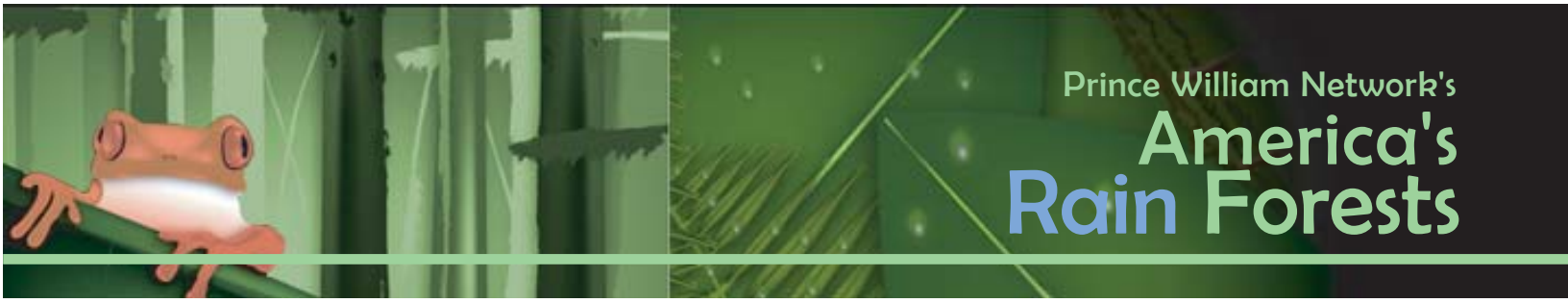


Seeing the Forest for the Trees

Exploring Your World

National Science Education Standards

- Standard C: *Life Sciences* — Populations and ecosystems.
- Standard C: *Life Sciences* — Diversity and adaptations of organisms.
- Standard E: *Science and Technology*— Understandings about science and technology.
- Standard F: *Science in Personal and Social Perspectives* — Populations, resources, and environments.
- Standard F: *Science in Personal and Social Perspectives* — Science and technology in society
- Standard G: *History and Nature of Science* — Nature of science.

OVERVIEW

Students plan and conduct a simple sampling activity to estimate quantify species diversity of an ecosystem. The project can also be extended to estimate populations of plants and animals in a given area.

OBJECTIVES

Students will:

1. Understand the importance of sampling in science.
2. Learn how to set up a quadrat.
3. Improve their observation skills.

SUBJECTS

Science, Math, Language Arts

VOCABULARY

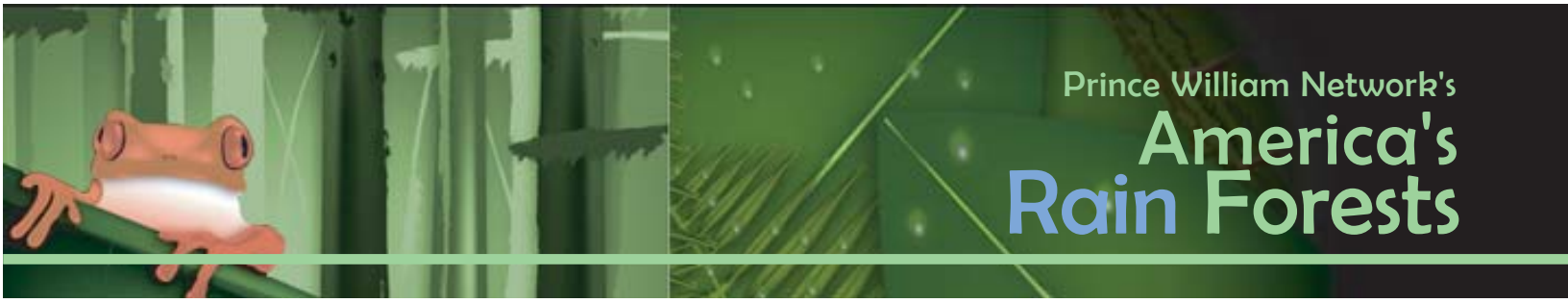
estimate, sample, grid, population, quadrat

TIME

50 minutes in field; 2, 50-minute sessions in class

MATERIALS

field log; notebook, or notepaper; pencil or pen; string or flagging, tape measure; grid paper; field guides; binoculars; speciman jars; plant press, gloves, small garden spade.



BACKGROUND

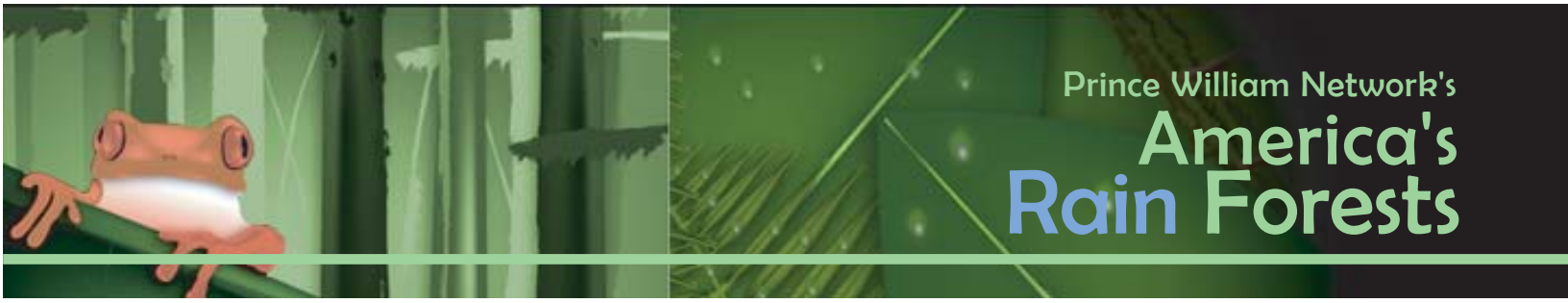
You have just been given the task of finding out how many dandelions or how many blades of grass are on your school grounds. How would you go about finding out? Your problem is similar to the problems scientists face all the time. How many whooping cranes are in existence? How many deer in a forest preserve? How many compass plants are in a section of prairie? You might solve your problem by getting down on your hands and knees and counting every dandelion on the school grounds. This might take you a very long time but if done carefully would give you a precise answer.

It is often unrealistic for a scientist to count every organism in her/his research area. What scientists often do is to work with a sample, a small section or plot of their research area. From their sample the scientist can then estimate many things about their research area without having spent all the time necessary to count each organism.

Selection of a **study site** is the first step in a field investigation of the forest environment. Obviously, scientists establish study sites in areas with properties they want to study. It is recommended that you select more than one site in order to replicate the study. A choice of several sites of different management history or successional stage will allow you to compare differences in what the students sample. You can consult with the US Forest Service, the state department of forestry, certified foresters, or university scientists about appropriate locations for your study site. If you work at a private site make sure your obtain appropriate permits for use. If possible, choose a site that is close to the road for easy access. This can come handy in case of an emergency or if you want to visit the site more often to resample your plots. Students can build and post a simple sign at their study site to notify visitors of an ongoing investigation.

When scientists investigate a forest it is not feasible to take measurements (**sample**) from the entire area. For example, it would expensive and time-consuming and often unnecessary to measure all trees in a 50-acre forest to estimate the average diameter or age of trees in this area. Instead, scientist select **sample plots** or **points**. These are locations uniformly or randomly distributed throughout the study area. Scientists then take measurements or sample these areas and extrapolate their results to the entire study site and other similar areas. Study plots can be square, rectangular or circular in shape. Sometimes, scientists do not establish permanent plots but instead they sample along a transect line. For example, in vegetation studies, they may want to count the number of plants that touch a sampling line stretched for many meters through the forest. Keep in mind several basic rules that scientists use to obtain a more representative characterization of the vegetation they sample:

- ✿ Two-dimensional plots such as squares and circles give you a better information about the plant community at each point of observation than linear transect plots.
- ✿ You are better off if you sample several smaller plots than one large plot at your study site.
- ✿ If you want to increase the accuracy of your sampling then increase the number, not the size of your sample plots.



TROPICAL RAIN FOREST LAYERS

EMERGENT LAYER

The tallest trees are the emergents, towering as much as 200 feet above the forest floor with trunks that measure up to 16 feet around. Most of these trees are broad-leaved, hardwood evergreens. Sunlight is plentiful up here. Animals found are eagles, iquanas, parrots, macaws, monkeys, bats and butterflies.

CANOPY LAYER

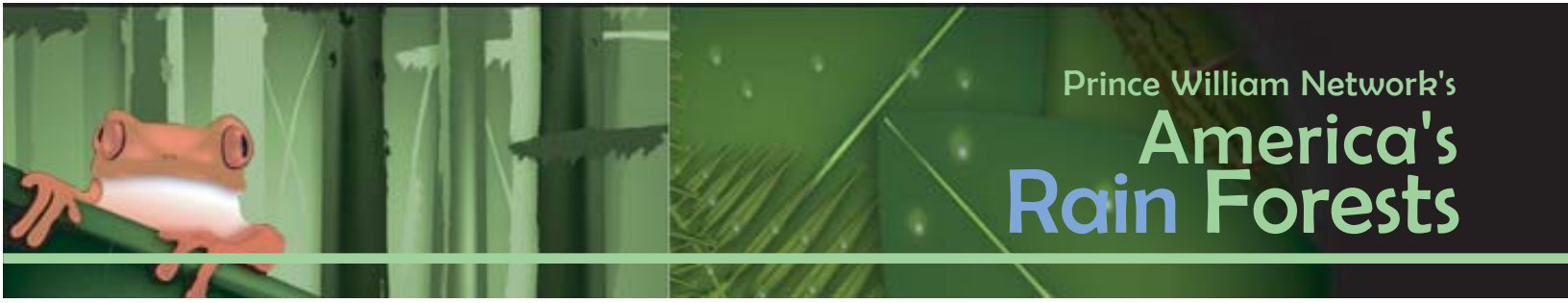
This is the primary layer of the forest and forms a roof over the two remaining layers. Most canopy trees have smooth, oval leaves that come to a point. It's a maze of leaves and branches. Many animals live in this area since food is abundant. Those animals include: snakes, toucans and treefrogs.

UNDERSTORY LAYER

Little sunshine reaches this area so the plants have to grow larger leaves to reach the sunlight. The plants in this area seldom grow to 12 feet. Many animals live here including jaguars, red-eyed tree frogs and lizards. There is a large concentration of insects here.

FOREST FLOOR

It's very dark down and almost no plants grow in this area. Since hardly any sun reaches the forest floor things begin to decay quickly. A leaf that might take one year to decompose in a regular climate will disappear in 6 weeks. You can find fungi, frogs, lizards, geckoes and snails in this layer.



Prince William Network's

America's Rain Forests

Be Gentle with the Forest...

The forest is home to an amazing array of plants and animals.

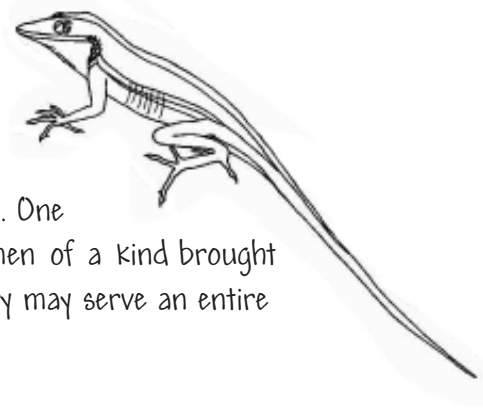
Each year, many people explore the forest. They come to hike, bike, hunt, fish, bird watch, or to just relax. Each time you walk in a forest you run the risk of disrupting animal's lives and damaging the forest ecosystem. However, if care is taken, damage can be minimized and enjoyment maximized.

Walk — don't run. You may trip and fall in unfamiliar terrain if moving quickly. Mossy logs and tangled roots can easily trip you. Walking also exerts less pressure on any animals you might step on. Watch for snails and small animals that might be trampled along the trail.

When you turn over a rock, do it gently, being careful not to crush any animal that is beside the rock or that moves suddenly as its hiding place is uncovered. It is generally better to move unattached creatures aside before you turn the rock back over again, as they will soon find cover; but if you do not think they will quickly seek shelter, put them under some leaves. When you leave, they will probably get along all right.

If you do some gentle digging, make sure to fill in the holes. Don't dig more than an inch below the surface—and in small areas. Be sure to restore the area once you are done with your investigations

(Adapted from ADF&G "Tidepooling Etiquette")



Don't collect more than you really need or want. One leaf, or live specimen of a kind brought back to a laboratory may serve an entire class.

Avoid collecting altogether in highly sensitive or unique natural areas. Certain animals or plants that inhabit these sites may not be commonly seen in the same general region. **Never** take the oldest, largest or rarest individual.

Don't collect or disturb animals and plants in areas designated by law as biological preserves.

On a field trip, do as much studying as you can right in the forest. Take photos of specimens rather than bringing them back to the classroom. Bring field guides and hand lenses with you so you can identify the plants and animals in the field. It is often difficult to successfully return plants and animals to their homes once they are removed. It's always best to bring the absolute minimum number of specimens back to your classroom.

Make all the use you can of the collected plants and animals before they die. Do not let your collection become an end in itself. Some animals and plants can be preserved in such a way that their usefulness may be extended beyond the time they are studied alive.

ACTIVITY

1. Collect materials that you will need for your investigation. Flagging, specimen jars, clipboards, pencils and paper, field guides and other field equipment can be very helpful.

2. Before leading your class to the field, make sure that you are aware of any risks your site may present. Consider stinging insects, noxious plants or severe weather. Talk with your class about safety concerns and insure that they are prepared for their field experience.

3. Choose an area to study—a nearby park, backyard, part of a baseball diamond, or some other natural environment. If desired, you could choose several environments and compare and contrast your findings.

You can pre-choose your study site, or let your class choose the final location for your 6 meter X 6 meter plot.

4. If you are investigating a forest environment **divide your class** into three teams—one that will investigate the plants and animals of the forest floor; one that will investigate the understory of the forest; and one that will investigate the canopy.

Depending upon your environment, you may need to divide your class in some other logical manner. For rain forest investigations, the following tasks work well.

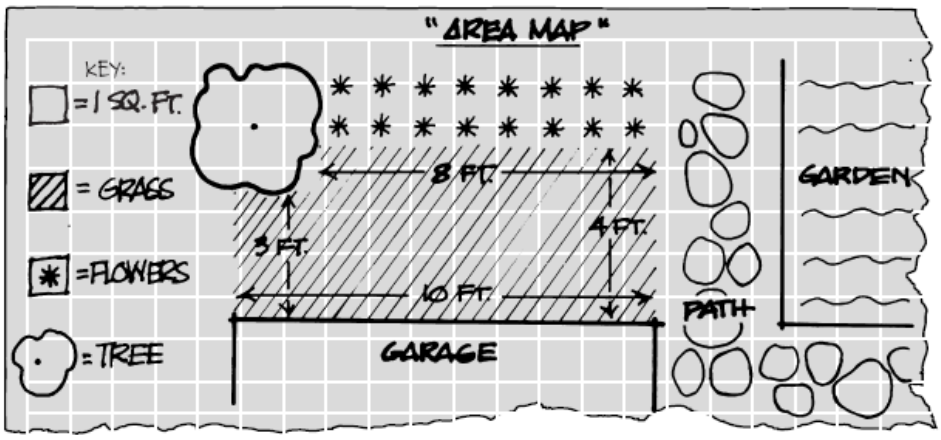
Forest Floor - team uses gloves and garden tools discover invertebrates in the forest litter. They document and describe the plants and animals that live in the lowest level of the forest.

Understory - team describes the plants and animals found from about knee-height to as far as they can reach upward. They collect and describe plants and animals growing on tree trunks and plants that grow into this zone.

Canopy - team describes and records plants and animals in the uppermost reaches of the forest. This group may need to use binoculars to gather information about this uppermost level of the forest. They should also record any birds observed or heard near their plot.

5. Lead your class to your site. Use a tape measure to measure out a 6 meter X 6 meter square plot. Use string, yarn or flagging tape to mark the boundaries of your plot.

6. Have each team conduct a **thorough investigation** of their plot. They should draw a map of their site, locate significant features of their site and record environmental conditions such as temperature, wind direction, precipitation and such.



Activity (continued)

7. Have your teams **record** the different species found on the project data sheet (you may need multiple copies). They can use field guides to identify plants and animals in the field. If they are unable to identify an item, they can collect a small sample to bring back to the classroom to identify. Remind the class to have as little impact on the site as possible!

8. If desired, the class can also record the population of each species found. Although the primary emphasis for this sampling activity is to quantify species diversity, collecting population data will allow you to extend the activity to estimate population size based on scientific sampling.

9. You may choose to sample a series of plots in the forest. Researchers usually choose plots in the upper, mid and lower elevations of the forest to provide a more complete picture of species diversity. They also may set out baskets to catch falling leaves, flowers and insects and collect the baskets after a period of time.

10. When you leave the site, make sure your class polices the area and returns it to it's natural condition.

Back in the Classroom

1. Back in the classroom, have teams work on identifying organisms, analyzing their findings and preparing a presentation of the work to the class.

2. Each **team presents** their findings to the entire class. Information can be shared in any number of ways depending upon the needs of your class. For example you could ask teams to draw a mural to emphasize creative arts, or write a story about the work to emphasize literature arts. Additionally, you could ask that students complete simple mathematical analysis of their data.

EXTENSIONS

You can use this activity and the data gathered in many different ways.

- Try estimating the sizes of other populations. For example, estimate the population size of your school. Select one sample classroom. Count the number of students in it. Count the classrooms in your school. Multiply the two numbers. Check with your teacher or principal and see how accurate your estimate is. What factors might influence accuracy?
- Sample other environments and have students compare and contrast these differing areas.

ASSESSMENT

1. Have student teams present their survey findings in a class presentation.

2. Have teams prepare a site report that documents there findings, their process and ways to improve their survey methods.

Student Page

Name _____

Our Site

Legend

_____

_____

_____

_____

Student Page

Name _____

Data Recording Sheet - Plot Survey

Sample	Specimen	Description
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		