each group will make a poster when they are done with their research to explain why the tree needs to live in a certain area. Also explain that their poster should provide the information they find in their own words and that citations must accompany the information.
4. Let the students conduct their research either on their own or using the resources you collected for them. Then the students should complete their posters.
5. Have each group present their posters to the whole class. After each presentation discuss the tree and keep a running list of its unique attributes on the board or a prepared poster.
6. Once everyone is done presenting, facilitate a group discussion. What are some of the things that determines why trees can only grow in certain areas of the world? What are some of the ways the trees you researched were different than the trees here in Nebraska and why were they different? Did we think of all the reasons trees were different/what did we miss? Did anything surprise you?

Trees Around the World

Group Member Names _____

Tree you are researching:

Make sure to include the following on your poster:

Where is your tree native to?

What are some unique characteristics of your tree?

How has your tree adapted or changed in order to survive in its habitat?

Does your tree grow in other areas? Is it used in landscaping outside of its intended habitat? Why/why not?

What is the status of your tree? Is it threatened due to over logging/climate change/human development etc.?

What other things did you learn about your tree?



What Does It Take?

Summary: Nebraska has a variety of native trees which thrive in the varied ecosystems contained within the state. So, what does it take for a tree to survive and thrive in Nebraska? In this activity your students will seek to answer that very question by researching native trees.

NE CCR-Science Standards:

SC.5.13.4

SC.6.9.3

Objectives: 1. Students will be able to describe what trees need in order to survive. 2. Students will be able to develop recommendations for proposed growing areas.

Grade Levels: 5th-6th grades

Time Consideration:

10 Minutes to prepare

10-15 Minutes for the introduction

20-60 minutes for the research

Background Information:

Nebraska's native trees vary just as much as its ecosystems vary. From ponderosa pine to chinkapin oak, Nebraska's trees run the gamut. However, all of these trees are uniquely suited to grow in the Great Plains region for one reason or another. Whether it be their ability to withstand periodic droughts or root themselves in sandy soil, they all have some sort of advantage or adaptation that has allowed them to thrive.

Throughout time, trees in Nebraska have had to overcome obstacles in order to stick around. At one time, prairie fires regularly roared across the plains, necessitating thick bark and other adaptations for trees to survive and regenerate. Droughts are commonplace across the state, so trees need to be able to continue to grow when water is scarce. Soils can range from clay to sand. Nebraska trees have managed to not only adapt to all of these features, but thrive in them!

For a list of native Nebraska trees visit:

<http://retreenebraska.unl.edu/Documents/Native%20Nebraska%20Trees.pdf>

Preparation: Review the background information, gather the supplies.

Materials:

Copies of the student pages, enough for each student

Research materials, a computer with internet is best

Procedure:

1. Ask the students: what do trees need to survive? (Water, sun, nutrients, and space). How do they obtain those things? (Water through roots, sunlight is absorbed through the leaves, nutrients through soil, air, and photosynthesis, and space by spreading their seeds and out-competing others.) What do people in Nebraska do regularly to keep their trees healthy? So, before people started taking care of trees, did they survive across the great plains?

2. Ask each student to take out a piece of paper and in 2-3 minutes to write down all of the challenges a tree might face in Nebraska as well as all the advantages the great plains have to offer a tree. You, or the students, will need to keep track of this paper for the end of the lesson.
3. Explain that the students will be researching native trees and tracking the different needs they have in order to thrive. Pass out copies of the requirement table. Explain to the students that it will be their job to do research and fill in any empty boxes on the sheet. Also, explain that it is important that their answers be accurate as they will use this as a key to make recommendations to homeowners based on their land conditions.
4. Give the students time to do the research and fill in the table. If you are short on time, you could fill in more of the table yourself before printing. Or each student could be in charge of one tree and they could report their answers to a master list.
5. Once the students have their tables filled in, pass out the homeowner scenarios. Ask the students to read through the scenarios and use their table to make a recommendation to each person. Make sure to point out that they should give a reason for their recommendation.
6. Facilitate a class discussion about their recommendations. What do most native trees have in common? How does that help them to survive and thrive? What adaptations have some trees made that others haven't? Why do you think that is?
7. To close out, ask the students to review their lists of the advantages and challenges they thought trees would face in Nebraska. Did they identify challenges the trees adapted to? How about advantages a tree benefited from?

What Does It Take?

Name: _____

Research the trees and complete the table with the information you find. Some of the information has already been entered to guide you in finding the most useful answers.

Tree	Mature Size	Sun Preference	Soil Preference	Positive Attributes/ notes
Bur Oak				Offers shade, food for wildlife, tolerates heat and pollution, some drought tolerance, can live 200-300 years!
Eastern Cottonwood			Moist, well drained, and wet soils. Tolerant to acidic and alkaline soils.	
Ponderosa Pine	60-100 feet tall 25-30 foot spread			
American Sycamore		Needs full sun		Tolerant to deer
Honeylocust			Wide range including acidic, alkaline, moist, dry, and salty	
Shagbark Hickory		Full or part sun		Has edible nuts
Pick your own tree:				

What Does It Take?

Name: _____

Scenario 1:

Kendra is a homeowner who recently had to remove a large tree that was shading the whole front of her house. Her tree contracted a disease and she had it removed. Now she would like to replace it with a native tree that will grow large and wide enough to shade her house. Kendra is more than willing to water the tree as it gets established, but would prefer something that has some drought tolerance. The area she will plant it has full sun throughout the day.

What would you recommend for Kendra and why?

Scenario 2:

Jason just moved into a new house with his two small children. As they grow, he wants them to be able to play in and under a tree or two in their backyard. Part of the backyard gets full sun most of the day and part of it is partially shaded by the house, so that area only receives part sun. Jason would like something that would attract some wildlife for his kids to watch and would also like it if they could harvest nuts or fruit from the tree for themselves.

What would you recommend for Jason and why?

Scenario 3:

Maria was recently given some of her family's land in western Nebraska and she would like to help it return to its original, natural state as much as she can. Unfortunately, she's not very knowledgeable about the ecosystem in this area. She knows that the soils tend to be a bit sandy and she sees mostly pine trees around her, but isn't sure what they are and if they are supposed to be there. Maria can help the trees get established, but after that she wants nature to take over, so she needs trees suited to the western Nebraska climate.

What would you recommend for Maria and why?