

Junior Forest Exploration Badge Supplementary Materials for Girl Scout Troop Leaders

For each activity listed in the badge requirements additional information and resources are presented below to help your Junior Girl Scouts meet the requirements of the Forest Exploration Badge.

Activity 1: Plants and Climate

A. Background Information

The Effect of Climate on Plants:

Plants are affected by climate. Climate is a word that describes the physical conditions of a region, and includes things like temperature, precipitation, wind, and sunlight. The plants that thrive in one climate might not survive in another. For example, the plants that live in a swamp are different from the plants that live in a desert. In a swamp, plants need to deal with an excess of water, while in a desert plants must deal with an extreme lack of water. If you planted a desert cactus in a wet area the abundance of moisture there would cause it to rot. A swamp plant transplanted to the desert would wither up and die because of lack of water. Similarly, the plants that live in a tropical region have to deal with very warm temperatures, and the plants that live in Alaska must deal with very cold temperatures. Other climatic factors like sunlight and wind affect how well a specific plant will grow. Below are a few main ways that plants are affected by climate:

1. **Climate and Plant Distribution**

The trees of forests grow to be quite tall when compared to other types of plants, like bushes, grasses, or flowers. Plants that grow tall require more water than shorter plants, and so forests generally do not exist in very dry areas. This is just one way in which climate determines what plants are likely to grow in a certain area.

2. **Plants and Seasonal Climate Change**

Seasonal changes in climate also affect plants. In Wisconsin, most plants die or go dormant over the cold, dry winter months. Plants that grow here must be adapted to survive the winter or complete their life cycle in one year (like annual flowers that sprout, grow, develop seeds, and die all within the same growing season).

3. **Climate and Plant Growth**

Climate can also affect the rate at which plants grow. Trees, for example, will grow the most when they receive the right amount of sun light and water. If there is a drought one year in the forest, the trees will grow less than they do in a normal year.

The Effect of Plants on Climate:

Plants can also affect the climate of an area. Have you ever noticed a change in climate as you entered a forest? Because plants shade the ground and transpire (transpiration is the process by which water evaporates from the leaves of plants) water, the air of a forest is

usually cooler and more humid than outside of the forest. Trees also block the wind, creating a less windy environment inside the forest. Can you think of any other ways that trees affect climate?

B. Suggested Ways to Complete Requirement

Explore in more detail the ways in which climate affects forest plants by doing one or more of the following:

- In order to see how climate affects plant growth, compare a map of United States that shows the annual precipitation of each region to a biome map of the U.S. (a biome is a major ecological community, such as a desert or tropical rain forest). Find the forest biomes. What range of rainfall occurs in the area where forests exist? Do forests occur in very dry areas? Or very wet areas?
- Consider how plants are affected by changes in climate. How do plants respond to seasonal climate changes? What affect does drought or flooding have on plants? What adaptations do plants have to help them survive such fluctuations in climate?
- Find out how the climate inside a forest is different from outside of the forest. On a sunny day, visit a forested area. Have the girls take the air temperature inside the forest, and compare that to the air temperature in an open area outside of the forest. Which temperature is lower? Consider also measuring the relative humidity, soil temperature, and wind speed inside and outside of the forest. To measure relative humidity, the girls will need an instrument called a hygrometer (available at hardware stores). You can build your own instrument for measuring wind speed, which is called an anemometer (you can find instructions for constructing a anemometer in library books, or on the Internet, at sites like this one:
<http://www.energyquest.ca.gov/projects/anemometer.html>)
- Have the girls learn more about the role of trees in the water cycle. The diagrams in the Appendix on pages 11 and 12 might be useful. Have them answer these questions: How do trees get water? What is the relationship between trees and rain? What is transpiration? What would happen to trees if it never rained? What would happen to rain if there were no trees?

One way to discover transpiration first hand is to place a baggie around the leaves of tree (without injuring the stems of the leaves). After waiting an hour or more, check the baggies to see if water has accumulated in them. Any water inside the bag has transpired out of the leaf. You can measure the amount of water by weighing the bag before you put it on the leaves and then after water has accumulated in it. Experiment with different species of trees (do they all transpire at the same rate, or do some give off more or less water than others during a given period of time). Also, see if your results are different depending on if the leaves are receiving direct sunlight or are in the shade, or if it has rained recently.

Activity 2. Wood Products Past and Present

A. Background Information

The list of products that humans produce from forest resources is a long one. This has been true throughout history. However, the ways in which people make use of forest resources has changed over time. Different technology, cultural changes, and expanding populations have transformed the ways in which forests are used today in comparison to the past. Considering the ways in which wood products have been used in the past and present reveals the long and changing history that humans have shared with the natural world.

B. Suggested Ways to Complete Requirement

- Have the girls make a list of some of the ways you and your family use wood products. Do a bit of library or Internet research to find out what things are direct and indirect forest products. For example, it is easy to identify a wooden bench as a forest product, but you might be surprised to know that shampoo also can be considered a forest product since it has some ingredients that come from the forest. Once you have compiled your list, visit with an older person in your community or an older relative and ask him or her about how forest products were used when he or she was growing up. Talk about the ways in which forest products are used differently between the two time periods, and what has caused these changes.
- Consider how wood products were used by native cultures prior to European settlement of the United States. Learn about the tools and shelters that were crafted by Native Americans living in forested regions of the country.
- Learn how the process of making different forest products has changed with changes in technology. For example, compare the process of making maple syrup in the early 1900's with how it is produced today, examine the history of papermaking and how it has changed through time, or investigate how the process of logging trees has changed.

Activity 3. The Seasonal Forest

A. Background Information

Because Wisconsin's climate changes seasonally, the plants and animals of the forest must be equipped to survive through different weather conditions. For the most part, this involves being able to withstand or avoid the harsher conditions that come with the winter months. All living things must endure the extremely cold temperatures, and animals must deal with a dwindling food and water supply. Plants and animals have many different strategies for doing this, and listed below are just a few of the possible ways in which plants and animals are adapted to survive through changing weather conditions:

Animals:

- Hibernation – some animals such as ground hogs lower their heart rates, breathing rates, and body temperature through the coldest months of the winter. Because of their inactivity, hibernating animals do not need much energy and can go without eating during the winter months when food is scarce. While hibernating, they are able to survive off the energy they have stored as fat.
- Migration – animals travel hundreds and sometimes thousands of miles in the fall to warmer climates. They spend the winter months in areas with milder temperatures and more abundant food
- Winter Coats – many animals grow a thicker coat of fur in the winter to help them stay warm despite the cold weather. This excess fur is shed in the spring so that animals do not overheat in the warm summer months. Some animals also have different color coats for the different season, helping them to stay camouflaged even when the ground is covered with snow. One example is the weasel, which has a white coat in the winter and a brown coat during the summer months so that it blends into the background during either season.

Plants:

- Leaf Drop – Because of the cold, dry conditions of winter, most broad-leaved plants in temperate regions drop their leaves in the fall. This is because leaves are a major source of water loss, and during the dry conditions (even if the ground is covered with snow, it is not in a form that plants can take up through their roots) of the winter these

trees would lose too much water through them. Trees drop their leaves to avoid this water loss problem.

- Waxy Leaves – Trees that do not drop their leaves in the fall, such as most conifers, need to deal with the problem of winter water loss in another way. A thick, waxy coating on the leaf surface can help prevent water loss during the dangerously dry winter months.

B. Suggested Ways to Complete Requirement

- Use a camera to photograph the same tree from the same angle over the course of several months. This will work best if you begin in late summer or late winter, so you can capture a period when the tree will undergo the most dramatic change. Compare the photographs to observe what changes have occurred. Also look for changes in the area surrounding the tree.
- Create a phenology calendar to record your observations about the changing forests. For each day on the calendar, make notes about the weather, the appearance of the forest plants, and the types of animals you see.

Activity 4. Become a Steward

A. Background Information

Stewards of the land are those who manage and protect it to ensure its enduring health. Wisconsin has a long history of being tied to individuals who have become environmental conservationists well known around the world. Just a few of these famous people include:

- John Muir – a founder of the Sierra Club
- Aldo Leopold – a world-famous author and scientist who worked at the University of Wisconsin-Madison
- Gaylord Nelson – former Wisconsin Governor, U.S. Senator, and founder of Earth Day.

These famous land stewards worked to educate the public about preserving natural resources and protect the environment from destruction and neglect. Environmental stewardship is about taking action to improve or protect the environment. Protecting and restoring forests is important for many reasons. In the past few decades many humans have become very concerned about the effect that people are having on natural systems. Our cars, factories and lifestyles produce a lot of pollution and waste that can have a negative impact on the environment. Forests play a large role in maintaining a healthy environment, and many environmental problems such as loss of biodiversity, global climate change, and water quality are linked to the health and size of the world's forests.

To learn more about famous conservationists and land stewardship, check out the following resources:

- Wisconsin Conservation Hall of Fame Foundation, Inc. – visit their website (<http://www.wchf.org/index.htm>) or Visitor Center in the Schmeckle Reserve at the University of Wisconsin – Stevens Point to learn about the lives and work of Wisconsin's important conservationists.
- Wisconsin DNR Environmental Heroes and Heroines Website (<http://www.dnr.state.wi.us/org/caer/ce/eeek/nature/heros.htm>) -- information about three of Wisconsin's important conservationists on the DNR Environmental Education for Kids! (EEK!) Website.

- *John Muir: Naturalist, Writer, and Guardian of the North American Wilderness* by Sally Tolan
- *Aldo Leopold: American Ecologist* by Peter Anderson
- *Gaylord Nelson: A Day for the Earth* by Jeffrey Schulman
- Wisconsin's Millennium Tree - Sustainable Forestry Activities – many ideas for stewardship activities available online at <http://www.dnr.state.wi.us/org/caer/ce/eeek/teacher/milltree.htm>

B. Suggested Ways to Complete Requirement

- Talk with a naturalist, forest ecologist, forester, or park ranger about what you can do to help keep Wisconsin's natural and urban forests healthy. Have the girls share the information they learn with their family and friends.
- Have the girls identify an area in their community that could be spruced up with the presence of trees. Research which types of trees and bushes are native to your area and might grow well on your chosen site, then develop a management plan for planting and maintaining trees on that site.
- Girl Scouts could develop a poster that shows the ways that people benefit from forests around the world. They should include the benefits we get from forest products, the ecological benefits that forests provide, and the recreational opportunities available in forests. Have them display the poster at their school, library or another community gathering place, and provide information on things everyone can do to become good stewards of the land.
- In his famous book *A Sand County Almanac*, Aldo Leopold writes about what he terms a Land Ethic. An ethic is a set of principles or values that people use as a guide for knowing how to treat each other. Leopold believed that we should grant respect and rights to the natural world just as we grant respect and rights to the people of a community. Help the girls learn more about Leopold's Land Ethic and develop their own set of guidelines for how people should treat that natural world.
- Consider how restoring and preserving forests can help solve environmental problems such as global warming, loss of biodiversity, and water quality. Choose one of these problems and investigate how it is related to the destruction or exploitation of the world's forests.

Activity 5. Tree I.D.

A. Background Information

To the untrained eye, a forest can seem to be filled with trees that all look the same. However, different species of trees are unique, and a close observer can even learn to recognize trees from the same species as individuals. There are many physical characteristics of trees that can be used to properly identify their species. Some of these include:

- | | |
|---------------------|------------------------|
| • Leaf/needle shape | • Bud shape/size |
| • Leaf/needle size | • Crown shape |
| • Leaf/needle color | • Fruit shape |
| • Bark texture | • Branch/twig position |
| • Bark color | • Tree height/girth |

B. Suggested Ways to Complete Requirement

- Help the girls try to identify trees in the winter by examining their bark, twigs, and buds.
- Use and compare a few different tree identification keys. Which one is easiest to use? Have the Girl Scouts learn to identify at least six different tree species until they recognize them by sight without the aid of the key.
- Help the girls create their own key to the trees in their neighborhood. Have friends or family members test out the key. Was the key easy for them to use? How could it be improved?

Activity 6. Forest Recyclers

A. Background Information

The process of breaking down dead things is called decomposition, and is a very important aspect of maintaining a healthy forest. Plants need nutrients to grow, and these nutrients come from the soil. Through their roots, plants take up water and nutrients from the soil and then use them to build tissue and grow. However, if plants kept removing nutrients from the soil and more nutrients were never added, soon the soil would be devoid of nutrients, and no new plants could grow. When a tree drops its leaves in the fall or loses a branch during a storm, critters that live in the forest floor, known as decomposers, get to work turning the dead leaves and branches back into soil and nutrients that a new generation of trees can use to grow. Decomposers that are commonly seen include earthworms and sow bugs (also called pill bugs). Another set of important decomposers is made up of microorganisms that we cannot see. There are many books that can provide more information about decomposers, such as:

- Kalman, Bobbie. 1998. *What are food chains and webs?*
- Ross, Michael. 2002. *Re-cycles.*
- McGinty, Alice. 2002. *Decomposers in the food chain.*
- Hughey, Pat. 1984. *Scavengers and decomposers: the cleanup crew.*
- Scott, Janine. 2002. *Food found all around.*

B. Suggested Ways to Complete Requirement

- Roll over a rotting log or dig through the forest floor and see how many different types of decomposers the girls can find. You might want to use a magnifying glass to get a closer look at your decomposing friends. Have the Girl Scouts try drawing a picture of each of the different decomposers they come across.
- Fill a jar or plastic bag with dirt, brown leaves, and other once-living materials. Poke a few air holes in the jar lid or near the top of the bag, and have the girls observe the contents of the container for several weeks.
- Many gardeners use compost bins to turn their garden waste into fertile soil. Learn about garden composting and how it related to the natural decomposition process that occurs in forests. How does the decomposition of old plants improve soil quality? What effect does this have on plants currently growing in a garden or a forest?
- Learn about the relationship between decomposers, producers, and consumers (hint: they are all part of the food chain/web). Make a map with the girls showing how energy (food) moves through a forest, starting with the sun. Where are decomposers located on

this map? In what ways are decomposers important to the cycling of nutrients and energy through a food web? What would happen if decomposers were absent in a food web?

Activity 7. The History of a Tree

A. Background Information

Trees can lead very long lives, sometimes surviving for hundreds of years. Much can happen over this long period of time. A tree changes as it matures from a seed to a sapling to an adult, and the environment in which the tree lives can change over its lifetime as well. A fire might sweep through and kill off many of the other plants and trees, or a drought might occur for a few years, slowing the growth of the forest plants. Both of these changes in the environment would likely affect the tree's health. Even after a tree has died, its history continues. It continues to provide habitat for animals, like certain insects or cavity nesting birds. People intending to produce paper, lumber, or some other wood product from it might harvest its wood.

As a tree grows, it produces growth rings that tell a story about its past. By examining a tree's rings, you can determine something about the environment in which the tree lived and how the tree grew throughout its life. Scientists who study the growth rings of trees are called dendrochronologists.

How to read rings:

- The outermost ring on a tree is from the last year a tree was alive. Rings are added each year as the cambium layer, just underneath the bark, grows new cells. So, the rings in the center are from the earliest years the tree was alive, and the outer rings are from the last years of the tree's life.
- A narrow growth ring indicates that the tree did not grow much during that year, perhaps because of drought, inadequate sunlight, insect damage, or disease.
- Wide growth rings indicate that the tree grew well during that year.
- Wider rings on one side of the tree indicate that the tree leaned in that direction or there was greater competition for resources on one side.
- Knots and "V" shaped indentations of the rings are caused by the growth of branches.

B. Suggested Ways to Complete Requirement

- Try to locate the stump of a tree that has been cut down, or try to find a disk from the trunk of a tree. Help the girls analyze the rings of the tree determine the history of that tree. Attempt to determine its age, when in its life it was growing fastest, when it was growing slowest, and whether it leaned to one side.
- Try comparing the rings of two different tree species. Does it seem as though one species is faster growing than the other? Discuss with the girls how different rates of growth are related to "hardwood" and "softwood."
- Examine the grain of different wood products around your house, such as furniture, flooring, or cabinetry. How do the grains of different types of wood look in comparison to each other? How is the appearance of a wood's grain related to its growth?

Activity 8. Forest Plant-Animal Relationships

A. Background Information

Because forest plants and animals share a habitat, they are connected to each other in many ways. Ecologists are people who strive to understand the many ways in which the plants, animals, and non-living things in an ecosystem are connected. Because forest plants and animals share a habitat, they are connected to each other in many ways. The purpose of this activity is to help Junior Girl Scouts get a sense of the many different relationships that plants and animals have with each other.

There are many ways in which plants and animals living within a habitat are important to each other. Some of them are listed below:

Food Sources – Many animals consume plants or parts of plants as a food source. Examples of this would be deer grazing on twigs, birds eating berries, and squirrels eating nuts. There are also plants native to Wisconsin that feed on animals! Pitcher plants, which grow in the boggy areas of some Wisconsin forests, rely on insects for food. Insects get trapped in the tube-shaped leaves of the plant, which contain a mixture of water and chemicals that work to dissolve the body of the insect (much the way our stomachs dissolve the foods we eat). The plant then absorbs the nutrients from the dissolved insect.

Shelter – Most forest animals rely on plants in some way to provide shelter at some point in their lives. Young bears scale trees to keep safe from danger, birds build their nests in trees for the same reason, and shrubs provide hiding places for deer.

Seed Dispersal – It is beneficial for plants to have their seeds spread away from them, and animals are one way in which this occurs. Birds eat berries, but their stomachs cannot digest the hard, specially coated seeds, which get excreted from the bird (probably in a different location). Animals (including children) running through the forest might get thistle seeds or burrs stuck to their fur (or clothes). Eventually these rub off, and the seeds land somewhere far away from the plant that produced them. Animals serve as seed dispersers for plants in these and other ways.

Pollination – Bats, birds, and insects are all important pollinators. Without the services of these sugar-seeking animals, certain plants would not be able to reproduce.

To learn more about plant – animal relationships, check out the following resources:

- Young, Allen. 1996. *Lives intertwined: relationships between plants and animals*.
- Morrison, Gordon. 2000. *Oak tree*.

B. Suggested Ways to Complete Requirement

- Play a game that demonstrates the ways in which plants and animals interact. Instructions for one such game, "The Squirrel and the Hickory Nut," can be found in the Appendix on page 13.
- Spend some time in the forest observing a single type of animal (it will be easiest to observe something commonly seen, such as certain birds, squirrels, or insects). Keep track of the number of times the animal comes into contact with a plant. How is the animal benefiting from the presence of plants? In what ways, if any, are the plants benefiting from the behavior of the animal?

References and Additional Resources

- Energy Quest Website (California Energy Commission). *Make an Anemometer!*
<http://www.energyquest.ca.gov/projects/anemometer.html>
- Howe, Henry and Lynn Westley. 1988 *Ecological Relationships of Plants and Animals*.
- Hughey, Pat. 1984. *Scavengers and decomposers: the cleanup crew*.
- Kalman, Bobbie. 1998. *What are food chains and webs?*
- Marchand, Peter J. 1996. *Life in the Cold*.
- McGinty, Alice. 2002. *Decomposers in the food chain*.
- Morrison, Gordon. 2000. *Oak tree*.
- Ross, Michael. 2002. *Re-cycles*.
- Scott, Janine. 2002. *Food found all around*.
- Young, Allen. 1996. *Lives intertwined: relationships between plants and animals*.

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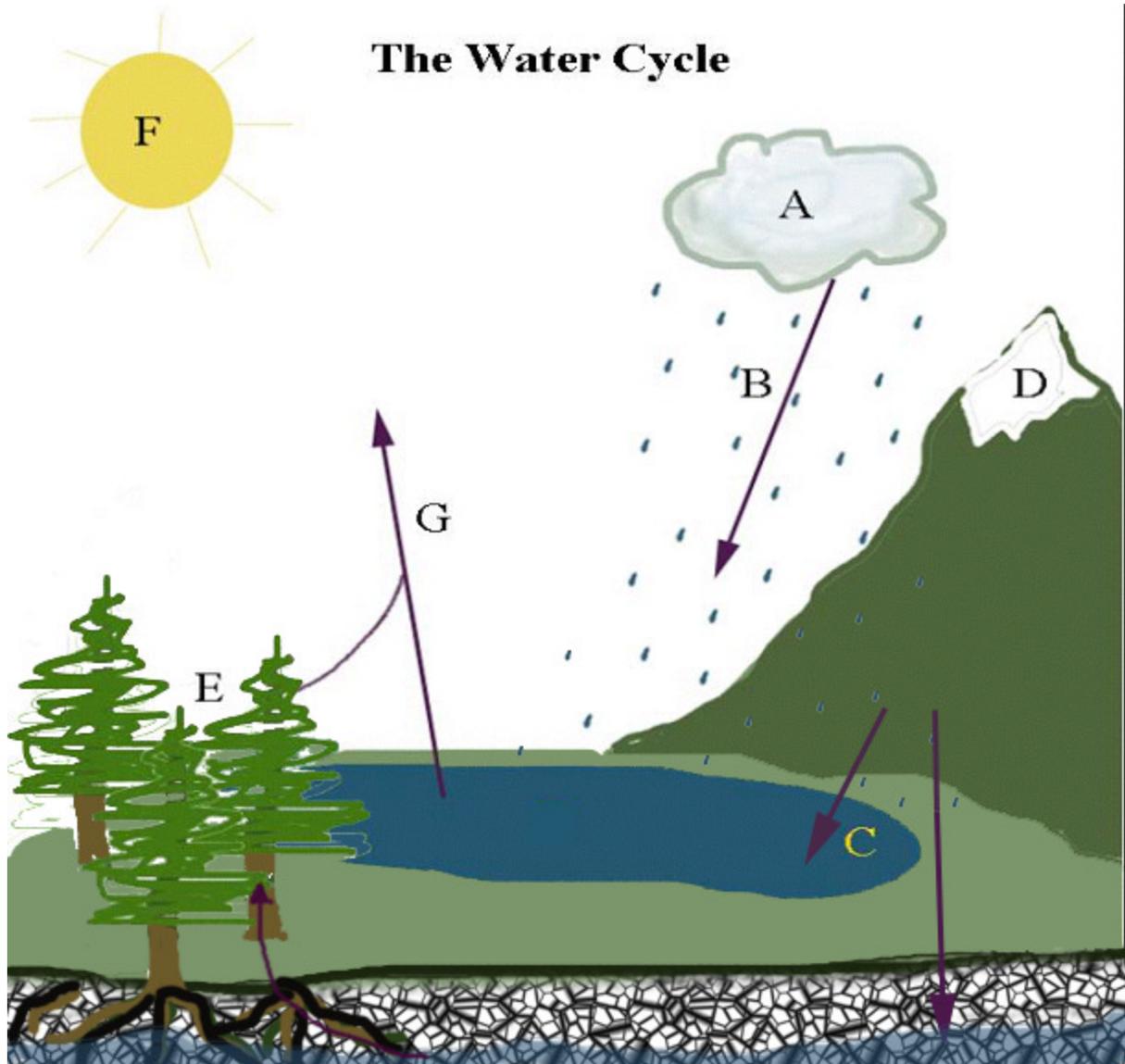
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APPENDIX

The Water Cycle

Plants and Water

The Squirrel and the Hickory Nut (or Acorn)



A. Condensation - Water molecules in the atmosphere come together to form clouds.

B. Precipitation - Depending on temperature and the amount of moisture in the air, the clouds can condense enough to generate precipitation in the form of rain, snow or hail.

C. Collection - After rain falls or snow melts, the water either makes its way into lakes and oceans or it penetrates into the soil.

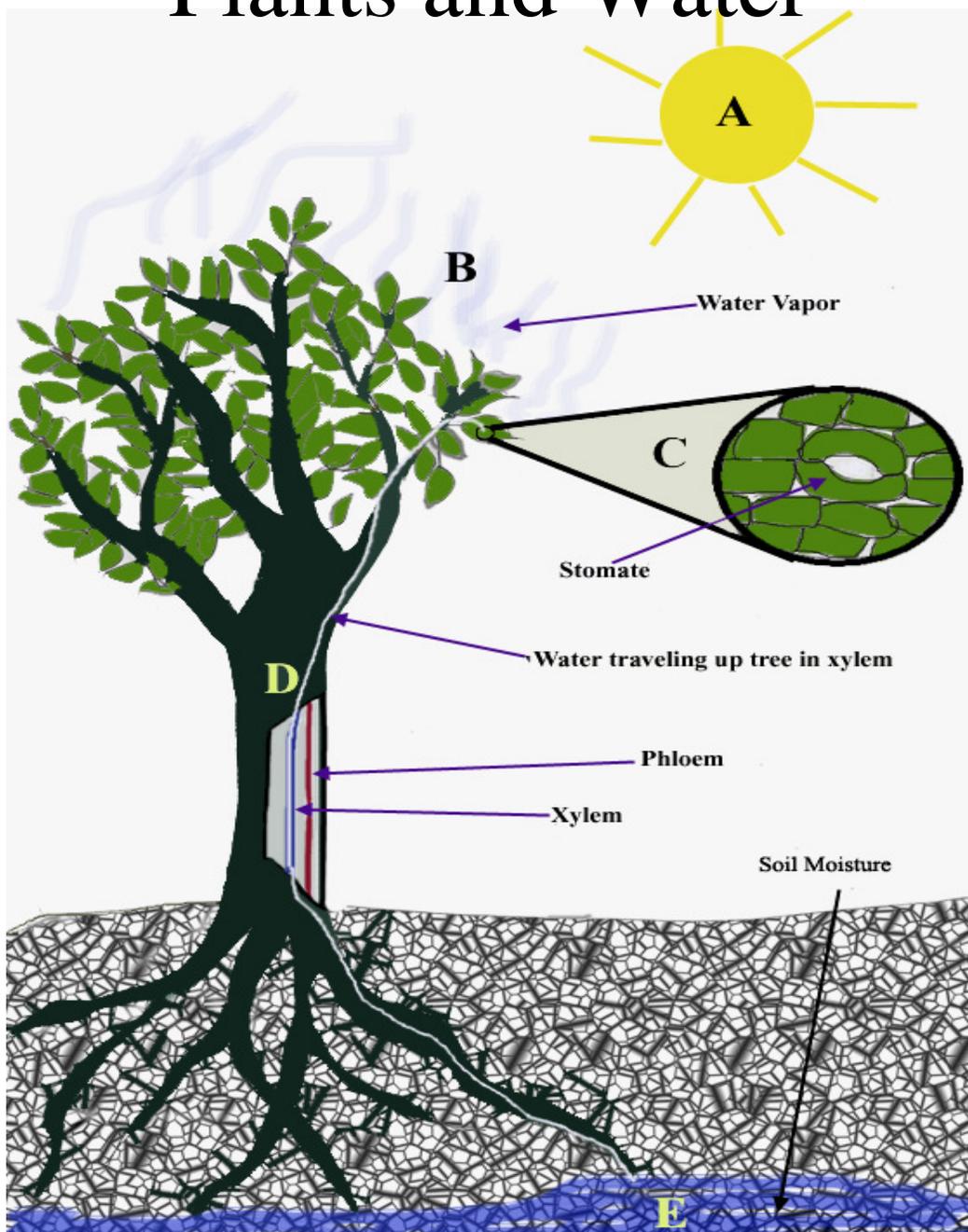
D. Glacier Formation - Sometimes the snow in very cold climates like on the top of mountains forms glaciers, which don't melt for hundreds of years

E. Transpiration - The roots of plants take up water from the soil. The plant then transports the water up its stem to its leaves, where it can exit the leaf through special cells called stomata.

F. Solar Radiation - Energy from the sun's rays heats the water in the lakes and on the surface of plant leaves.

G. Evaporation - The water in the lakes and on leaves is heated by the sun and becomes warm enough to turn into water vapor. The vapor goes into the air and eventually condenses to form clouds.

Plants and Water



A. Solar Radiation – Energy from the sun’s rays heats the surface of the leaves.

B. Evaporation – The increased heat from the sun causes transpired water to evaporate from the leaves, creating water vapor that is released to the atmosphere. This water vapor will eventually condense and become precipitation

C. Transpiration – The transpiration, or release of water from a plant, is regulated by the guard cells of the stomate. These cells can open and close to control the amount of water that leaves the plant (cells are shown in open position).

D. Transportation – The transpiration and evaporation of water through the stomata (plural word for stomate) of the leaves creates a pulling force (like sucking through a straw) that moves water from the roots up the tree. The water travels up the tree through vessels called xylem. Other vessels, termed phloem, are used by the tree to transport nutrients and food from one part of the tree to another.

E. Collection – The tree collects water from the soil through its root. The soil moisture is replenished through rain and melting snow.

The Squirrel and the Hickory Nut (or Acorn)

This activity will demonstrate the co-reliance of forest plants and animals by examining one specific plant-animal relationship.

Materials:

About 3 kernels of corn, dried peas, beans or other biodegradable item per girl

Instructions:

Gather the girls underneath a tree (preferable a hickory or oak) and tell them that they are squirrels living near this tree. Tell them that it is fall, and the tree is getting ready to drop its nuts. Once the nuts have been dropped, the squirrels will prepare for winter by collecting and hiding the nuts. Then spread all of the “nuts” onto the ground beneath the tree and tell the squirrels to get to work hiding them.

After the nuts are hidden, call the girls back to the tree and discuss how squirrels benefit from living near a hickory or oak tree. You might want to cover the following points:

- The tree provides a place for the squirrel to hide from predators (including the neighborhood dogs).
- The tree provides a place for squirrels to build nests and raise their young
- The tree provides food for the squirrels that can be stored to help them get through the winter months.

Also ask the girls whether or not they think the tree benefits from living near squirrels (don't have an in depth discussion at this point, just have them state 'yes' or 'no.')

Next, tell them that it is now mid-winter, and they are quite hungry and need to go foraging for the nuts they hid in the fall. After they have searched for their nuts for a few minutes, call them back to the tree and count how many nuts they recovered. It is very likely that the girls will not have recovered all of the nuts.

Have them guess what happens to the nuts that the squirrels could not find. Explain that, because squirrels do not always remember where they hid nuts, they are acting as seed dispersal mechanisms. Because nuts are actually tree seeds, the ones that have been buried and forgotten might have a good chance at sprouting and growing into a young tree. Talk about why it is beneficial for plants to have their seeds dispersed away from them. Touch on the following points:

- Because hickory nuts and acorns are relatively heavy, when they fall from the tree they land directly beneath it because they are too heavy for the wind to carry them. If they were sprout in the same place where they land, they would have to compete with each other and the much larger parent tree for resources such as water and sunlight. This would not be a good situation because the taller parent tree would shade them and, with its well-established roots, slurp up most of the water. By being moved away from the tree by squirrels, the nuts might end up in a place where they have more access to these important resources.