INTRODUCTION

Trees are an everchanging part of the landscape. They are always beautiful, yet often overlooked in winter. In contrast to their autumn colors, deciduous trees appear lifeless in winter. Yet, activities involving the study of trees can show that life processes continue year-round.

This unit is designed to sharpen and focus students' observational skills, encouraging them to take a closer look at winter trees. Studies of trees can illustrate the effects of weather and seasons on life. Students can learn to appreciate the processes by which trees survive the freezing temperatures, heavy snow-loads and lack of water in the frozen woodlands.

Cayuga Nature Center is a wonderful resource for tree studies, located on 88 acres of mixed woodland with over 30 tree varieties. Many trees on the trails are labeled for a tree identification walk. The Nature Center has cross-sections of trees, twig displays, and tree products for teachers to include in their lessons. Field guides and tree keys are available for the identification of common species in the area.
CONTENT/GRADE LEVEL FRAMEWORK

This teaching unit will provide for the instructor and student a selective study of trees in winter beginning with an observational approach to learning about tree characteristics and developing into more advanced ecological concepts of how environmental conditions influence plant adaptations to the environment. Several learning skills are integrated throughout this unit: observing, communicating, comparing, classifying, measuring, and recording data.

The following information on trees in winter is divided into four content areas. This background information is written for the teachers and is developed in a sequential manner beginning with concrete science experiences and utilizing this knowledge to develop more advanced science concepts.

THE CONTENT FRAMEWORK IS:

- What Is A Tree?
- Differences Between Evergreen And Deciduous Trees
- Tree Identification
- How Trees Survive Winter

THE GRADE LEVEL FRAMEWORK IS:

Grade PreK-K: Exploring Trees In Winter Using The Senses
Grade 1-2: Discovering Tree Variation In Winter
Grade 3-4: Looking Closely At Conifers In Winter
Grade 5-6: Investigating Twigs In Winter For Signs Of The Four Seasons
BACKGROUND INFORMATION

WHAT IS A TREE?

A tree is a tall perennial plant with a woody stem. This supports a crown of branches high in the air, avoiding competition for light at the ground level. A tree is distinguished from a shrub by being taller and having one main stem (trunk) rather than many divided stems.

FOOD PRODUCTION: Like other plants a tree produces food in its leaves by using water from the roots, energy from the sun, and carbon dioxide from the air to make sugar and give off oxygen.

GROWTH: A tree grows by producing buds that contain next year's leaves and flowers.

REPRODUCTION: A tree reproduces by flowers and seeds, of which there are many different forms and many dispersal methods.

DIVERSITY: The tallest and oldest living things on earth are trees. The great diversity of species allows trees to live in a wide range of habitats. Trees have many values in our world:

- they provide us with wood, paper, cellulose, cork, gum, resin, maple syrup, fruit, chocolate and many other products.
- they recycle the carbon dioxide that we produce and give out oxygen.
- they provide homes and food for millions of insects, birds, mammals and even other plants.
- they help prevent soil erosion.
- they are beautiful living things.
HOW TREES SURVIVE THE WINTER

In Northern climates winter can bring severe weather conditions and problems for plant and animal life. For trees the main problems are freezing, snow-load and drought. The latter may seem unlikely, but when rain turns to snow and the ground freezes solid there is no water for the roots to absorb. In warmer weather the site of food production is the leaf, and in winter the broad leaves of deciduous trees are lost to prevent evaporation of water from their large surface areas. Next year's leaves, which are present in the winter buds, are covered with scales to prevent further water loss. Evergreens, however, have spiny leaves with a thick waxy coating which cuts down water loss and allows the tree to keep its needles all year.

Tree growth stops before the first frost and a hardening process begins. Water passes out of cells in the leaves, buds, twigs and branches. This raises the sugar level of those cells and makes them less likely to freeze. If water within the tree does freeze, it will have previously passed from the cells into the spaces between, and the intricate cell structure will not be damaged.

Thus trees "shut down" for the winter; unable to migrate or take cover, they become dormant. Only the life-preserving functions will continue, and growth and fruit production will cease until spring time. As the weather improves the hardening process is reversed, triggered by chemical breakdowns within the tree and the changing day length. These changes may occur so that the awakening tree is not fooled by an early thaw.
DIFFERENCES BETWEEN EVERGREEN AND DECIDUOUS TREES

Deciduous trees are also called broadleaves because of the large surface area of their leaves. As these leaves might lose large quantities of water in winter, they are lost in fall. In this way a deciduous tree protects itself from winter dessication, and awaits spring for the growth of new leaves.

Evergreen trees have spiny, wax-coated leaves that lose very little water and can be kept even in times of drought. This gives them the advantage of being able to photosynthesize (produce food) all year round. Consequently, evergreens can grow faster than deciduous trees. Evergreens shed their leaves a few at a time and continually grow new leaves throughout the year.

Deciduous trees are also called hardwoods, and evergreens softwoods, because of the different properties of their wood. In general, softwoods are used for pulp and packing products, hardwoods for fine furniture and veneers.

Deciduous trees usually grow with a divided trunk and spreading branches. Evergreens often have a central trunk around which grow horizontal branches. This growth gives the evergreen tree its conical shape.

Evergreens are cone-bearing trees, also called conifers. Seeds are produced when the large female cone, or flower, is fertilized by pollen from the smaller male cone. The female cone then grows and hardens over a period of two years, eventually opening and releasing the seeds. Deciduous trees produce seeds, fruits or catkins of varying forms, but do not produce cones.

Because of their hardiness and adaptive form, evergreen trees can often live in harsh conditions in which deciduous trees cannot grow.
BASIC TREE IDENTIFICATION

The following questions will focus the students' attention on the key features of a tree, increasing their observational skills and distinguishing the many different species of wintering trees.

Location:

- Is the tree crowded or alone?
- Is the ground wet and heavy, or dry and sandy?
- Is the tree shaded or in direct sunlight?
- Is it a windy or sheltered location?

Structure:

- Does the tree have one main trunk with branches growing horizontally from it, or does the trunk divide above the ground into many spreading branches?
- How are the branches arranged around the trunk: whorled, opposite or alternate?

Shape:

- Is the overall shape of the tree rounded, oval, conical, slim or irregular?

Bark:

- Is the bark a distinctive color - pinkish, gray, white, black, greenish?
- Does it have clear vertical or horizontal markings?
- Is it smooth or rough?
- Are there plates or strips peeling from the tree?
- Is the bark thick or thin, hard or soft?
- Does the bark have an odor? Is it sweet or sour?
- Does the bark on the twig look different from that on the main trunk?
Buds:

- How are the buds arranged on the twig: alternate, opposite or whorled?
- Is there a single bud at the end of the twig, or a cluster of buds?
- Are the buds large or small?
- Are they brown, black, green or another color?
- Are the buds smooth, fuzzy or sticky?
- Is there a bundle scar below the bud? What shape is it?

Leaves:

- Are there any leaves on the tree?
- Are they old, dead leaves or still alive?
- Are they needle-shaped and waxy, or crisp and brown?
- Do the needles grow in bundles (if so, how many in each bundle?), in two rows along the twig, or all around the twig?
- Are the needles dark or light?
- Do they have markings?
- Do the needles grow from small bumps or directly on the twig?

Cones:

- Does the tree have cones?
- Are they short and round or long and thin?
- Are there points on the cone scales, or three-pronged tongues beneath them?
- Are the cones at the end of the twig, evenly spaced along it, or in different places?
- Are they open or closed?
- Do they point up from the twig or hang down?
Pith: (Cut a twig from the tree and look at the cut end):

- Is the pith small or large, hollow or solid, round or star-shaped?
- In longitudinal section in the pith solid or chambered?
EXPLORING TREES IN WINTER USING THE SENSES

FOCUS: An exploration of trees in winter can encourage an attitude of respect and appreciation.

GRADE LEVEL: PreK–K

RELATED SUBJECTS: Science, math, art, writing, reading

ACTIVITIES:

• LEAD-UP: Hug A Tree

• CORE LESSON: Tree Texture Collector's Walk

• FOLLOW-UP: Texture Lotto

NEW YORK STATE SCIENCE CURRICULUM REFERENCE:

• The parts of some plants undergo seasonal changes that enable them to meet the surrounding conditions.

• Plants have certain characteristics by which they can be described and identified.
LEAD-UP ACTIVITY: HUG A TREE

OBJECTIVES:

1. To develop a sense of responsibility for the natural world.
2. To recognize that trees are living things that change with the seasons.
3. To record written and pictorial observations of a specific tree throughout the winter season.

MATERIALS:

- tape measures
- trees (schoolyard or nearby park)
- paper and drawing materials
- blindfolds
- tree I.D. books
- Refer to Trees and Me Activities handout, page 190

PROCEDURE:

1. Lead the students outside into the schoolyard or to a nearby park where there are trees. Choose a tree for each student. If you have a large group, divide the group as necessary to share the available trees.

2. Have the students go to their selected trees, give the tree a hug and introduce themselves. Then guide them through an exploration of their tree (Refer to Discussion Sheet page 193).

3. Tell the tree what you have found out about it and anything that the tree should know about you. Give the tree a "bye-hug".

4. Upon returning to the class, help each student make a tree book. This book will contain all the personal data about their tree: its name, feeling, shape, etc.

5. Return each month to the trees. Each return should involve a hello and goodbye hug and continued dialogue. During or following these visits, have students note the changes in their tree and record them in their tree book. Refer to Trees and Me Activities for more ideas.
TREES AND ME ACTIVITIES HANDOUT

1. Draw a picture of your tree and write a few sentences describing what it looks like and where it is located. Help the students identify the kind of tree that they have adopted using reference books.

2. Collect a bud, leaf, or needles from your tree. Lay them on construction paper and cover them with clear contact paper. Glue the mounted cards into your tree book.

3. Make a bark rubbing of your tree. Trim and glue it into your tree book.

4. Try to draw your own representation of the bark pattern in a 2 inch square or circle and enter it in your book.

5. Draw any plant and/or animal life found in your tree.

6. If possible have someone take a picture of you next to your tree to put in your book.

7. In early spring, take a twig from your tree and put it in a jar of water. You will be able to watch the buds open into next year's new leaves. Describe the changes in your book.
CORE LESSON PLAN: TREE TEXTURE COLLECTOR’S WALK

OBJECTIVES:

1. To describe tree textures.
2. To increase observation skills through these sensory activities.
3. To recognize that trees are alive in winter.

GROUP SIZE: 6-8

DURATION: 30 Minutes

MATERIALS:

- hand lenses
- texture boards

PREPARATION: In advance, prepare a piece of poster board by dividing it into squares (20 cm by 20 cm). A texture from nature will be placed in each square.

MOTIVATOR:

Tell the students that they are taking a texture walk to collect plants in winter. Ask the students:

- What senses do we use to learn about texture?
- Do you think that there will be much to find in winter?

PROCEDURE:

1. Explain that texture is the "feel" of a living or non-living object. Ask for words, such as touch, soft, smooth, rough, hard, to help define the term.

2. Before leading the students out on a collecting walk discuss trail manners. Then have students choose partners.

3. Tell the students that the purpose of this walk is to gather as many textures as possible from plants. Have textures placed in bags so their form is preserved. Suggested textures to look for are:

- fall leaves
- winter weeds
- loose bark
- buds of trees (pick carefully)
- fall seeds hanging on trees or on the ground
VARIATION: Use lotto cards that have pictures of familiar plant items on them. The cards are distributed to the students, who collect objects matching their cards as they walk along the trail. When all objects have been collected, return to the Nature Center.

4. Have students find textures that are similar to those on the texture board.

5. Demonstrate how to make texture rubbings using chalk or dark crayons, and assist students with their rubbings.

6. When 10 minutes remain, return to the Nature Center.

SUMMARY:

1. Seat the students in a circle and have them place their collections in front of them.

2. Distribute the texture boards and glue to each pair. Have students glue the collection onto the texture boards, placing the items randomly, or grouping them into categories such as rough, bumpy, or smooth.
1. Walk through a the Nature Center's forest (or schoolyard or park) and choose one tree for each student or group of students.

2. Have the students close their eyes and hug the tree. Ask:
   • How big is it? Can you reach around it? If not, how many people would you need?

3. Keep your eyes closed. Run your hands up and down the tree. Ask:
   • How does the bark feel on your hands?
   • Can you feel any sap?
   • Touch the leaves, needles, or buds. How do they feel?

4. Keep your eyes closed and sniff the tree. Ask:
   • How does it smell?
   • What does the smell remind you of?
   • Smell the sap, needles, leaves, buds, bark.

5. Press your ear against the tree. Ask:
   • Can you hear its heartbeat? (The heartbeat is best heard in spring with a stethoscope.)
   • What other sounds does the tree make?

6. Open your eyes and look at the tree from top to bottom. Ask:
   • Is it alive or dead?
   • Is it straight or crooked?
   • Can you count the branches?
   • Does it have leaves, needles, cones, fruits, or nuts?
   • Who are its neighbors (Any animals or signs of animals in, on, or near the tree)?
   • Who lives in the tree?
   • How old do you think it is?
   • Can you see any roots?

7. Distribute hand lenses to each student. Ask:
   • What is the texture of the bark?
   • What patterns do you see?
   • Do you see any insects overwintering in the bark crevices?

8. Ask the tree:
   • What have you seen in your life?
FOLLOW-UP ACTIVITY: TEXTURE LOTTO

OBJECTIVES:

1. To develop matching and sorting skills.

2. To increase observation skills through a matching game.

MATERIALS:

- lotto boards
- bag
- collected objects from nature

PREPARATION: Make a lotto board using a 8" x 12" piece of construction paper or cardboard for a six picture lotto. Use a 8" x 8" piece for a four picture lotto and rule it off into six 4" squares. If you want to have a different color background in each square you can cut 4" squares of different colored paper and paste one of these in each of the squares on the board. Sort out the collected items and place one on each card to make a master card, and return the remaining collected objects in a large grab bag.

PROCEDURE:

1. Begin by seating the students in a circle. Place the grab bag in the center of the circle, and make the master card visible to all students.

2. To play the game, distribute the blank cards to the players. Explain that students will be picking an item out of the grab bag. If the item is like one on the master card, it is placed in the same position on the individual playing card.

3. Begin passing the bag around the circle and have each student take a collected item, following the instructions given in step 2.

4. The game is completed when someone fills his or her own card with the same objects that are on the master card.

- [Image of four different objects]
DISCOVERING TREES VARIATION IN WINTER

FOCUS: Evergreen trees beautify the winter landscape with their variation in forms designed to withstand hardships from weather and animals.

GRADE LEVEL: 1-2

RELATED SUBJECTS: Science, art, math, writing, language arts

ACTIVITIES:

• LEAD-UP: Drawing Trees
• CORE LESSON: Evergreen Matching Walk
• FOLLOW-UP: Evergreen Texture Displays

NEW YORK STATE SCIENCE CURRICULUM REFERENCE:

• The parts of some plants undergo seasonal changes that enable them to survive in the surrounding conditions.

• Plants have certain characteristics by which they can be described and identified.

• The properties of plants and their parts vary from one kind to another and from one individual to another.
LEAD-UP ACTIVITY: DRAWING TREES

OBJECTIVES:

1. To distinguish between a deciduous and an evergreen tree.

2. To recognize geometric shapes which occur in trees and classify trees according to their shapes.

3. To increase visual perception skills through a drawing exercise.

MATERIALS:

- handout for teacher – Visual Perception Tree Branching, page 199
- worksheets for students – Tree Shapes, Tree Branches, pages 198, 200
- pencils and crayons
- drawing boards
- pictures and reference books on winter tree identification (See Teacher’s Bibliography)

NOTE TO THE TEACHER: This lesson is designed to be taught in 3 sessions.

PROCEDURE:

Lesson 1:

1. Introduce this lesson by suggesting that winter is a good time to learn tree shapes and types through observation and drawing activities.

2. Using pictures of familiar deciduous and evergreen trees, introduce students to the terms and explain that deciduous trees have leaves which fall off every autumn, while evergreens do not lose their leaves all at once: they are evergreen.

3. Explain that each tree has a special shape. Some are narrow, tall, and featherlike. Others are wider and look like an umbrella. Some are triangular. Ask the students to look out the classroom window and describe the shapes of the schoolyard trees, or take a walk outside. How many shapes can they observe?

4. Then distribute the Tree Shapes worksheet and give instructions for students to cut and paste the trees by shape categories. This worksheet can also be used as a take home sheet.
Lesson 2:

PREPARATION: Draw the Visual Perception Tree from the handout on the chalkboard.

1. Explain that the branches of a tree often look like the letter Y. Ask students to find all the Y shapes hidden in the tree drawing on the chalkboard. Circle the Y's.

2. Pass out paper and pencils to practice drawing the different types of lines that pencils make. Using the chalkboard again, show the students how to make diagonal branching lines. Point out that there are very few straight or continuous lines in a tree.

3. Have students practice on the Tree Branches worksheet, connecting the dots by drawing lines.

Lesson 3:

1. On a warm day, take the class outside to sketch a deciduous tree. Give each student a pencil, some rough paper, and a drawing board to sketch on. Encourage students to draw several sketches or quick drawings, and then work on one tree illustration carefully.

2. Back in the classroom, help students identify and label the trees they illustrated, using reference books to assist.

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The branches of a tree often look like the letter Y. Draw this feature on the chalkboard. How many Y's can the students find in this tree? Mark them with your chalk.

Connect the dots to make the shapes shown in column 1. Can you see these shapes in real trees?
1. Look at the shapes of these trees. Is the tree like an umbrella ☘, a feather ⚑, or a triangle △?

2. Cut out the trees. Paste them in shape groups.
The branches of a tree often look like the letter Y. Draw this picture on the chalkboard. How many Y's can the students find in this tree? Mark them with your chalk.
Connect the dots to make the shapes shown in column 1. Can you see these shapes in real trees?
CORE LESSON PLAN: EVERGREEN MATCHING WALK

OBJECTIVES:

1. To appreciate the structure of evergreens through bark rubbings and clay impressions.

2. To create an evergreen twig and bark impression to demonstrate tree variation in nature.

GROUP SIZE: 8-10

DURATION: 30-45 Minutes

MATERIALS:

For the Teacher:

- read Background Information, pages 184-187
- 5-7 evergreen twig samples: scotch, white and red pine; spruce, hemlock, cedar and fir.
- data board
- bark rubbing and twig impression example for demonstration

For each pair of Students:

- magnifying lense
- modeling clay
- dark crayons
- rough paper

MOTIVATOR:

Show the students the assorted leafy twigs and ask them to describe their characteristics (e.g. shape, texture, color, size). Ask the students:

- Do these needles come from evergreen or deciduous trees?

PROCEDURE:

1. Explain that each evergreen tree has its own distinct needle leaf, and can be identified by the way the needles grow on the twigs. Use the data board to illustrate how needles may group in a bundle, have scales, or grow around the twig. Help students to understand the differences between pine, fir, spruce and cedar trees.
2. Tell the students that in this lesson they will learn how evergreen leaves and bark can help to identify a tree.

3. Divide the group into pairs and distribute an evergreen twig from a different type of tree to each pair.

4. Tell the group that they will be going outside to identify trees, and try these activities:
   - find an evergreen tree that has leaves that match the examples they have.
   - make rubbings of the tree's bark. (Show a completed bark rubbing.)

5. Lead the students on a group walk to find the 5 trees. As you stop at each tree, share a story with them to help them learn the name of each tree. As they examine the tree's twigs or needles, they should check to see if their example matches the tree's needles. If they think they have a match, have them point out the characteristics that helped them decide.

6. After the group has observed and identified all five trees, demonstrate how to make a bark rubbing: one partner should hold a piece of white paper against the bark of a tree while the other lightly rubs with a dark crayon.

7. Then pass out paper and crayons or clay. Tell the students to return to their tree and make a rubbing or clay impression of the bark. Optional: Have students collect a cone on the ground for the follow-up activity.

8. When 10 minutes remain, return to the Nature Center to share the students' tree impressions and observations.

SUMMARY:

1. Have students describe and classify their bark rubbings according to common attributes (texture, color, size). Use the Discussion Sheet to guide the summary if needed.

2. Remember to have students write their name and the tree's name on the bark rubbing. Collect students' rubbings and evergreen twigs as these will be used in the follow-up activity back in the classroom.
1-2 DISCUSSION SHEET

1. What are the differences between evergreen and deciduous trees?

A deciduous tree loses its leaves every fall. Evergreens do not lose their leaves in one season, but shed them a few at a time, all year round. Evergreens continually grow new leaves which are usually tough and waxy.

2. In what ways can you tell evergreens apart?

Some evergreens grow needles in bundles, usually of 3 or 5; some have short, single, stubby needles; some have long needles; some needles have white stripes on them; some feel prickly; others have broad leathery leaves.

- White pine spells its name with 5 needles
- Shake hands with a spruce – its needles will not fall off.
- Cedar leaves wear scales
- Pines have longer, more flexible needles than the shorter, stiffer needles of spruces and firs.

3. What different colors of bark can you find?

- Black birch is dark gray/black
- Aspen is greenish
- Hickory is dark brown
- Oak is lighter brown

4. What is the texture of different barks?

- Sumac is fuzzy and soft
- Hickory is flaky like cornflakes
- Beech is smooth
- Birch peels
- Oak is chunky and wide-grooved

5. What animals and insects live in bark?

- Insect cocoons overwintering (oaks and ash trees)
- Animal homes (squirrel nest, woodpecker holes)
FOLLOW-UP ACTIVITY: EVERGREEN TEXTURE DISPLAYS

OBJECTIVE: To record variations in evergreen needles using a classification chart.

MATERIALS:

- evergreen twigs collected on walk
- tagboard
- glue or tape
- crayons
- duplicate Evergreen Match Chart on next page (optional)

PROCEDURE:

1. Using the assorted evergreen twigs collected from the Evergreen Tree Walk have students work in small groups to record the different textures of evergreen needles. Provide each group with art materials for their visual display.

2. Ask each group to decide on category headings, such as fuzzy, prickly, rough, and stiff, that describe the different evergreen needle textures. Then attach evergreen examples by glue in the appropriate categories. (See chart, next page.)

Variation: Have the students use the Evergreen Texture Chart instead of devising their own classification scheme. Instruct the students in the use of the chart, and to place their examples in the correct spaces.

3. Share each group’s evergreen texture display with the whole class. Compare the classification schemes.

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<tr>
<th>prickly</th>
<th>fuzzy</th>
<th>rough</th>
<th>stiff</th>
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Match the Evergreen twig with a texture.
<table>
<thead>
<tr>
<th>Stiff</th>
<th>Rough</th>
<th>Fuzzy</th>
<th>Prickly</th>
</tr>
</thead>
</table>

Match the Evergreen twig with a texture.
LOOKING CLOSELY AT CONIFERS

FOCUS: Evergreen needles may vary in appearance and texture, but they are all designed to function as food producers in winter.

GRADE LEVEL: 3-4

RELATED SUBJECTS: Science, reading, math, language arts, art

ACTIVITIES:
- LEAD-UP: Using A Key
- CORE LESSON: Conifer Walk
- FOLLOW-UP: Conifer Printmaking

NEW YORK STATE SCIENCE CURRICULUM REFERENCE:
- Plants provide the basic food supply for animals because only plants can manufacture food by utilizing the sun's energy.
- Plant health, growth, and development are affected by environmental conditions.
LEAD-UP ACTIVITY: USING A KEY

OBJECTIVE: To use a simple taxonomic key to identify the students in the class.

MATERIALS:

• copies of Keying Out Trees worksheet page 209
• draw large diagram of Keying Out Trees on the blackboard
• pencils

PROCEDURE:

1. Begin by telling the students that at the Nature Center they are going to study trees and learn to use a tree identification key. Ask the students, "What is a key?"

2. Explain that a key is a series of questions, each of which asks about a certain feature of a tree, such as the shape of the needles, color of its bark, and so on.

3. Then ask the students how they can tell different students apart (by their sex, hair color, eye color, height, etc.). If necessary, clarify why clothing isn't a good way to tell people apart.

4. Distribute copies of Keying Out Trees and have the students follow along as you explain how the key works:

   • Each of the branches represents a physical feature that helps to tell people apart.

   • By starting at the trunk and moving up the branches that correctly describe the person being "keyed out", you will reach the very tip of an outermost branch. This is the person's position in the key.

3. Demonstrate how the key works by using a volunteer as an example. Check for understanding.

4. Divide the students into pairs, and have them work together to key out each other on their diagrams. Instuct them to go through the key to find each other's position on the key and then write their names at the ends of the branches.

5. After the students have finished, have the pairs go up to the large diagram one at a time and fill in their names. Note: If you have more than one student placed at a single position on the key, call the students to the front of the room and ask the class: "What other characteristics could separate them?" (Height, length of hair, shade of skin, etc.)
EXTENDED ACTIVITY:

To test the accuracy of your "class key", invite someone into the room who doesn't know the names of the students. Ask for a volunteer, and have the guest "key out" the student to determine his or her name.
CORE LESSON PLAN: CONIFER WALK

OBJECTIVES:

1. To identify several evergreens using a simple dichotomous key.
2. To demonstrate how to use a dichotomous key.

GROUP SIZE: 8–10

DURATION: 45 Minutes

MATERIALS:

For the Teacher:

- read Background Information, pages 184–187
- data board and pens
- CNC map with trees identified
- evergreen examples (hemlock and pine sprigs)
- A Field Guide To Trees Of The Cayuga Nature Center

For each pair of students:

- Conifer Key handout
- pencil
- clipboard

MOTIVATOR:

Ask the students if they can define what a key is using their own words.

PROCEDURE:

1. Explain that now that the students understand how a key works (taught in the lead-up activity), they will try keying out trees by looking at their needles.

2. Divide the group into pairs, and distribute a copy of the Conifer Key to each pair of students. Explain that they will identify the type of tree the leaves come from by using the key.
3. Using a data board, copy the terms, "needle-like, scale-like, single, bundles, and branchlets," and necessary illustrations for understanding. Then use several examples of fresh evergreens to key out the needles with the students as they follow along on their handouts. Discuss the shape of different leaves and compare their characteristics.

4. Next have the students look at the dichotomous key. Explain that the word dichotomous comes from two Greek words that, together, mean "to divide into two parts". A dichotomous key is based on the idea of making a choice between two alternatives. In this key, there are two options which describe different features of the leaves, but only one of the options correctly describes the leaf being keyed out.

5. When keying out these examples, each student will need to decide which phrase applies to the particular leaf they have. The correct phrase will either guide them to the next pair of phrases or state the name of the tree on which the leaf grows.

6. Lead the group outside to key out 9 of the 12 trees by their leaves (assign an appropriate number for the student's level). As they identify each leaf, they should write the name of the tree on the correct line of the worksheet. When students complete the tree keys or when 10 minutes remain, return to the Nature Center to summarize their recordings.

SUMMARY:

1. Review the answers with the group, correcting any misguided recording. The students can also check their answers using the field guide.
Conifer Key

1. Leaves are needle-like and 1 cm. or longer ..........2
   Leaves are not needles, but small scales, less than 1 cm. long .................10

2. Needles in bundles or groups .....................3
   Needles borne singly .........................4

3. Bundles of needles in 2's, 3's, or 5's (Pines) ....5
   Bundles of needles more than 5's; deciduous... Larch or Tamarack (Larix laricina)

4. Needles without petioles ........................7
   Needles with short petioles, flat in cross-section, with blunt tips ............9

5. Needles in 5's (rarely 4's) .................. White Pine (Pinus strobus)
   Needles in 2's or 3's ........................8

6. Needles in 3's .............................. Pitch Pine (Pinus rigida)
   Needles in 2's
   a. Needles straight, 7-15 cm long, tend to break when doubly bent .......... Red Pine (Pinus resinosa)
   b. Needles twisted, 3-5 cm long, not brittle... Scotch Pine (Pinus sylvestris)

7. Needles with square or 4-sided cross-section, very sharp pointed at tips (Spruces) .........8
   Needles are flat in cross-section, blunt tips .... Balsam Fir (Abies balsamea)

8. Needles dark, yellowish-green ........ Red Spruce (Picea rubra)
   Needles bluish green or silvery white ... White Spruce (Picea glauca)

9. Two light stripes on underside, less than 1.5 cm .... Hemlock (Tsuga canadensis)
   Dark green, usually over 1.5 cm ........ Yew (Taxus canadensis)

10. Scales are sharp-pointed ..................... Juniper (Juniperus virginiana)
    Scales not sharp, form a fan-like cluster ... Arbor Vitae (Thuja occidentalis)

leaf blade
leaf petiole

---

1 2 3 4 5 6 7 8 9

---

1 2 3 4 5 6 7 8 9 10 11 12 cm.
1. Are all evergreen needles alike?

There are many different types of evergreen needles. The needles evolve differently depending on the area where the tree is growing and the prevailing conditions (sunlight and moisture).

2. Do all needles grow in the same pattern?

- The form and arrangement of a tree's needles allow it to make better use of the available sunlight.

- Cedars and firs are more shade-tolerant than some other trees. Their needles make better use of the limited sun that they receive.

- Cedar needles are scale-like, fir needles grow individually straight off the stems and branches of the tree.

- Pine needles are in bunches of 2-5.

- Spruce needles grow individually on small pegs, all around the twig.

3. What special defences do needles have?

Inside evergreen needles there are tubes lined with special cells that secrete resin. This is a substance which prevents the development of fungi, and keeps certain insects from attacking the tree.

4. Do evergreen trees shed their needles?

Yes, but unlike deciduous trees, evergreens shed their needles continuously and not just in autumn. Most evergreens are self-pruners which means that they shed their lower branches as well as their needles. This happens because these branches receive no sunlight and are not able to photosynthesize. They would simply be extra growth for the tree to keep alive.

- An exception to the rule is the larch which sheds its needles in fall.

5. Are all needles the same color?

Evergreen needles have different shades of green. In warmer and lower altitudes needles are a lighter shade. Their light gray/green color reflects the sunlight and keeps the temperature of the needles lower.

6. Do all conifers have cones?

Yes, but all cones do not look alike.
FOLLOW-UP: CONIFER PRINTMAKING

OBJECTIVES:

1. To create a record of the conifers which students can correctly identify.
2. To appreciate the form and structure of a tree's needles.

MATERIALS:

- brayer (ink roller attached to a handle)
- waterbase printing ink
- piece of glass or plastic sheet
- paper and newsprint
- conifer examples
- 5"x 5" squares of cardboard.

PROCEDURE:

1. Begin this lesson by telling the students that they are going to make prints of the conifers that they can now identify, and preserve the trees' needle shape and texture.

2. Explain and demonstrate the entire process before the students start:

   - Put glass, conifer needles, brayer, and cardboard on newspaper while working.

   - Squeeze out 1-2 inches of ink onto the glass and roll the brayer back and forth over the entire surface of the brayer – it should make a sticky, tacky sound when rolling.

   - Place the plant on a piece of paper. Roll the inked brayer over it, coating it with ink.

   - Lay your printing paper down on a firm suface, and lay the inked plant facedown on the paper. Cover it with a piece of clean paper and press firmly. A spoon or fingers may be used to press the paper.

   - Lift up the paper and plant gently and inspect the print. Hang it up to dry for several minutes, using clothespins.

   - Wash the glass, fingers, and brayer with soap and water.

3. When prints are completed, let dry, and display them on the classroom walls.
INVESTIGATING TWIGS IN WINTER FOR SIGNS OF THE FOUR SEASONS

FOCUS: The winter twigs of each kind of tree are unique. Careful examination of twigs reveals not only common and distinguishing features that assist identification, but also signs of the coming spring and the history of seasons past.

GRADE LEVEL: 5-6

RELATED SUBJECTS: Science, reading, writing, math, art

ACTIVITIES:

- LEAD-UP: Introduction To Winter Twig Identification
- CORE LESSON: Keying Trees in Winter
- FOLLOW-UP: Twig Displays

NEW YORK STATE SCIENCE CURRICULUM REFERENCE:

- Plant health, growth, and development are affected by environmental conditions.

- Plants have certain characteristics by which they can be described and identified.
LEAD-UP ACTIVITY: INTRODUCTION TO WINTER TWIG IDENTIFICATION

OBJECTIVE: To identify the parts of a twig and use this knowledge to complete a worksheet using a twig sample.

MATERIALS:

For the Teacher:
- data board and pens
- Refer to Background Information pages 185–187 and Discussion Sheet, page 224

For each pair of Students:
- Parts of a Twig handout, page 218
- pencil
- magnifying lenses

PREPARATION: In advance, copy the diagram of the twig onto the chalkboard.

PROCEDURE:

1. Show the students a twig from a tree. Discuss why twigs are an important part of the tree. (They carry buds for new leaves and flowers, and help identify trees in winter.)

2. Distribute the Parts of a Twig handout and discuss the parts of a twig and their function as the students write in the terms. (Refer to Discussion Sheet as needed.)

3. Pass out a twig to each pair of students. Have them examine the buds on the twig. Explain that the bud at the tip of the twig is called a terminal bud. The twig grows longer at the terminal bud. When the bud opens and growth takes place, a new growth ring is left on the twig. The buds on the side are called lateral buds. Lateral buds or side buds grow new shoots or tiny branches off the main branch.
4. Have students pull a leaf off the twig (if it is still attached). Discuss the following details:

- Point out the leaf scar left on the twig. Explain that these are the joints where the old leaves were attached to the tree.
- Notice the protective covering on the new buds. What do buds need protection from? (Freezing temperatures, predators.)
- What is the scar position (alternate, opposite, or whorled)? This indicates the leaf pattern of the tree.
- Point out the small white dots called lenticels. Explain that oxygen and other gases flow into the cells of the trees through these pores.
- Point out a growth ring. Show students how to count how old the twig is by looking at its cross-section and then counting its rings or circle scars along the twig. This indicates a year's growth.

5. Have students complete the worksheet and then compare results.
Parts of a Twig

From this bud the twig will grow branches, leaves, and flowers. They are found on the very top of a twig & vary in size, shape, & color.

Some kinds of trees have buds that are protected by scales.

Last year's leaf was attached here.

These small dots are scars from the veins that transported water and food to and from the leaf.

The dots or patches all over the twig are pores that allow the twig to breath.

From this bud a side branch will grow. It is usually smaller than the terminal bud.

These ring-like lines are the scars of last year's terminal bud. From the terminal bud to the first bud scale scar shows one year's growth. Count back the rings to determine the "age" of your twig.

The soft, inner core is found only in young twigs.

Fill in the blanks!
CORE LESSON PLAN: KEYING TREES IN WINTER

OBJECTIVES:
1. To identify twigs in winter from leaf scars and bud characteristics.
2. To increase observation skills and the appreciation of nature's intricacies.

GROUP SIZE: 8-10

DURATION: 45 Minutes

MATERIALS:

For the Teacher:
- read Background Information pages 184-188 eeded.
- data board and pens
- sample buds (horse chestnut, beech)

For each pair of Students:
- Twig samples, 1 per pair (sugar maple, oak)
- magnifying lense, clipboard, pencil
- Clues for Twig Detectives handout, page 221
- Tree Detectives in Winter worksheet, page 223
- Winter Tree Finder and reference guides (See Teacher's Bibliography)

MOTIVATOR:

Begin by reviewing twig identification and terminology, using a data board to illustrate and label the parts of a twig. Ask the students:

- What characteristics help differentiate twigs from one another?

PROCEDURE:

1. Explain to the students that in this lesson they are going to discover more clues for twig detectives, and learn to identify common trees of the region.

2. Distribute Clues for Twig Detectives handout and a twig to pairs of students.

3. Name and locate each part of the twig, and discuss the function. Have students match the leaf scars and buds of their twig to the correct examples in the handout.
4. Turn the sheet over to the side titled, Clues for Twig Detectives. Demonstrate how to use this guide (which is a simplified key) using the sample bud. Note: To check for understanding, hold up a second sample bud such as an oak, and help students differentiate between the clustered terminal buds of the oak and the maple bud. Allow more time for demonstration and explanation, if needed.

5. Assign students to work in pairs. Distribute worksheet titled, Tree Detectives In Winter, and explain that they are to identify 3 of the 5 trees and fill in the information spaces, using the clues provided. Make field guides and winter tree guides available.

6. Lead the students outside to begin identifying trees. Remind students to check several buds on the same tree for accuracy in identification. We suggest that you key out a tree twig as a group before sending pairs out to identify trees.

7. When 10 minutes remain, return to the Nature Center.

SUMMARY:

1. Ask students to share their tree identifications. Which were difficult, simple, or obvious? Were there buds they particularly liked to key out? Use the Discussion Sheet to assist as needed.
Clues for Twig Detectives

1. Terminal Bud
2. Bud Scales
3. Bundle Scar
4. Leaf Scar
5. Lenticel
6. Lateral Bud
7. Growth Rings
8. Pith

Leaf Scars

Growth and Form

Twig Piths

Bark
Twig Detectives

Alternate

Whorled

INSTRUCTIONS:
Examine each twig and then read the descriptions A and AA.
If the twig is described by A then read 1 and 1a to identify your twig.

A. Leaf scars and buds opposite each other
   1. Twigs brown; buds brown and sharp-pointed: Sugar Maple
      1a. Twigs large, buds rusty color, bark brown with diamond-shaped figures: White Ash

AA. Leaf scars and buds alternate on twig
   2. End bud on twig with a cluster of other buds around it, fruit is an acorn.
      . Buds sharp-pointed: The Black Oaks
      . Buds blunt-pointed: The White Oaks
   2a. End bud is single
      Buds with 3 or 4 scales standing away from bud, bark in loose hanging sheets: Shagbark Hickory
      Buds are long and pointed, bark is light silver-gray, and smooth: Beech
INSTRUCTIONS: Identify 3 of the 5 trees given below and fill in the blank information spaces, using the clues provided. The first tree example is completed to get you started.

<table>
<thead>
<tr>
<th>TREE</th>
<th>BUDS/TWIGS</th>
<th>BARK</th>
<th>GROWTH AND FORM</th>
<th>SPECIAL CLUES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>White Oak</strong></td>
<td>• white</td>
<td>• red: flat, red-tinged plates</td>
<td>• open grown; mushroom shape;</td>
<td>• galls (oak apple, oak bullet);</td>
</tr>
<tr>
<td></td>
<td>• red</td>
<td>• black: chunky, white: gray</td>
<td>• broader than tall;</td>
<td>• acorns (check ground)</td>
</tr>
<tr>
<td></td>
<td>• black</td>
<td></td>
<td>• massive side branches</td>
<td>• some brown leaves may remain on tree</td>
</tr>
<tr>
<td></td>
<td>• buds clustered at end of twigs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• alternate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Shagbark Hickory</strong></td>
<td>• bitternut</td>
<td>• peeling</td>
<td>• open grown; oval</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• shagbark</td>
<td>• twigs stout</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• pignut</td>
<td>• diamond pattern</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td><strong>Sugar Maple</strong></td>
<td>• sugar</td>
<td></td>
<td>•</td>
<td>• Yellow-bellied Sapsucker holes</td>
</tr>
<tr>
<td></td>
<td>• red</td>
<td></td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• silver</td>
<td></td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• twigs red-brown</td>
<td></td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>•</td>
<td></td>
</tr>
<tr>
<td><strong>White Ash</strong></td>
<td>• bundle scars form crescent</td>
<td></td>
<td>•</td>
<td>• often root suckers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>•</td>
<td></td>
</tr>
<tr>
<td><strong>American Beech</strong></td>
<td>• alternate</td>
<td>•</td>
<td>• very shade-tolerant</td>
<td>• very fast growing in sunlight</td>
</tr>
</tbody>
</table>
INSTRUCTIONS: Identify 3 of the 5 trees given below and fill in the blank information spaces, using the clues provided. The first tree example is completed to get you started.

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<th>SPECIAL CLUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Oak</td>
<td><strong>white</strong></td>
<td>red, flat, red-tinged plates</td>
<td>open grown; mushroom shape; broader than tall; massive side branches</td>
<td>gallic (oak apples, oak bullet); acorns (check ground); some brown leaves may remain on tree</td>
</tr>
<tr>
<td></td>
<td><strong>red</strong></td>
<td>black chunky, white; gray</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>black</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shagbark Hickory</td>
<td><strong>bitternut</strong></td>
<td>large and bud</td>
<td>open grown; oval</td>
<td>nuts (husks on ground)</td>
</tr>
<tr>
<td></td>
<td><strong>shagbark</strong></td>
<td>twigs stout</td>
<td>peeling</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>pignut</strong></td>
<td>alternate</td>
<td>shaggy strips</td>
<td></td>
</tr>
<tr>
<td>Sugar Maple</td>
<td><strong>sugar</strong></td>
<td>opposite brown buds</td>
<td>open grown; <strong>egg-shaped</strong></td>
<td>tap holes; Yellow-bellied Sapsucker holes</td>
</tr>
<tr>
<td></td>
<td><strong>red</strong></td>
<td>twigs red-brown</td>
<td>bark peels from sides</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>silver</strong></td>
<td>red; odor when crushed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Ash</td>
<td><strong>alternate</strong></td>
<td>opposite</td>
<td>thick twigs from stems almost at right angles</td>
<td>old leaves may remain on young tree; often root suckers</td>
</tr>
<tr>
<td></td>
<td><strong>long-pointed buds</strong> (up to 1&quot;)</td>
<td>dome-shaped bud</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>bundle scars form crescent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Beech</td>
<td><strong>alternate</strong></td>
<td>smooth, silver-gray bark</td>
<td>sometimes low branches</td>
<td>canoe-paddle shaped seeds; very fast growing in sunlight</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>very shade-tolerant</td>
<td></td>
</tr>
</tbody>
</table>
1. Use the labelled illustration of a twig and compare to an actual twig. The parts of a twig are:

Terminal Bud: The largest bud at the tip of the twig.

- When the terminal bud is formed, growth has finished for the season.

Lateral Buds: The side buds on the twig.

- The larger buds usually contain flowers, or leaves and flowers, while the small buds are leaf buds.

- Buds are protected by several scales.

Leaf Scar: Marks where the leaf fell off in the autumn.

Bundle Scar: The circles or lines on the leaf scar are the ends of veins that transported food and water between the leaf and twig.

- These tiny dots may form a pattern, even resembling a face in walnut and butternut trees.

Lenticels: Little raised dots that allow oxygen and gases to flow into the cells of the tree.

- The dark lines on white birch tree bark are the lenticels.

Growth Rings or Bud Scale Scars: These remain from the bud scales of last year's terminal bud when they fell off. They indicate last year's growth, or how much the twig grew in one year.

- Start at the tip of the twig and count the growth rings to find the twigs age.

To identify buds it is important to notice their arrangement on the twig: Are they alternate, opposite or whorled?

- Most buds are alternate, appearing first on one side of the twig and then on the other (Oak, Birch, Beech).

- Only four groups of trees in the Northeast have opposite branching: Buckeyes (Horsechestnut), Dogwoods, Ashes, and Maples. The acronym is BDAM.

- Some buds are arranged around the entire tree (whorled) as in the Catalpa tree.
7. Do conifers and deciduous trees grow at the same rate?

Conifers can grow quicker and taller than deciduous trees because they keep their needles all year, and therefore can photosynthesize (produce food) continuously.

8. Do evergreen needles freeze in the winter?

No. To prevent freezing temperatures from destroying their leaves, evergreens undergo a process called hardening. Water in the leaf passes out of the cells and into spaces between them; if the water freezes the cells themselves are not damaged. Needle-shaped leaves are less vulnerable than broad leaves and their cells can further protect themselves by changing their chemical make-up.
FOLLOW-UP ACTIVITY: TWIG DISPLAYS

OBJECTIVES:

1. To assemble a twig display and correctly label the parts.

2. To identify at least 3 twigs and their characteristics, using a identification key.

MATERIALS:

- 5"x 7" index cards
- Winter Tree Finder and field guides (See Teacher's Bibliography)
- pruners

PROCEDURE:

1. Take the class on a schoolyard walk to collect twigs, or have students collect from their neighborhood in advance. Cut and collect a number of twigs 4 to 6 inches long. Stress the importance of always choosing samples with terminal buds. Cut a twig from a stump sprout or sapling, and one from the tip of a mature tree of the same species for later comparison.*

2. To make an identification key, here are some questions which will help the students:

- Are the buds opposite, alternate, or whorled?
- Are the buds grouped in a bunch at the end of a twig (e.g. oak) or is there only one bud at the end of the twig? (e.g. sycamore)?
- What color is the twig? Are the lenticels easy to see or not?
- How are the bundle scars arranged? What shape are they?
- Are the buds large or small?
- Examine the bud scales. (Sugar maple has many; willow has only 1; witch hazel none.)

What other questions can the students devise that may help in making an identification key?

3. To mount the twig collection use 5"x 7" index cards or tag board. Glue or tape twigs on carefully.

4. Label all the parts properly. You might encourage students to write the scientific name as well as the common one. Cut the twig crosswise or lengthwise to display the pith located in the center of the stem.
5. Point out the rings which mark the yearly twig growth. *Optional: Mount the sapling and the mature twigs for comparison. Mark the distance between the growth rings on the two specimens. Why are they different?

6. Display the students' completed twig collections in the school corridors or in the classroom.

EXTENDED ACTIVITY:

Bring Spring into the classroom ahead of schedule by forcing buds to bloom. You can cut twigs or branches from flowering trees such as pussy willow or forsythia and bring them inside for early blooms. There must have been four to six weeks with temperatures below 3°C (37°F) before this will work. Put the twigs or branches in a vase and partly fill it with water. Place the vase near a window where it will receive plenty of sunlight. Like magic, within a couple of days, students will observe tree flowers blooming.
UNIT RESOURCES

CAYUGA NATURE CENTER MATERIALS:

ART MATERIALS:

- Paper (various colors and sizes)
- Pencils, colored pencils, markers, crayons, chalk
- Tagboard
- Cardboard
- *Index cards
- *Tape
- Scissors
- Rulers and meter sticks
- Tape measures
- *Glue
- *Clay
- Newspaper
- *Waterbased printing ink
- Brayer (ink roller)
- Glass squares

TWIG AND EVERGREEN EXAMPLES:

Refer to Twig I.D. Display List, page
- Scotch, white and red pines
- Spruce
- Cedar
- Hemlock
- Balsam Fir

EQUIPMENT:

- Blindfolds
- Hand lenses
- Drawing boards
- Clipboards
- Data board
- Pruning sheers
- *Lotto boards
- *5"x 5" cardboard squares
- *Twig displays

*expendable items teachers are requested to supply
*preconstructed equipment or materials for demonstration or Core Lesson Plan
HANDOUTS/WORKSHEETS:

Trees And Me Activities
Tree Shapes, Tree Branches, Visual Perception Tree Branching
Evergreen Match Chart
Keying Out Trees
Conifer Key
Parts Of A Twig
Clues For Twig Detectives
Tree Detectives In Winter
Cayuga Nature Center Map

REFERENCE GUIDES:


BIBLIOGRAPHY FOR STUDENTS:


RECORDS AND COLORING BOOKS:

Billy B Sings About Trees. Do Dreams Music. P.O. Box 5623, Takoma Park, MD 20912.


BIBLIOGRAPHY FOR TEACHERS:


BOCES FILM AND VIDEO LIBRARY:

16 MM Films:

Winter Comes to a Forest (P) MS0917

PROCESSING CENTER MATERIALS:

Kits:

Math for Every Season (P/K,P) K1510
A Tree Through the Seasons (P) K1582.16
I Can Read about Trees: Troll Series (P) K1372.4

Filmstrips:

True Book Natural Science: Trees (P,1) FS500.9

Paperback Books:


CONTACT PEOPLE AND PLACES:

Cornell Arboretum
Local Nurseries
Field Trip to Stewart Park
Field Trip to Finger Lakes State Parks