TEACHING KATE
TEACHING KIDS ABOUT THE ENVIRONMENT

Trees Around The School

Grade Level: 9 **Time Required: Four-Five 90-minute class periods**

SC Science Standards

This lesson plan was correlated with only the grade level specified unless otherwise noted.

I. B. 2, 9
I. C. 1, 3
II. C. 3. a-b (if unit is taught showing the relationship of trees due to evolution)

Purpose

The students will learn to use a dichotomous key to identify designated trees. They will learn to use a Biltmore Stick to measure the diameter of the study trees. Students will then learn how to use computer technology and Microsoft Excel (or other comparable Spreadsheet Software) to display this data in columnar graph form. They will gain proficiency in converting English units of measurement to SI units.

Skills

Analyzing, classifying, constructing graphs, identifying, interpreting, measuring, observing, problem solving, recording data, using technology.

Concepts

Trees have definite structures that are useful for identification. Dichotomous keys are very helpful in identifying tree species. Diameters of trees may be determined at a distance by use of a Biltmore stick. Computers can be powerful tools to manipulate and display forestry data.

Materials Needed

Biltmore Sticks
Computers
Printers
Dichotomous Key of Familiar Trees of South Carolina
8 Designated trees around the school
Microsoft Excel
Hand-outs/Worksheets

Definition of Terms

Angiosperms	Flowering plants characterized by seeds that are fully enclosed by fruits.
Annual Ring	Ring of growth produced in one growing season.
Biltmore Stick	A pre-marked stick used to determine the diameter of a tree; also has a conversion chart to determine board feet in a log.
Cambium	A layer of cells located inside the bark between the xylem (wood) and phloem (inner bark). Cambium cells divide during the growing season to form xylem and phloem cells.
Classify	To put objects, ideas or organisms into groups based on similarity.
Community	All organisms in a particular habitat that are bound together by a food chain and other interrelationships.
DBH	The diameter of a tree as measured at breast height. Standard DBH is measured at 4.5 feet above the ground.
Dichotomous Key	Identification key based on a series of choices between alternative characteristics.
Environment	The sum of all external conditions and influences, living and nonliving, that affect the development and, ultimately, the survival of an organism or group of organisms.
Genus	A group of similar species.
Gymnosperms	Seed plants that produce naked seeds not enclosed in fruits.
Habitat	The area that provides an animal or plant with adequate food, water, shelter and living space.

Heartwood	The central, supporting pillar of the tree. Provides strength for the tree. Dark area surrounding the pith, consists of closed up capillaries.
Outer Bark	The tree's protection. It is constantly renewed from within. The outer bark insulates against cold and heat; also wards off insect enemies.
Phloem	The plant tissue that transports dissolved nutrients from the leaves to the outer parts of the plants.
Sapwood	The tree's pipeline, moving water to the leaves. Sapwood is new wood.
Scientific Name	The two-part name of an organism consisting of the genus and species.
Species	A group of closely related organisms capable of mating and producing viable offspring.
Tree	A woody plant having a well defined single stem and capable of growing more than 20 feet tall when mature.
Xylem	The complex woody tissue of higher plants that includes systems for transporting water, storing nutrients, and structural support.

Before the Session

Select eight trees (of eight different species, if reasonably available) on or near the school grounds for the students to use for their observations and measurements. Number eight pieces of ribbon, one through eight, and tie one piece around each designated tree. Make copies of the dichotomous key of Familiar Trees of South Carolina, hand-outs, and worksheets. Make arrangements to use the computer lab during the week. Procure copies of field guides of trees for the students to use. Make transparencies of the vocabulary list above.

Background Information

Carolus Linnaeus developed the classification system that biologists use today. In Linnaeus' system, all organisms are grouped into five large groups called kingdoms. The five kingdoms are divided into smaller groups called phyla or in the case of plants, divisions. Phyla or divisions are divided into classes, classes into orders, orders into families, families into genera and genera into species. The last two groupings, genus and species, are used together to give each organism a two-word name called the scientific name.

A classification key is a tool which organizes the traits of a particular group of organism so that these traits may be used to identify an individual organism in the group. One type of classification device is a dichotomous key. Dichotomous keys have a series of numbered steps which take the user from very general to more specific traits. Each step consists of two statements about a single trait. Only one of these statements can be true about a single organism. Each key is specific for a group of organisms.

A Biltmore Stick is pre-marked for determination of the number of 16 foot logs in a tree (height) while standing at a distance of 66 feet (1 chain). The Biltmore Stick may also be used to determine diameter of the trees. To determine the DBH (diameter at breast height) the Biltmore Stick should be held horizontally at a height of 4.5 feet with the arm extended approximately 25 inches from the body. The diameter is then read directly off the Biltmore Stick. Another way to determine the diameter is to obtain the circumference at 4.5 feet above the ground and solve for the diameter using the formula:

$$\text{Diameter} = \text{Circumference} / \pi \qquad \pi = 3.1416$$

Use the following chart to convert from inches into centimeters.

Metric Conversion Chart

Symbol	When You Know	Multiply By	To Find	Symbol
in	inches	2.5	centimeters	cm

In Microsoft Excel, you can create an embedded chart directly on the worksheet. An embedded chart (graph) is a graphic object, a picture, of the data that appears on the worksheet along with your worksheet data. To begin, type the names of each tree in specific cells in a column and diameter beside each tree. To create a chart (graph), you select the data you want to use, find the chart; then choose Insert, Chart or click the Chart Wizard button on the Standard toolbar. The Chart Wizard provides step-by-step assistance through a series of dialog boxes to choose a chart type and specify chart options; then automatically creates the chart from the selected data and places it in a box (frame).

Gymnosperms are plants whose seeds do not develop within ovaries. Most gymnosperms produce seeds in cones and are pollinated by the wind. The most common types are conifers, like redwoods, firs and pines. Their leaves, bark, seeds, and roots provide food for many kinds of animals. Cones contain seeds, not spores. Pollen (male) cones are found in clusters at the end of branches in the spring. Seed (female) cones are larger and more woody than pollen cones.

Angiosperms are flowering plants whose seeds develop within ovaries. Angiosperms have flowers and seeds that develop within a fruit, pome or nut. Angiosperms are pollinated by insects, bats, birds and the wind. The angiosperms include wildflowers, shrubs and many trees.

Suggested Lesson Plan

Lesson 1

1. Use the overhead projector to introduce and discuss the vocabulary list. Have the students copy the definitions of the words into their notebooks.

2. Walk the students to the site of the eight designated trees. Have the students work in cooperative groups of three and write one observation about each tree in their journals.

3. Have each group read aloud their observations. Lead a discussion of these observations about the trees.

4. Lead a discussion of the parts of a tree. Have the students work in their groups to complete the worksheet on the "Parts of a Tree."

5. Review how to use a dichotomous key.

Lesson 2 (This may take two days)

1. Review the activity completed on the previous day.

2. Distribute copies of the dichotomous key Familiar Trees of South Carolina to each student.

3. Distribute copies of the activity sheets to record the steps used in determining the common names of the trees.

4. Walk the students to the site of the eight designated trees.

5. Have the students work in cooperative groups of three to identify the names of the trees.

6. Have the students record all steps they used to identify the trees.

7. Have copies of tree guides available for the students to use.

8. Lead a discussion on the correct name of each tree and the steps that should have been followed to obtain the name.

Lesson 3

1. Review the activity completed on the previous day.

2. Demonstrate how to use the Biltmore Stick to obtain the diameter of a tree.

3. Distribute copies of the activity sheets on Diameters of Trees. Have the students work in cooperative groups of three. Have each group use a Biltmore Stick to measure the diameter of all eight trees.

4. Have the students use the field guides of trees to determine the scientific names of the trees and record that information on their activity sheets.

5. Have each group write their diameter data on the chalkboard. Have the students use this data to compute the average diameter of each tree.

6. Review how to convert English units to SI units.

7. Have the students convert the average diameters from inches to cm.

8. Collect and correct the activity sheets.

Lesson 4

1. Review the previous activities. Respond to any questions that may have arisen from the review of the previous day's work.

2. Administer a vocabulary quiz.

3. Walk the students to the computer Lab and review the operating procedures for the computer terminals and the printer, and how to use the Microsoft Excel to construct a columnar bar graph.

4. Have the students work in cooperative groups of three. Have each group work at one computer terminal to construct a columnar bar graph with the variables being the names of the trees and the average diameter of each tree species.

5. Have the students print a copy of the columnar bar graph and submit it along with their completed activity sheets.

6. Lead a discussion of this entire activity to bring closure to the mini unit.

Application

Classification systems are used constantly in everyday life. Items are grouped according to their similarities in grocery stores and dry goods stores. We group foods in our refrigerators according to similarities. Classification of objects or organisms by using a dichotomous key is just one

method of identifying distinct traits specific to one individual object or organism. Students will encounter the need to classify and measure items throughout their entire lives. Measuring occurs in practically any activity we can think of: cooking, sewing, building, etc. Some type of tool must always be used to obtain these measurements.

Extension

Have each group of students select one of the designated trees and design a poster containing information about the tree. Have each group present an oral report on the information they acquired about their tree.

Resources Available

Familiar Trees of South Carolina. A Manual for Tree Study. Kessler and Schoenike. S.C. Forestry Commission, in cooperation with Clemson Cooperative Extension Service, Clemson, SC 29634-0331.

Microsoft Office 97, Professional Essential. 1998. Que Education & Training, Macmillan Computer Publishing, Indianapolis, IN 46290

Project Learning Tree. 1996. American Forest Foundation, 1111 19th Street NW, Washington, DC 20036

Teaching KATE. 1996. Coalition for Natural Resource.

Trees. 1992. Allen J. Coombes. Dorling Kindersley, Inc., New York.

Prepared By: Sadie Cooper

OBSERVATION SHEET

Names_____

Write one observation about each tree.

Tree #1	
Tree #2	
Tree #3	
Tree #4	
Tree #5	
Tree #6	
Tree #7	
Tree #8	

WORKSHEET
DIAMETER OF TREES AND SCIENTIFIC NAMES

Complete the table below:

Trees	Common Name	Scientific Name	Diameter (inches)
Tree # 1			
Tree #2			
Tree #3			
Tree #4			
Tree #5			
Tree #6			
Tree #7			
Tree #8			

PROBLEM SOLVING

Names_____

Convert average diameters from inches to cm. Use the factor label method. Show the steps.

1. Tree #1

2. Tree #2

3. Tree #3

4. Tree #4

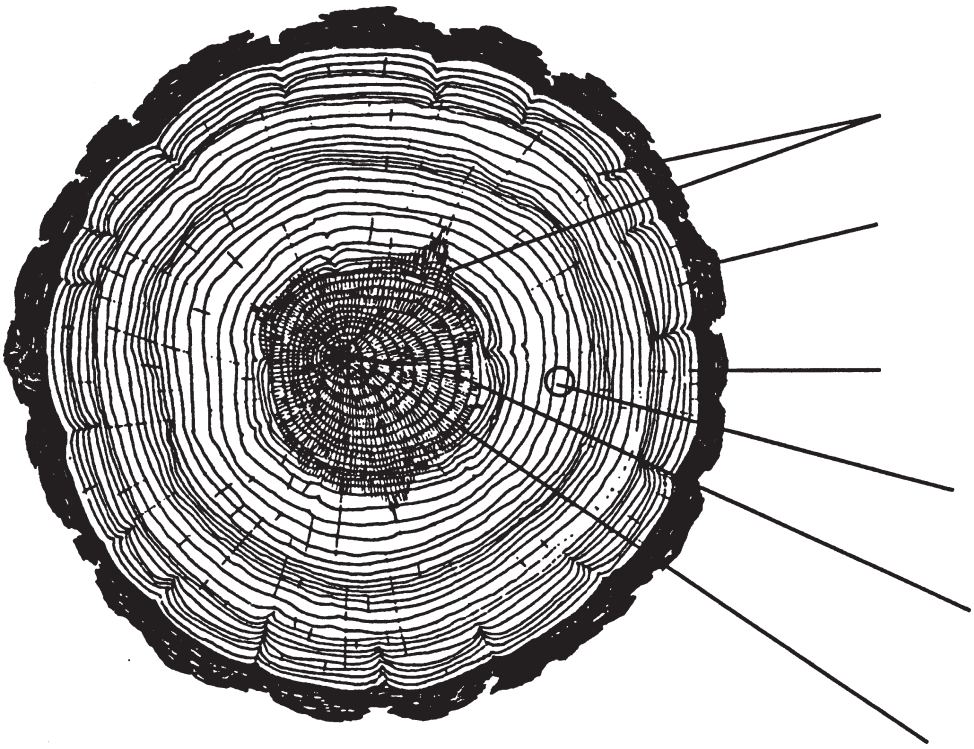
5. Tree #5

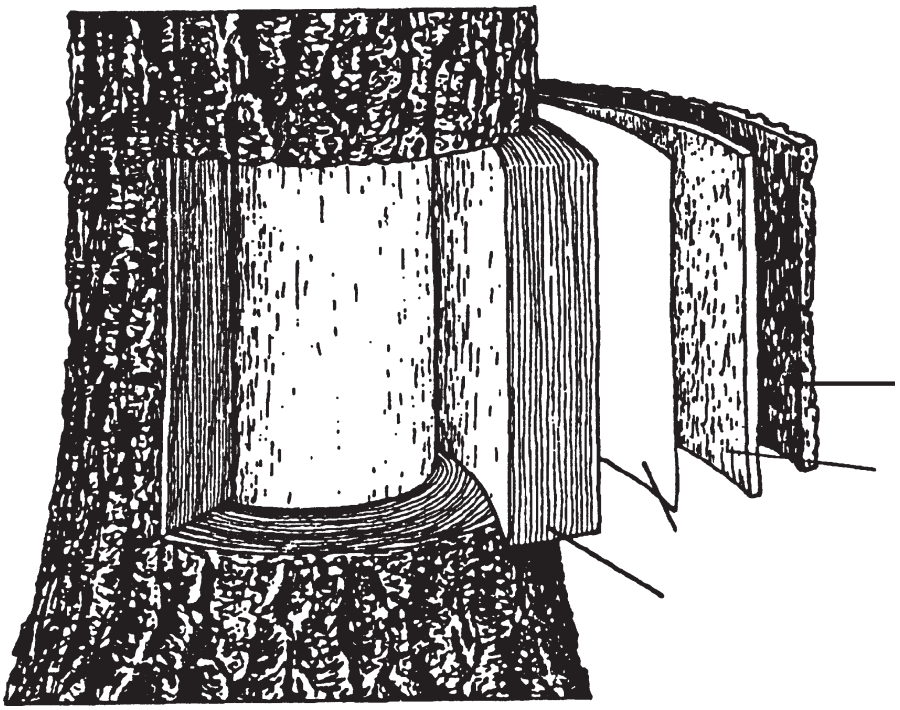
6. Tree #6

7. Tree #7

8. Tree #8

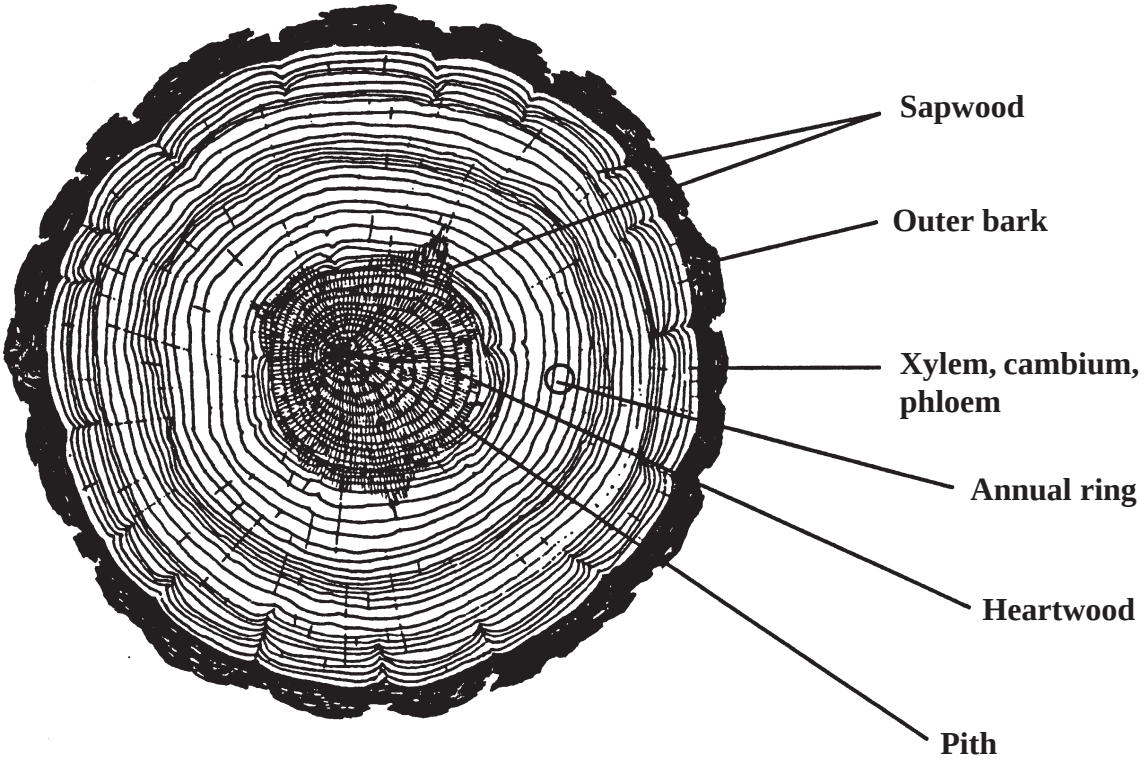
Parts of a Tree

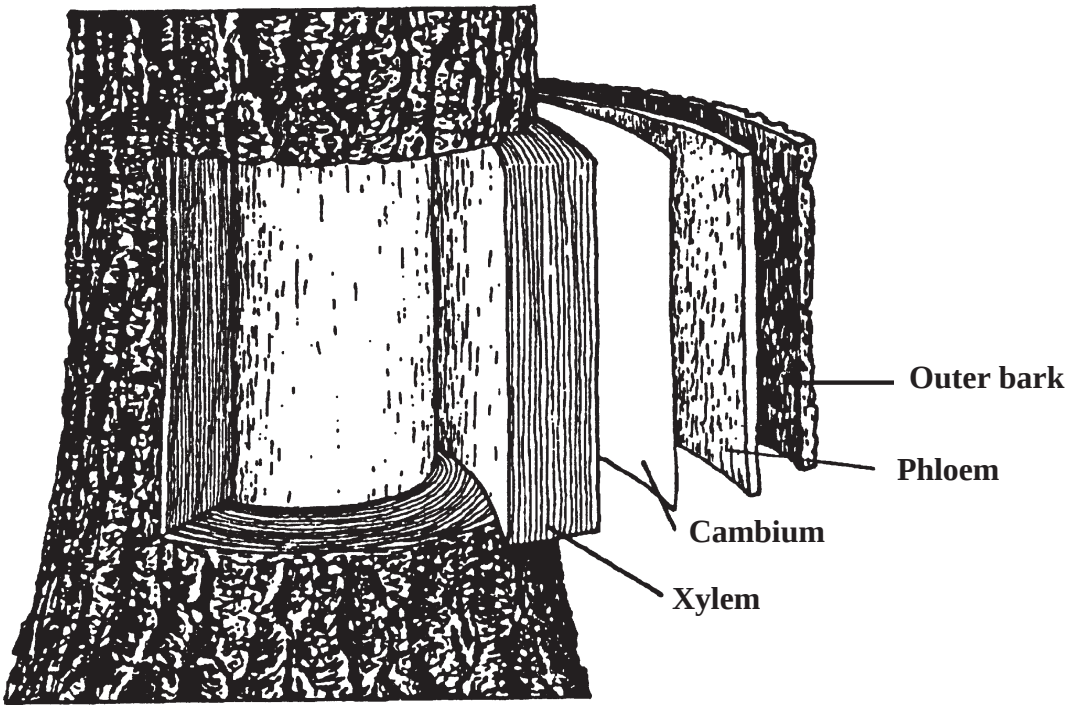




Parts of a Tree

Teacher's Key





METRIC CONVERSION CHART

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30.0	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
cm	centimeters	.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.84	square meters	m^2
mi^2	square miles (640 acres)	2.6	square kilometers	km^2
a	acre (43.560 sq.ft.)	0.4	hectares	h
cm^2	square centimeter	0.16	square inches	in^2
m^2	square meter	10.8	square feet	ft^2
m^2	square meter	1.2	square yards	yd^2
km^2	square kilometer	0.4	square miles	mi^2
h	hectare	2.5	acres	a
		MASS		
oz	ounces (avoirdupois)	28	grams	g
lb	pound	0.45	kilograms	kg
	short tons (2,000 lbs.)	0.9	tonnes (metric ton)	t
g	grams	0.035	ounces (avoirdupois)	oz
kg	kilograms	2.2	pounds	lb
t	tonnes	1.1	short tons (2,000 lbs.)	t
		VOLUME		
tsp	teaspoons	5.0	milliliters	ml
Tbsp	tablespoons	15.0	milliliters	ml
fl oz	fluid ounces	30.0	milliliters	ml
c	cups (liquid)	0.24	liters	l
pt	pints (liquid)	0.47	liters	l
qt	quarts (liquid)	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
ml	milliliters	0.2	teaspoons	tsp
ml	milliliters	0.07	tablespoons	Tbsp
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	4.2	cups (liquid)	c
l	liters	2.1	pints (liquid)	pt
l	liters	1.06	quarts (liquid)	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35.0	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE		
F	degrees Fahrenheit	(9/5 x C) + 32	decrees Celcius	C
C	degrees Celsius	5/9 x (F-32)	degrees Fahrenheit	4.92

CLASSIFICATION
LEAF KEY TO COMMON TREES OF SOUTH CAROLINA

1. Trees with needlelike or scalelike leaves (conifers)	2
1. Trees with broad flat leaves of many shapes and patterns (broadleaves)	11
2. Leaves needlelike	3
2. Leaves scalelike, sometimes prickly on young trees	Eastern red cedar
3. Leaves in bundles or clusters (fascicles) of 5 or fewer (pines)	4
3. Leaves not in bundles or clusters	10
4. Leaves in bundles of 5	Eastern white pine
4. Leaves in bundle's of 2 or 3	5
5. Leaves in bundles of 2	6
5. Leaves in bundles of 3 or of 2 and 3	7
6. Leaves twisted, mostly 2 inches long or shorter	Virginia pine
6. Leaves not twisted, mostly more than 2 inches long	Spruce pine
7. Leaves in bundles of 2 and 3	8
7. Leaves in bundles of 3	9
8. Leaves short (2-4 inches), cone small (2-3 inches)	Shortleaf pine
8. Leaves long (6-10 inches), cone large (4-6 inches)	Slash pine
9. Leaves very long (10-14 inches), cone very large (8-10 inches)	Longleaf pine
9. Leaves 5-9 inches long, cones 4-6 inches	Loblolly pine
10. Leaves flattened, evergreen, white on underside	Eastern hemlock
10. Leaves fernlike, deciduous, green on both sides	Baldcypress
11. Leaves fan-shaped, 2 or more feet across	Cabbage palmetto
11. Leaves otherwise	12
12. Leaves opposite or whorled	13
12. Leaves alternate	17
13. Leaves in whorls of 3	Southern catalpa
13. Leaves opposite in pairs	14
14. Leaves compound	15
14. Leaves simple	16
15. Leaflets 3-5, margins with coarse large teeth or shallowly lobed	Boxelder
15. Leaflets 5-9, margins smooth or with fine serrate teeth	White ash
16. Leaves 3-5 lobed, margins doubly serrate	Red maple
16. Leaves unlobed, margins smooth	Flowering dogwood
17. Leaves compound	18
17. Leaves simple	23
18. Twigs with thorns, spines, or prickles	19
18. Twigs without thorns, spines, or prickles	20
19. Twigs with long thorns, leaves twice compound	Honey locust
19. Twigs with short spines, leaves once compound	Black locust

CLASSIFICATION
LEAF KEY TO COMMON TREES OF SOUTH CAROLINA - CONTINUED

20. Leaves with terminal leaflets larger than lateral leaflets, twigs with solid pith	21
20. Leaves with terminal leaflets same size as lateral leaflets, twigs with chambered pith	Black walnut
21. Leaflets 5-9, leaflets, petiole, and rachis densely hairy	Mockernut hickory
21. Leaflets 3-7, leaflets, petiole, and rachis smooth or nearly so	22
22. Bark shaggy, peeling in long strips	Shagbark hickory
22. Bark tightly furrowed, not peeling	Pignut hickory
23. Leaves evergreen, thick and leathery	24
23. Leaves deciduous, thin and papery	27
24. Leaves with spine-toothed margins	American holly
24. Leaves with smooth margins	25
25. Leaves large, over 6 inches long, with rusty hairs beneath	Southern magnolia
25. Leaves small, 2-5 inches long, without hairs	26
26. Leaves densely white beneath, without lobes	Sweetbay
26. Leaves greenish or slightly white beneath, occasionally with lobes	Live oak
27. Leaves lobed	28
27. Leaves unlobed or with occasional small shallow lobes	41
28. Leaves with 3 shapes (unlobed, lobed, 3-lobed)	29
28. Leaves with one basic shape	30
29. Leaves with smooth margins	Sassafras
29. Leaves with serrate margins	Red mulberry
30. Leaves star-shaped, with 5 to 7 lobes	Sweetgum
30. Leaves not star-shaped	31
31. Tip and base of leaves truncate, shallowly 4-lobed	Yellow-poplar
31. Leaves not truncated	32
32. Leaves with 3 or more main veins, margins with large coarse teeth	American sycamore
32. Leaves with 1 vein, margins deeply lobed (oaks)	33
33. Leaves with smooth, rounded lobes (white oaks)	34
33. Leaves with bristly tipped lobes (red oaks)	36
34. Lobes similar with sinuses halfway to midrib	White oak
34. Lobes uneven with varying depths of sinus	35
35. Three upper lobes square, forming a cross, deep central sinus	Post oak
35. Three upper lobes pointed, shallow, central sinus	Overcup oak
36. Base of leaves bell-shaped, 3-5 leaflets with terminal lobe long and narrow	Southern red oak
36. Base of leaves tapering or rounded with terminal lobe and lateral lobes of same size	37

CLASSIFICATION
LEAF KEY TO COMMON TREES OF SOUTH CAROLINA - CONTINUED

37. Base of leaves strongly tapering	Turkey oak
37. Base of leaves rounded or shallowly tapering	38
38. Base of leaves rounded, shallowly 3-lobed, with minute bristles at tip of lobes	Blackjack oak
38. Base of leaves shallowly tapering with 5 to 7 lobes	39
39. Leaves leathery, hairy beneath	Black oak
39. Leaves papery, without hairs beneath	40
40. Lobes large, sinuses shallow, narrow	Northern red oak
40. Lobes small, sinuses deep, wide	Scarlet oak
41. Leaves with smooth margins (or occasionally with shallow teeth)	42
41. Leaves with toothed margins	48
42. Leaves heart-shaped	Eastern redbud
42. Leaves not heart-shaped	43
43. Leaves deciduous, but stay on the tree through the winter, less than 4 inches long	44
43. Leaves deciduous and fall off the tree before winter, 4-10 inches long	45
44. Leaves with occasional lobes and teeth, having a long tapering base	Water oak
44. Leaves with wavy margins, occasionally with teeth, having a rounded base	Laurel oak
45. Leaves 3 or more times as long as wide	Willow oak
45. Leaves less than 3 times as long as wide	46
46. Leaves 6-10 inches long, with occasional large shallow teeth	Water tupelo
46. Leaves 4-6 inches long, without teeth	47
47. Leaves widest in upper half	Black tupelo
47. Leaves widest at middle or in lower half	Common persimmon
48. Leaves with small teeth above the middle, smooth margins below	Sourwood
48. Leaf margins toothed throughout	49
49. Leaves with parallel veins, each vein ending., in a tooth	50
49. Leaves with net veins, not ending in a tooth	56
50. Leaf margins with singly serrate teeth	51
50. Leaf margins with doubly serrate teeth	53
51. Leaves with rounded teeth	52
51. Leaves with sharp points or bristles on the teeth	American beech
52. Leaves downy beneath, petioles yellow	Swamp chestnut oak
52. Leaves smooth beneath, petioles green	Chestnut oak
53. Leaves that have bases with unequal sides (elms)	54
53. Leaves with symmetrical bases	55

CLASSIFICATION
LEAF KEY TO COMMON TREES OF SOUTH CAROLINA - CONTINUED

	54. Leaves 1 to 3 inches long	Winged elm
	54. Leaves longer than 3 inches	American elm
55.	Leaf bases broadly wedge-shaped	River birch
55.	Leaf bases rounded or tapered	American hornbeam
	56. Leaves 4 or more times as long as wide	Black willow
	56. Leaves not more than twice as long as wide	57
57.	Leaves heart-shaped, white beneath	White basswood
57.	Leaves not heart-shaped, green beneath	58
	58. Midvein paralleled by two prominent lateral veins from leaf base	Sugarberry
	58. Midvein distinct, often with rusty hairs beneath	Black cherry