

# Terrific Trees!

at the San Antonio  
Botanical Garden



## Curriculum Unit for Grades 3-5

Use trees in school and at the Garden to explore:

- Adaptations
- Needs and habitats
- Roles in an ecosystem



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[www.sabot.org](http://www.sabot.org)

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# **Introduction to Terrific Trees!**

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**Overview:** This curriculum unit is designed to help you use the San Antonio Botanical Garden to teach students about key scientific concepts. Using trees as the main topic, students can explore themes of an organism's needs, adaptations, habitat, and role within an ecosystem.

## **The unit is divided into three parts:**

- 1. Pre-visit activities:** Students examine trees in the schoolyard to learn the basic needs of trees and evaluate the habitat in which they are growing. Students will further investigate tree adaptations by focusing on one adaptation in particular: leaf size.
- 2. Tour of the Botanical Garden:** Each student will use a Field Journal to explore the Garden. The Journal includes seven investigations at different sites around the Garden with questions to guide their explorations.
- 3. Post-Visit Activities:** These activities will bring together the investigations at the Garden and offer opportunities for further learning extensions.

## **Science TEKS Correlations:**

### **Grade 3:**

1). Scientific processes. The student conducts field and laboratory investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:

A) Demonstrate safe practices during field and laboratory investigations.

2.) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:

B) Collect information by observing and measuring;

C) Analyze and interpret information to construct reasonable explanations from direct and indirect evidence.

D) Communicate valid conclusions

E) construct simple graphs, tables, maps, and charts to organize, examine and evaluate information.

8.) Science concepts. The student knows that living organisms need food, water, light, air, a way to dispose of waste, and an environment in which to live. The student is expected to:

A) Observe and describe the habitats of organisms within an ecosystem.

B) Observe and identify organisms with similar needs that compete with one another for resources such as oxygen, water, food, or space;

C) Describe environmental changes in which some organisms would thrive, become ill, or perish;

9). Science concepts. The student knows that species have different adaptations that help them survive and reproduce in their environment. The student is expected to:

A) observe and identify characteristics among species that allow each to survive and reproduce;

B) analyze how adaptive characteristics help individuals within a species survive and reproduce.

#### **Grade 4:**

1). Scientific processes. The student conducts field and laboratory investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:

A) Demonstrate safe practices during field and laboratory investigations.

2.) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:

B) Collect information by observing and measuring;

C) Analyze and interpret information to construct reasonable explanations from direct and indirect evidence.

D) communicate valid conclusions;

E) construct simple graphs, tables, maps, and charts to organize, examine and evaluate information.

5) Science concepts. The student knows that complex systems may not work if some parts are removed. The student is expected to:

A). identify and describe the roles of some organisms in living systems such as plants in a schoolyard

B). predict and draw conclusions about what happens when part of a system is removed.

8) Science concepts. The student knows that adaptations may increase the survival of members of a species. The student is expected to:

A) identify characteristics that allow members within a species to survive and reproduce;

B) compare adaptive characteristics of various species;

11) Science Concepts. The student knows that the natural world includes earth materials and objects in the sky. The student is expected to:

C) identify the sun as the major source of energy for the Earth and understand its role in the growth of plants, in the creation of winds, and in the water cycle.

## **Grade 5**

1). Scientific processes. The student conducts field and laboratory investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:

A) demonstrate safe practices during field and laboratory investigations.

2.) Scientific processes. The student uses scientific methods during field and laboratory investigations. The student is expected to:

B) collect information by observing and measuring;

C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;

D) communicate valid conclusions;

E) construct simple graphs, tables, maps, and charts to organize, examine and evaluate information.

6) Science concepts. The student knows that some change occurs in cycles. The student is expected to:

A) identify events and describe changes that occur on a regular basis such as in daily, weekly, lunar and seasonal cycles;

9) Science concepts. The student knows that adaptations may increase the survival of members of a species. The student is expected to:

A) compare the adaptive characteristics of species that improve their ability to survive and reproduce in an ecosystem.

B) analyze and describe adaptive characteristics that result in an organism's unique niche in an ecosystem; and

C) predict some adaptive characteristics required for survival and reproduction by an organism in an ecosystem.

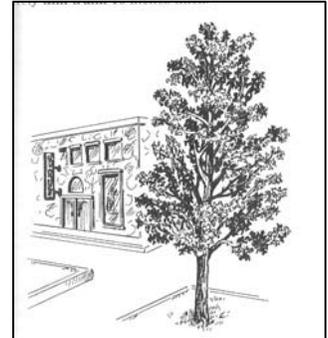
# Pre-visit Activity: Tree Survey

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**Summary:** Students will survey trees in the schoolyard to determine the basic needs of trees in an urban/suburban environment and their role within that ecosystem.

**Time:** Two 45-minute sessions

**Materials Needed:** Writing materials, clipboards, tape measure (optional)



## Background Information:

Many different species of trees survive in urban environments. Some trees are natives that were not removed for the construction of a new building, street, parking lot, or sidewalk. Most, however, have been planted after construction. Either way, if a tree is to survive in any habitat it must have its basic needs met: water, soil, clean air, sunlight and space. Additionally, trees get a helping hand from wildlife for pollination, seed dispersal, and disease control.

Urban habitats can create many challenges for the tree to get what it needs to survive. Just a few challenges include:

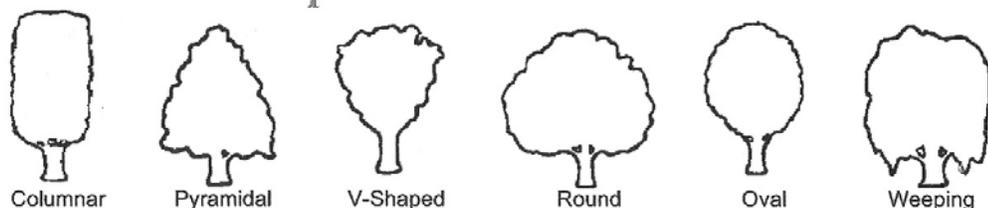
- Roots can be damaged by growing too close to a building or having pavement poured above them.
- Polluted air and/or water can affect leaf growth.
- Grass planted over a tree's root zone creates too much competition for water and nutrients.
- Herbicides used to kill weeds may also damage trees.
- Lack of diversity of trees and other plants in a habitat can lead to vulnerability to disease.
- Exotic trees that are not adapted to the climate of a particular area will also suffer.
- Trees with large canopies are often planted too close together and don't have enough room to grow.

As in a natural environment, the trees that thrive in an urban environment are native or well-adapted to the conditions in which they are growing.

## Procedure:

1. Group discussion. Ask students what they think trees need to survive. Develop a list of Tree Needs. This should include the water, soil, clean air, sunlight (review photosynthesis as necessary) and room to grow.
2. Group discussion. Ask students to describe the school campus as a habitat for trees. What is the climate like? Is there much rainfall? Heat? Cold? Many buildings? Streets? Sidewalks? Is the school near any parks or “green” spaces? Have students brainstorm what some challenges might be for trees growing in this habitat.
3. Field work. Divide students into small groups to assess the trees on your campus. Each group can survey a different area or they can all survey the same area, as dictated by safety. Each group should produce a map of their area that includes all trees, buildings, and other plants. In addition, students should take notes about the trees. Observations should be made about:
  - a. Tree size and age: do the trees look newly planted or are they established?
  - b. Proximity to buildings: are they close to buildings or pavement?
  - c. Diversity: how many different types of trees are there? Are there other types of plants (flowers, shrubs, grass, etc.)?
  - d. Tree health: do any of the trees look sick (brown leaves, empty branches, new trees that are drooping)? Is any bark damaged or peeling?
  - e. Wildlife: What animals or evidence of animals (e.g. nests) can you see?
  - f. Tree shape: what is the general shape of the tree? Does it have enough room to grow?

### Common tree shapes:



4. Drawing conclusions. In the classroom, have students discuss the results of their survey. Using their maps and observations, let each group decide whether their area of the campus was a good habitat for trees. If more than one area of campus is mapped, let the class decide which area of the schoolyard is the best habitat for trees and which has the most challenges.

# Pre-Visit Activity: Leave it to Leaves

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**Summary:** Students will investigate leaf size and shape as an adaptation.

**Time:** One 45-minute session

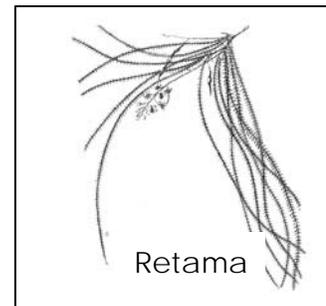
**Materials Needed:** Writing materials, “Zip-Loc” baggies, mailing labels, leaves (or pictures of leaves) from such trees as mesquite, retama, anaqua, oak, palm, cedar or other conifer, and a banana tree.

## Background Information:

Trees, like all organisms, have adaptations that allow them to survive in the environments in which they live. Among the most prominent and recognizable adaptations on a tree are its leaves. Trees are divided into three main categories based on their leaves: Broadleaf trees, conifers, and palm trees.

One of the most important environmental factors that affect leaf shape and size is the presence or absence of water. Leaves have pores on their underside called stomata (singular: stoma) that open and close for the exchange of carbon dioxide and oxygen. When the stomata open, they also release water vapor. The hotter the temperature, the more the stomata open and lose water. Therefore, larger leaves lose more water than smaller leaves. The process of water evaporation from leaves is called transpiration.

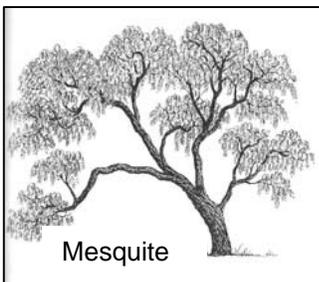
In arid climates, trees and other plants have small leaves to reduce water loss. In some trees like retama, leaves are so small that the trees branches and trunk are green with chlorophyll to assist in photosynthesis. Pine trees and other conifers have needles, modified leaves that help reduce water loss in dry winters. Many drought-tolerant leaves also have a rough texture which helps hold water.



In areas with high rainfall, trees (like a banana tree) have large leaves. The high rainfall causes dense vegetation. The density of vegetation creates competition for light. Therefore, trees and other plants have large leaves to capture more light. Water loss through stomata is not a problem because water is plentiful. Tropical leaves tend to be glossy and slick, allowing rainfall to roll off and away from the tree.

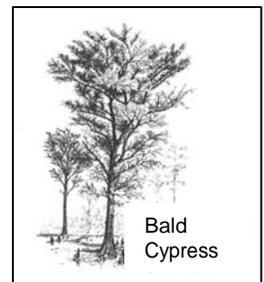
## Procedure

1. Group discussion. Show students leaves from a variety of trees and ask for descriptions of each leaf. What makes them unique? What do they have in common? Brainstorm reasons why trees might have different leaves. This can either be done as a class or in small groups.
2. Group discussion. Review the function of leaves. Students should be familiar with photosynthesis and oxygen/carbon dioxide exchange. Discuss stomata and water loss. Water loss during transpiration is like water loss when you breathe—have them think of breathing on glass and “fogging” it up. Stomata opening when it’s hot is also comparable to skin pores opening and releasing sweat.
3. Field work. Tell students that they are going to capture water escaping from trees. Choose several trees in the schoolyard to examine. Have students select trees with different leaf types and growing in different conditions (sun vs. shade). For each tree take a Ziploc baggie and place it around a leaf or several leaves, sealing it around the stem. Place a mailing label on each baggie and write the type of tree, location, and time of day on it. During the course of the day, the baggie will trap the water evaporating from the leaves.
4. Examining Results. After conducting the experiment, seal all of the baggies and bring them back to the classrooms. Ask students to measure the amount of water that was captured from each tree. Which tree had the most? Least? What did the trees that lost the most water have in common? Was there a difference between trees in the sun or shade? Morning or afternoon?
5. Drawing conclusions. Have students discuss which tree they think is adapted to living without much water. They may want to ask groundskeepers which, if any, trees need the most water. If they know the name of trees that they have examined, students can research whether these trees are drought tolerant and recommended for the San Antonio area.
6. Extensions. Students can research and discuss other adaptations drought tolerant trees have. These include thorns to keep thirsty animals away (e.g. mesquite).



Multiple trunks and/or wide canopies (e.g. mesquite, live oak) are common because the trees are not competing for space.

Trees in wetter habitats (e.g. bald cypress) are usually tall and straight because they are competing with lots of other trees for light.



# At the Garden

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Visiting the Garden:

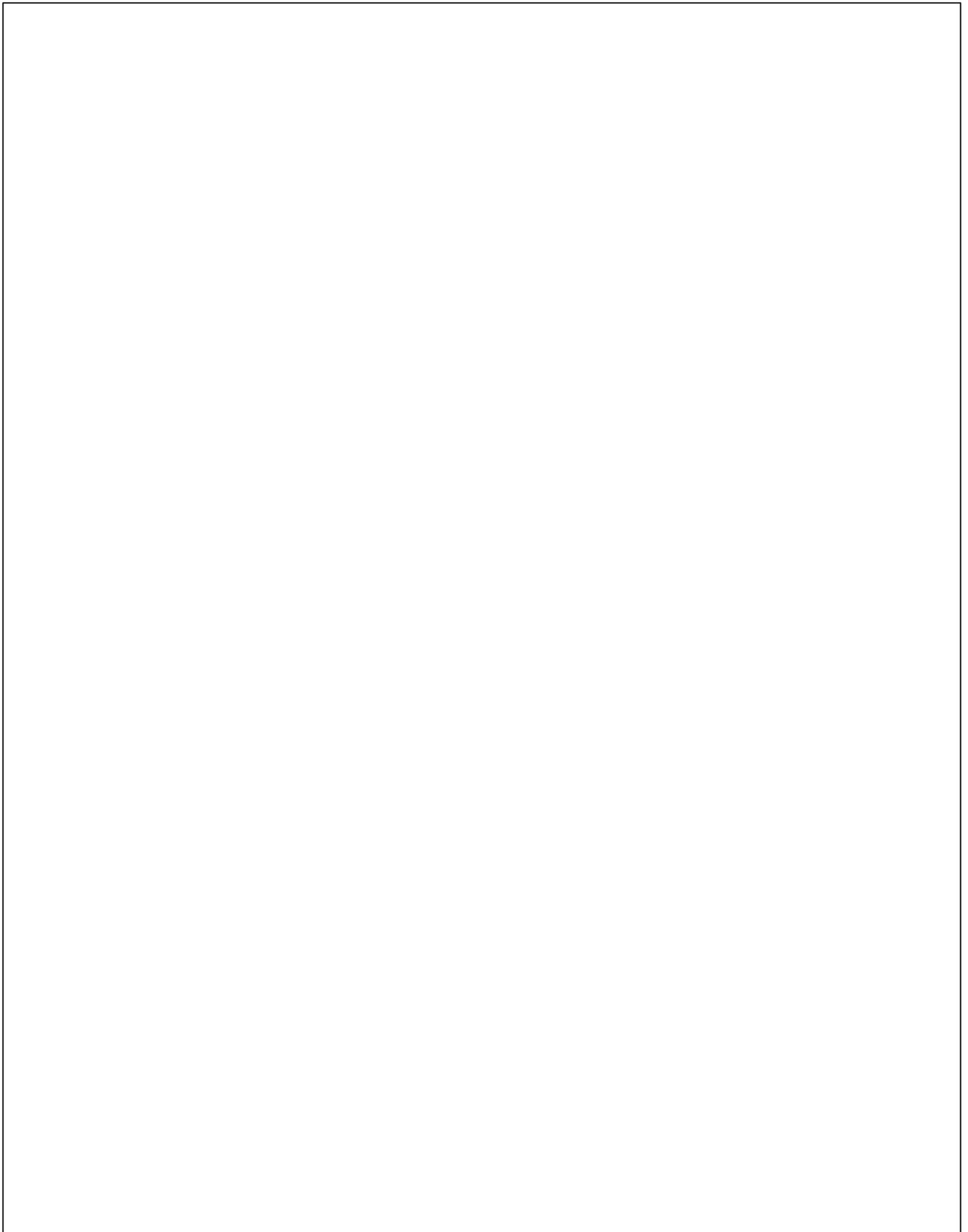
1. Be sure to book your trip prior to your visit in order to receive the group discount. To book your school visit, go to [www.sabot.org](http://www.sabot.org) for a Group Visit Request Form, Visit Guidelines, and FAQ's.
2. All teachers who book a field trip to the Garden are welcomed to preview the Garden at no cost. We encourage you to visit the Garden prior to bringing your students so that you are prepared to get the most out of the experience with your class.
3. Give each student a pencil and a copy of the Student Field Journal to help guide their experience at the Garden and to record observations. Give each adult a copy of the Teacher/Leader Guide; it is identical to the Student Journal but has answers to the student questions.

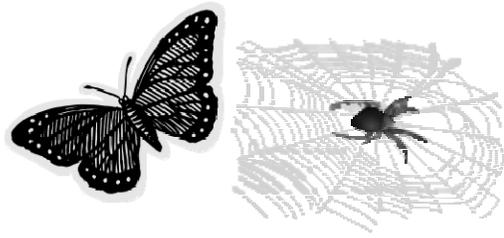
***\*\* The Student Journal is formatted to be photocopied as two-sided documents. Each page is numbered to help in assembling the pages.***

Students have seven Investigations to complete in their journals. These can be done in any order. If you have a large group, you may want to encourage Teacher/Leaders to start in different areas of the garden.

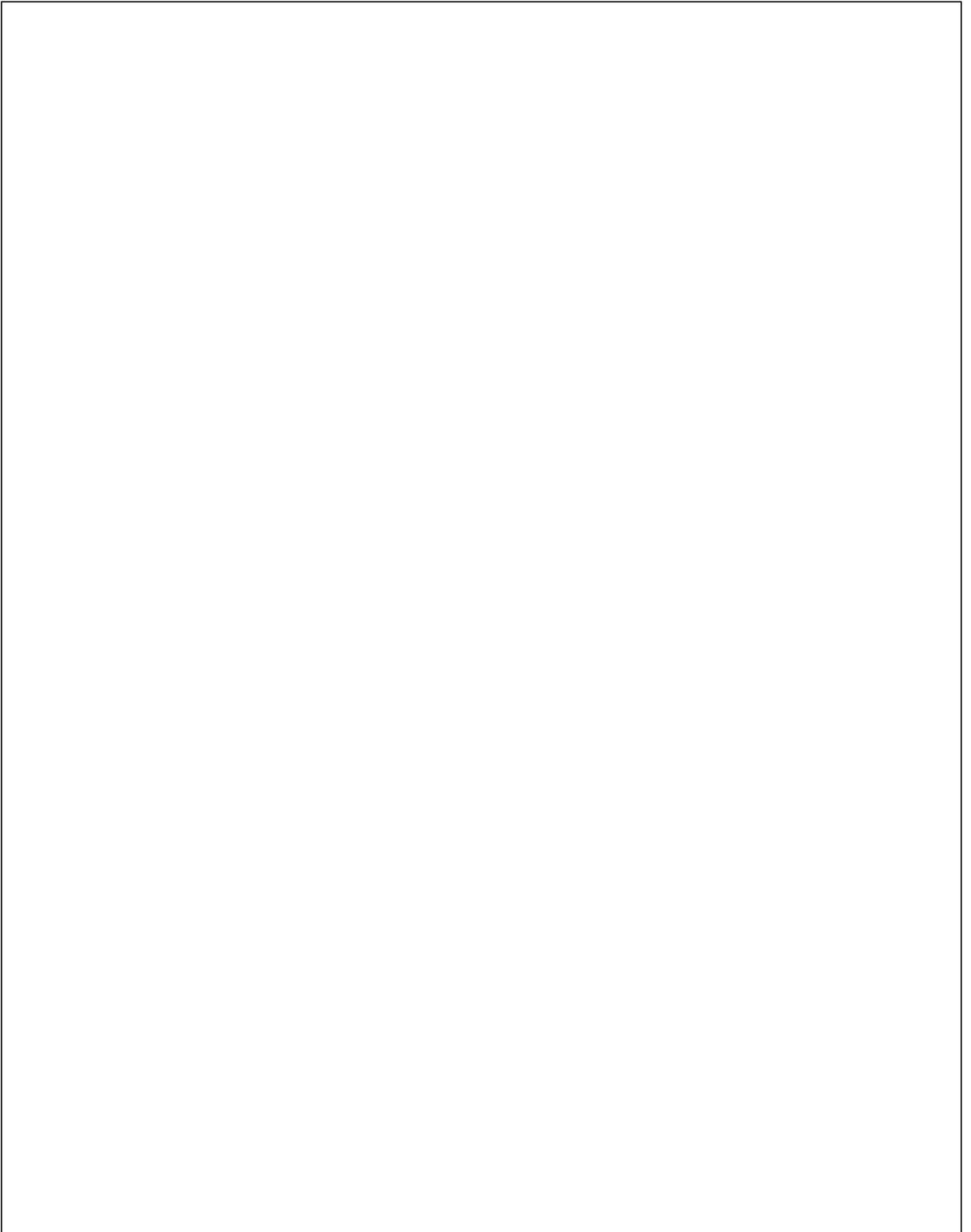
Maps of the Garden are available at [www.sabot.org](http://www.sabot.org) and at the front desk. Each chaperon should have a map.

4. Please review with your students how to visit the Garden safely (no running, do not touch plants or wildlife, etc.) and responsibly (do not pick flowers, leaves, etc.)

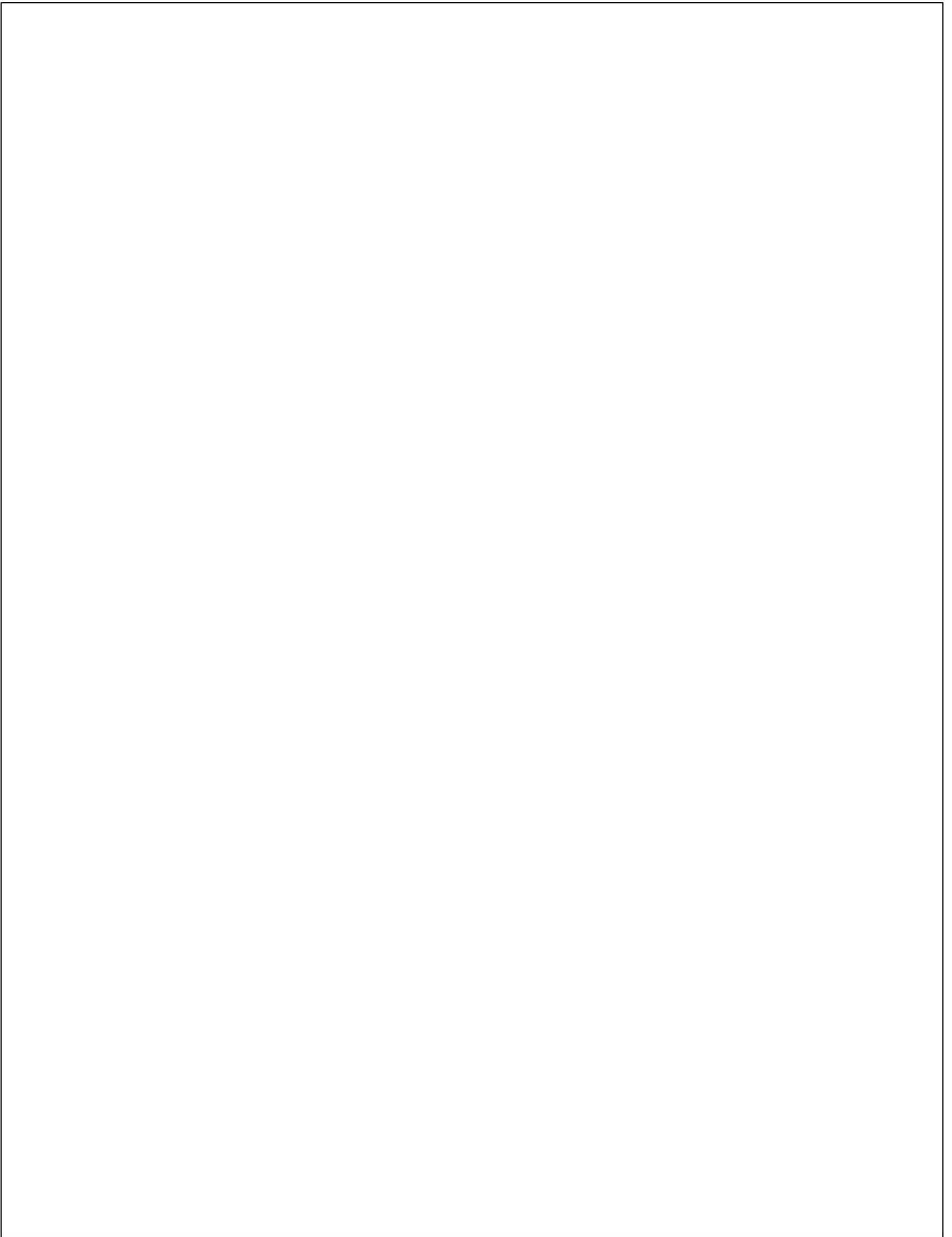




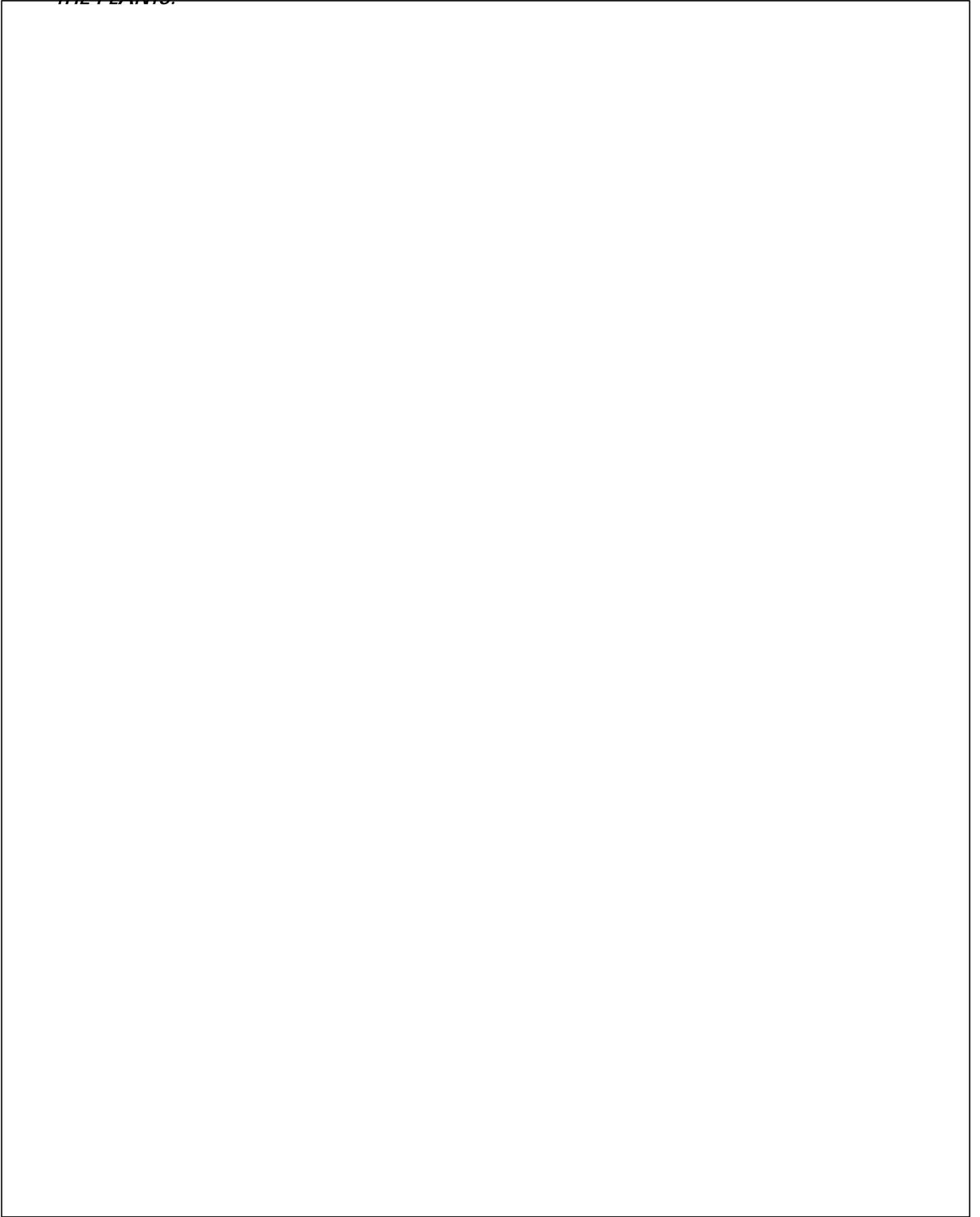








*STUDENTS CAN LOOK FOR CONES BUT PLEASE DO NOT COLLECT THEM. FALLEN CONES , LEAVES, AND FLOWERS DECOMPOSE AND HELP FEED THE SOIL AROUND THE PLANTS.*



What is your favorite tree at the San Antonio Botanical Garden?

Common name:

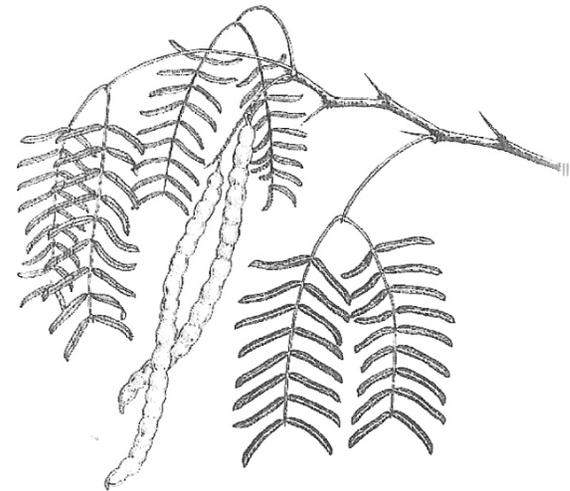
Scientific name:

Family:

Where is it from?

Draw or describe what you like about the tree:

## Terrinc Trees! Student Field Journal



Have a safe field investigation. Please remember to:

- Stay on the pathways
- Do not touch the plants and trees
- Do not collect leaves, flowers (even if they are on the ground)
  - Walk
- Do not disturb the wildlife (birds, bugs, squirrels, etc.)

Thank you!

## Investigation 1: Life in the Trees

**Location: All Gardens**

Trees provide food and shelter for many animals.  
Circle each animal you see in or around the trees as you visit the Botanical Garden.

Is the tree providing food, shelter, or both to the animal?  
(Write "F", "S", or "B" next to the animal)



List any other animals or evidence of animal activity (worm holes, nests, leaves that have been chewed, etc.) that you see.

Look for these!

**Bald Cypress Tree.** Do you see the "cypress knees" sticking up from the ground and water around the base of the tree?

What part of the tree are the cypress knees?

Draw the "knee" that you think has the strangest shape.

**Loblolly Pine Tree.** Pine trees do not have fruit. What are pine tree seeds found in?

Do you see any on the loblolly pine tree (or on the ground around it)?

### Investigation 4: Palm Trees

#### **Location: Palm and Cycad Pavilion**

Most palm trees grow where it's windy. The shape of their leaves lets wind blow through without tearing them.

Palm tree leaves have two basic shapes: fan and feather.

1.) Name one palm tree that has a fan-shaped leaf:

Draw a fan-shaped leaf:

2.) Name one palm tree that has a feather-shaped leaf:

Draw a feather shaped-leaf:

Look for these!

**Screw Pine.** Its "buttress" roots are above ground to keep it from falling over.

**Coconut palm.** Do you see any coconuts hanging from this tree?

### **Investigation 5: Big City Trees**

#### **Location: Overlook**

This overlook is one of the highest points on land in San Antonio. Look for areas of the city with many trees. Do you see any areas where there are no trees?

List four benefits of trees in cities:

1.)

2.)

3.)

4.)

### Investigation 6: Trees for the Heat

#### **Location: Acequia Walkway**

The trees along the sidewalk are mesquite trees.

Circle the adaptations you see that help the mesquites survive in hot, dry climates.

Thorns

Straight Trunks

Small Leaves

Large Leaves

Many Trunks

Waxy Leaves



# Post –Visit Activities

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## 1. Class Favorite tree

A). Compile a list of the trees the students listed as their favorite at the San Antonio Botanical Garden. Have students discuss their reasons for selecting the tree. Classify the reasons into broad themes e.g. Beauty, Usefulness, Size, Wildlife benefits, etc.

B.) Hold a Class Favorite Tree election. Students can do further research on their trees and create persuasive posters or presentations about their tree. Encourage students to think about the many reasons a tree can be important (it's not just a beauty pageant!). The class can decide on what categories they want their trees to "run for" e.g. Best for San Antonio, Shadiest, Tastiest, Wildlife Friendliest, etc.

## 2. Plant a Tree

If it is permissible on your campus, plant a tree! Tell students that planting a tree is a long-term commitment so choosing the right tree for the right spot and planting it correctly will help the tree survive long after they have graduated.

A). Choose a location. Review the things a tree needs to survive in an urban habitat. Make sure the tree will get the light it needs, will have enough room to grow, and will be drought tolerant.

B). Choose a tree. Have students discuss the adaptations the tree will need to survive in the location they have chosen. Students can select a tree from the "Class Favorites" or from recommended tree lists provided by local organizations such as the Texas Agrilife Extension Service or San Antonio Water System (see "Additional Resources" for contact information.)

C.) Plant the tree and help it grow. Depending on the size of the tree, you may need to ask grounds keeping staff (or parents) to help dig the hole. Students can research how to properly plant a tree and how to care for it as it gets established (it's best not to plant too close to summer vacation!). The Bexar County Master Gardeners (see "Additional Resources") have volunteers who may be able to visit your school to help out.

### **3. Adopt a Tree**

Each student can choose a tree to observe over an extended period of time and note the seasonal changes it goes through. Observations should include:

- when leaves fall (deciduous tree leaves fall all at once; evergreen tree leaves fall only a few at a time)
- when flowers appear
- when flowers fall
- when seeds form
- what animals visit and how they use the tree (food, shelter, nesting, etc)
- new branch growth

# Additional Resources

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## **Arbor Day Foundation**

[www.arborday.org](http://www.arborday.org)

The Arbor Day Foundation provides free on-line activities for students, tree curricula, and a tree identification guide. Students 9 and older can participate in the annual Arbor Day tree poster contest.

## **Texas Forest Service**

[www.txforestservation.tamu.edu](http://www.txforestservation.tamu.edu)

The Texas Forest Service website includes a native tree identification and planting guide, resources for teachers, lesson plans, travelling tree activity trunks, and information about Project Learning Tree.

## **National Gardening Association**

[www.kidsgardening.org](http://www.kidsgardening.org)

The NGA offers lessons and activities for teachers interested in teaching about all aspects of gardening and botany. The NGA on-line store offers books and supplies for outdoor education.

## **Texas Agrilife Extension Service, Bexar County Bexar County Master Gardeners**

[www.bexar-tx.tamu.edu](http://www.bexar-tx.tamu.edu)

The local extension office has lists of recommended trees and other plants for Bexar County. The Bexar County Master Gardeners have a speakers bureau available for classroom presentations.

## **San Antonio Water System**

[www.saws.org](http://www.saws.org)

SAWS offers a \$1000 mini-grant for environmental education. Information and application are available on-line. The website also includes suggested trees and other plants that are drought tolerant.

# Tree Bibliography

Prepared by the San Antonio Public Library

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## Pre-K to First Grade

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*The Apple Pie Tree* by Zoe Hall with pictures by Shari Halpern.

Two girls play around their apple tree and observe the robins that live in it while they observe the growth of the fruit over the seasons. They celebrate their harvest with a delicious apple pie. A recipe is included.

*The Growing-up Tree* by Vera Rosenberry.

Alfred grows old with the apple tree his mother planted for him when he was a baby. Generations of Alfred's family enjoy the apple tree in this touching, charmingly illustrated meditation on life and death.

*Red Leaf, Yellow Leaf* by Lois Ehlert.

Colorful collages illustrate this first-person account of a child's experience planting a tree in his yard. Additional information about the parts of a tree and planting trees are included.

*The Seasons of Arnold's Apple Tree* by Gail Gibbons.

Simple colorful illustrations detail a boy's interactions with an apple tree throughout the seasons. His activities include building a swing and a tree house, enjoying the fruit, and making apple pies and fresh apple cider.

*Tell Me, Tree: All About Trees for Kids* by Gail Gibbons.

This oversized guide discusses the parts of a tree, photosynthesis, and tree identification. A section of tree-related activities include instructions for creating a tree identification book.

*A Tree is Nice* by Janice May Udry with pictures by Marc Simont.

A poetic appreciation of the beauty and many uses of trees. Winner of the 1957 Caldecott medal.

## Second Grade to Fourth Grade

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*Be a Friend to Trees* by Patricia Lauber with pictures by Holly Keller.

Simple illustrations depict many kinds of trees and their uses. Other topics explored include photosynthesis, mankind's dependence on trees, and ideas to conserve resources.

*Crinkleroot's Guide to Knowing the Trees* by Jim Arnosky.

Crinkleroot, the forest-dwelling narrator who was "born in a tree", explains the differences between hardwood and softwood trees, how to identify trees, how trees grow, and the importance of trees to wildlife.

*National Audubon Society First Field Guide: Trees* by Brian Cassie.

An identification guide to fifty of the most common trees in North America along with brief descriptions of an additional ninety-five. Includes a reference section with a glossary and an illustrated list of the fifty state trees.

*Our Tree Named Steve* by Alan Zwiebel with pictures by David Catrow.

A family's relationship with the majestic tree next to their house is told through playful, colorful illustrations. The tree they saved when they built their house ends up saving their lives in a storm and wins a place in their hearts.

*A Tree is Growing* by Arthur Dorros with pictures by S.D. Schindler.

This detailed explanation of how a tree grows, its parts, and its place in the larger context of the forest is accompanied by detailed, realistic illustrations. Illustrated sidebars accompany the main text and encourage browsing.

*The Tree That Would Not Die* by Ellen Levin with pictures by Ted Rand.

The story of "Treaty Oak" in Austin, Texas, told from the perspective of the tree. Five hundred years of the tree's history are captured in delicate watercolors, from the earliest days when it provided shelter to buffalo to the present-day efforts to preserve the tree after it was poisoned in 1989.

## Fifth Grade to Eighth Grade

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*Regarding the Trees* by Kate Klise with pictures by M. Sarah Klise.

Students of Geysers Creek Middle School rally together to save the school's trees after the principal announces his intention to trim or cut them down. The story is told through letters, newspaper articles, illustrations, and class assignments.

*Tree Girl* by T.A. Barron.

Nine-year-old Rowanna lives in a seaside cottage with an old fisherman named Master Melwyn, who has forbidden her to enter the dangerous forest. A friendly bear cub lures her into the forest where she learns the secrets of her past.

*Trees* by Allen J. Coombes.

Over 1,500 annotated photographs to facilitate tree identification. Explains tree classification and how to keep a record of the trees one has seen. Published in association with the Smithsonian Institution.

*The Urban Tree Book: An Uncommon Field Guide for City and Town* by Arthur Plotnik.

A tree guide that focuses on the 200 tree types most likely to be found in North American cities and suburban areas. Includes a tree planting-and-care section.