**TREES….THE WATER KEEPERS! Lesson Plan**

**Grade Level:**

3-8

**Learning Objectives:**

* Students will locate an area where they view trees growing in a “riparian area.”
* They will learn how trees improve water quality, help stabilize the river banks and the different parts of a tree.

**Background:**

Anatomy of a Tree



* The **outer bark** is the tree’s protection from the outside world. Continually renewed from within, it helps keep out moisture in the rain, and prevents the tree from losing moisture when the air is dry. It insulates against cold and heat and wards off insect enemies.
* The **inner bark,** or “phloem”, is pipeline through which food is passed to the rest of the tree. It lives for only a short time, then dies and turns to cork to become part of the protective outer bark.
* The **cambium cell layer** is the growing part of the trunk. It annually produces new bark and new wood in response to hormones that pass down through the phloem with food from the leaves. These hormones, called “auxins”, stimulate growth in cells. Auxins are produced by leaf buds at the ends of branches as soon as they start growing in spring.
* **Sapwood** is the tree’s pipeline for water moving up to the leaves. Sapwood is new wood. As newer rings of sapwood are laid down, inner cells lose their vitality and turn to heartwood.
* **Heartwood** is the central, supporting pillar of the tree. Although dead, it will not decay or lose strength while the outer layers are intact. A composite of hollow, needlelike cellulose fibers bound together by a chemical glue called lignin, it is in many ways as strong as steel. A piece 12" long and 1" by 2" in cross section set vertically can support a weight of twenty tons!

**Time:**

20 minutes or less

**Preparation:**

Bring a variety of tree cookies along that clearly shows the different parts of the inside of a tree (heartwood, rings, etc)

**Vocabulary Words:**

* Riparian – the land on either side of river/stream including the river banks
* Non-point source pollution – pollution discharged from a wide land area, not form a specific location; i.e. excess fertilizer on farm fields, construction zones, etc.
* Heartwood – dense inner part of tree
* Sapwood/Xylem – tissue that moves water and nutrients from roots to leaves
* Cambium – tissue that produces new cells
* Phloem – tissue that moves tree food from leaves to roots
* Bark – protective outer shell of tree
* Tree ring – each ring around the center of a tree represents one year of growth

**Dripial Pursuits:**

* What is the land called on either side of a river/stream? (riparian area/zone)
* What is the part of a tree that moves water and nutrients from the roots to the leaves? (sapwood/xylem)
* What is the part of a tree that moves water and nutrients from leaves to the roots? (phloem)
* What is the part of a tree where new cells are produced? (cambium)

**Activity:**

1. Tell the students we are going to talk about trees and their impacts on water quality...how they are all water keepers! We generally have three kinds of forests in North Dakota...(1) native forests, (2) city forests, and (3) country or conservation forests.
	* Our native forests are trees that grow "naturally," planted by birds dropping seeds or seeds blowing in the wind or floating on water. Most of the trees growing naturally in North Dakota are found along the water...along our rivers, streams and lakes. These have a special name called "riparian forests." They are the trees and shrubs that grow along the water.
	* Our city or community forests are the trees that grow in our town. Look around your school, your house or the park. There are a lot of trees in a city. If I were a city forester, my job is taking care of those trees and giving homeowners advice on how to take care of their trees.
	* Our country or conservation forests are the trees planted by farmers and
	people who live in the country. The might be windbreaks around their home,
	farm, livestock or field.
2. Whether the trees growing are native forests, city forests or country forest...they provide a lot of benefits (good things) for all of us. I think you can already name many good things we get from trees and forests. Raise your hands and let’s list all the good things we can think of that trees provide. (Get the students to list as many things that they can think - oxygen, paper, food, shelter, clean the air, help soil erosion, blocks unsightly views, increase property value, etc. Someone may or may not list clean the water.) show woodpecker-pecked tree---trying to get insects inside of dead tree
3. One of the most important jobs the trees have is to be "**water keepers**." They help keep our water clean! There are many ways they do this. Then explain the many ways trees impact water - roots hold the soil along the banks in place (show pictures of a healthy riparian zone and the unhealthy riparian zone, trees stop the wind from blowing so much soil in the water, roots filter out pollutants and they are stored in the "heart wood" of the trees so they can't harm anyone. The trees stop some blowing snow so a farmer has more water for his crops, so they grow better, etc.
4. Go to a near tree or show a picture of a tree and explain to them the basic parts - the crown is made up of the branches, stems and leaves. The trunk makes it different from other plants – one main woody stem that is very tall (some shorter-shrubs, some taller- Show the picture of Christine standing next to the redwood tree cookie - Red Sequoias up to 300 feet!!!!). The roots we don't see under the ground hold the tree in place (anchor it and give it strength so it doesn't blow over in the wind) and the suck up water and nutrients the tree needs
	* show pictures of shallow tree root, root ball and the plant root comparison – turf grass VERY short roots cannot hold the soil together, versus the native plants which were made to hold soil together, and note the cottonwood
5. Hand out tree cookies to kids in groups of two. Now show a larger tree cookie and explain the parts:
	* Heartwood (the center) – usually a bit darker, holds nutrients and metals collected from the soil and is the main support of tree
	* Sapwood/Xylem (usually lighter color outside heartwood) – youngest layers of wood, nutrients flow through the sapwood up from soil through roots to leaves
	* Cambium (layer just inside bark) – thin tissue that produces new cells, makes trunk/branches/roots grow larger in diameter
	* Phloem (inner bark) – food supply line from leaves to the rest of the tree
	* Bark (outer bark/outermost layer) – acts as suit of armor for disease, insects, storms, etc.
6. No tree is the same; different trees need different amounts of water, nutrients, sunlight, etc. Ask them to examine the tree cookies and talk amongst their groups.
	* How are they different?
	* How many rings do they have (compare it to their ages-they love this!)?
	* Show tree cookies with scars–wet year, dry year, broken branch, new branch, worm/insect holes, etc.
7. How does a tree grow?
	* Ask the kids ‘where does a tree start?’ (hopefully they say “A SEED!”)
	* What does a tree need to grow? Water, food, sunlight, soil, etc.
	* Have them pretend to be a seed of their favorite tree (even if they don’t know the name). NOTE: Remind them that trees come in all different shapes and sizes.
	* Presenter pretends to rain on them, then sun shine on them so they can grow.
		+ Some will grow slow, fast, crooked, short, tall, etc – point these attributes out: “Look how fast you’re growing/taking more time” “see those crooked branches-what a great place to build a treehouse” “look how straight and tall you are – you could help build a house someday” “look how this one is leaning towards this one”
		+ Have the kids look around to see all the different trees the class has grown.
8. If a tree made sounds, what would it sound like? Let’s building a tree and find out!!!
	* For building a tree:
* The center or heartwood goes hummm (kids in middle shoulder-to-shoulder hands in middle and arms crossed over one another for strength)
* The phloem goes whosh (kids around heartwood, jazz hands moving down)
* The xylem/sapwood goes wheee (kids around phloem, hands going up)
* The bark goes ruff (kids around outside facing outward, fists together but with random kids with arms stretched out for branches) and
* The roots go slurp (kids lay on ground-straight or crooked, mention that roots are similar to branches just underground-stretching from the trunk)
* The leaves rustle (kids at the end of ‘branches’ made by the bark rubbing their hands together while swaying their arms)
* Show the tree rings again and point out parts they are playing
1. Sum up the parts of a tree and their importance. End of activity.

**Another option for beginning**

Ask students to have a seat in the forest, close their eyes, breathe deeply and become rooted. Let them feel the sun and shade on their bodies. Let them touch the ground, and feel the damp soil against their fingers. Tell the story of their birth and growth as a tree in this forest patch.

**\*\*Additional Attachments:** The following attachments,Tree Rings and Tree Identification,

 are two activities that can be added on to Trees the Water Keepers or done separately. They all teach lessons about trees.\*\*

**TREE RINGS**

**Grade Level:** MN: 1st / 2nd

 ND: 3rd

**Time Required:** 20 minutes

**MN Standards:** 1.4.3.1.1

 2.1.1.2.1

 2.4.3.1.1

**Fargo Standards:** 3.2.3

 3.2.3.c

 3.4.2.b

 3.4.2.c

**Learning Objectives:**

1. Students will understand that counting tree rings determines the age of a tree.
2. Students will learn that rings that are closer together or farther apart can signify when a drought or flood occurred.

**Method:**

Students will look at tree stumps to determine the age of trees, taking note of what years had good growth and what years probably had a growth inhibitor such as a flood.

**Background:**

Tree rings can show the age of a tree, but they can also show whether there’s been a flood or a drought. Looking at a cross-section of a tree stump reveals concentric circles that formed throughout the tree’s life. One ring forms each year, so counting the number of rings in the cross-section tells the age of the tree. Rings that are closer together signify that the tree didn’t grow much that year, and perhaps it was a flood or a drought year. Rings that are far apart signify a successful growth season, meaning that growing conditions were ideal for the tree. This lesson allows students to examine a tree stump in order to determine the age of it, and also look for signs of flood or drought.

**Items Needed:**

1. Tree cookies
2. Paper and pencil to record observations.

**Activity**

1. Tell students that trees grow throughout their entire life. Each year they grow a little taller, and their trunks grow a little wider. If you cut a cross-section out of the tree, you can see rings. A tree develops one of these rings each year as its trunk grows wider.
2. Ask students to brainstorm reasons why some rings are closer together and some rings are further apart. Make sure they understand that rings will be closer together if the tree didn’t grow much that year, and that rings are further apart if the tree had a good growing season.
3. Have students examine the tree cross-section on display. Have them count rings to determine the age of the tree. Ask them to note particular years where the rings are close together and the tree didn’t grow much.
4. Explain that since flooding is common in the Red River Valley, the reason the rings are close together is probably because that was a flood year and the tree was unable to grow much.

**Evaluation:**

Have students draw a set of concentric circles or “tree rings” for a tree that is 7 years old. Ask them to include a flood year in their drawing.

**TREE IDENTIFICATION Lesson Plan**

**Grade Level:** 3rd / 4th

**Time Required:** 30 minutes

**MN Standards:** 3.1.1.2.3

 3.4.1.1.1

3.4.1.1.2

**Fargo Standards:** 3.2.3

 3.2.3.a

 3.2.3.d

 3.4.1

 4.4.1

 4.4.2

**Learning Objectives:**

* Students will learn how to identify native trees by their needles, leaves, and bark.
* Students will understand the purpose of needles, leaves, and bark, and how each characteristic helps trees survive.

**METHOD**

Students will use a tree identification book and a tree chart to identify different trees.

**BACKGROUND**

The most basic distinction between trees is whether they are coniferous (needle-bearing) or deciduous (leaf-bearing). However, there are many distinctions to be made within those two broad groups. For coniferous trees, looking at the needles alone usually tells what species a tree is. The length and shape of the needle as well as the number of needles in a bunch differ for every tree species. Deciduous trees can be distinguished by looking at their leaves and their bark. Different leaf shapes and different bark colors and textures set every species apart. In this lesson, students will learn the differences between several tree species along the Red River by using tree identification books and the tree identification chart attached to this lesson plan.

**MATERIALS**

1. Tree identification book
2. Attached tree identification chart
3. Pencil and paper

**PROCEDURE**

1. Explain to students the differences between coniferous and deciduous trees.
2. Explain that leaf/needle types and bark differ from tree to tree and can help identify the tree.
3. If outside, have students choose two trees – one with leaves and one with needles. Tell them that they are going to try to identify what type of tree they both are.
4. Give students a copy of the Leaf and Needle Tree ID chart below. Remind them that this is a VERY SIMPLIFIED identification chart, and that it should only be used to start their investigation.
5. Give students time to try to identify their chosen trees. Have them write down observations about the leaves and needles, the size, and the bark of the tree. Once they have observed most of the major tree characteristics, it’s time to start classifying.
6. Have students start with the simplified Leaf and Needle Tree ID chart below. Once they have pinpointed the species as best as possible with the Tree ID chart, have them double check in their tree books.
7. If the Tree ID chart doesn’t have the species of tree on it that the student chose have them look through their tree books to try and find the type of tree.
8. Once they have found one or more species in their tree books that fits the type of tree they chose, have the class gather back together.
9. Discussion: Was it difficult to classify the tree? Was there more than one possible species in the tree book that seemed to fit their chosen tree?
10. Explain that many tree species wherever the activity is taking place have similar characteristics because they grow in a similar environment. If students were to go examine trees in a different habitat, they would notice different characteristics.

**EVALUATION**

Give students several groups of needles or leaves or bark samples. Have them identify which tree each sample is from using their tree identification charts and tree books.

