DOCUMENT RESUME

ED 051 993 SE 007 639

AUTHOR	Ware, George; McCollum, Howard P.
TITLE	A Guide for Teaching Conservation and Resource-Use Education in the Schools of Louisiana, Forest Section.
INSTITUTION	North Louisiana Supplementary Education Center, Natchitoches.
PUB DATE	67
NOTE	49p.
EDRS PRICE	EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS	Biology, *Conservation Education, *Elementary School Science, Forestry, Junior High Schools, *Science Activities, *Secondary School Science, *Teaching Guides
IDENTIFIERS	Louisiana

ABSTRACT

These guides for teaching conservation and resource-use education give a sequential treatment of conservation concepts from primary through junior high school grades. There are four sections, each sequential; this guide covers the "Forest" section (others are "Soil and Water," "Minerals" and "Wildlife"). Ten major concepts are arranged in a sequence which is repeated at three levels: primary, intermediate, and junior high. The concepts are "identity," "parts," "life needs," "reproduction," "community," "enemies," "recreation," "wildlife," "conservation," and "utilization." For each level the concept is stated as it applies at that level, then a paragraph of discussion of the concept directed to the teacher is followed by suggested activities for students and a statement of possible outcomes. A glossary of terms is given, and appendices give instructions for making paper by hand, building, stocking and caring for terrariums, and constructing a pegboard model of a forest. (EB)

A GUIDE FOR TEACHING CONSERVATION AND RESOURCE-USE EDUCATION IN THE SCHOOLS OF LOUISIANA

FOREST SECTION

A GUIDE FOR TEACHING CONSERVATION EDUCATION IN THE SCHOOLS OF LOUISIANA

FOREST SECTION

Prepared originally by a committee of teachers

under the direction of

Dr. George Ware

and

Howard P. McCollum

and

Issued by the
State Department of Education
Baton Rouge, Louisiana
1962

Revised by the

NORTH LOUISIANA SUPPLEMENTARY EDUCATION CENTER

by permission of State Department of Education
1967

WILLIAM J. DODD
STATE SUPERINTENDENT

STATE OF LOUISIANA
DEPARTMENT OF EDUCATION
BATON ROUGE 4

To the Teachers and School Officials of Louisiana

Greetings:

If one accepts the modern school as an effective institution for the attainment of improved living, then a consideration of the conservation of natural resources as one phase of the school program is no longer debatable. The importance of the problems connected with the wise use of natural resources and their broad implications for the welfare of our people leave the school no alternative.

Our place as a nation has been established because our people have had the energy and skill to develop and use our abundant supply of natural resources. So abundant were these resources when first discovered that they were looked upon as being limitless and inexhaustible. The face of this nation has been changed through the years by those who have thoughtlessly wasted wildlife of all sorts, large areas of fertile land, and vital water supplies. In the past, industry has been draining our valuable mineral resources and changing the ecology of our streams and forests. The carelessness of past generations is now apparent; the lack of prescience resulted in the destruction of our lavishly plentiful natural resources. Our resources will last only if we accept the obligations of our stewardship. We should use rationally, build up, and distribute equitably in terms of public benefit, what we call the natural resources of the country. This is conservation.

Sincerely yours,

William J. Dodd
State Superintendent

Louisiana Forestry Commission

James E. Mixon, State Forester

Alexander State Forest Woodworth, Louisiana 71485

COOPERATION - Resource Use

September 29, 1967

To the School Personnel of Louisiana:

Throughout Louisiana increasing numbers of our citizens are coming to believe that our schools can and must contribute to improvement of our standard of living. Schools should deal with real problems in a realistic way. It is incumbent, therefore, upon state agencies, the general public, and schools, that they join together to determine curriculum needs, to plan for meeting these needs, and to implement these plans.

Many of us have found that the creation of more desirable attitudes and more accurate information concerning the use of natural resources have long been among the greatest needs of our state. The Louisiana Forestry Commission has been aware of this fact and has cooperated to the fullest extent with all groups and agencies to fill the need. Short courses have been offered to acquaint teachers with basic data and to provide a means for exchange of ideas and philosophies.

Recently the formation of the North Louisiana Supplementary Education Center has given us an additional powerful tool with which to work. Drawing from experiences at past workshops, the Center and Commission have brought together the attached concepts, activities, and related information which will assist teachers and potential teachers in presenting a correlated and coordinated approach to forest conservation from Grades One through Nine.

It is my sincere hope that these materials will play an important role in creating a conservation ethic in the minds of tomorrow's citizens, a harmony between our young people and their land, insuring that our forests will prosper and become a continuous source of spiritual as well as material benefits which make for better living.

JAMES E. MIXON
State Forester

Foreword

In the summer of 1962 there were prepared four Guides for Teaching Conservation and Resource-Use Education in the Schools of Louisiana. This was done by committees of teachers under the direction of Dr. George Ware and this writer. The teachers involved in this effort were Misses Frances Arledge, Ruby Bogan, Lucille England, and Jena Reynaud; Mesdames, Anita B. Derbonne, Elsie G. Lawson, June Moore, Ira R. Rogillio, and Gladys Simmons; and Messrs. Robert G. Daspit, Charles C. Moss, and Milton Seilhan. These Guides were published by the State Department of Education and distributed to a limited number of teachers for trial use. They dealt separately with Forests, Wildlife, Soil and Water, and Minerals, and were covered by the State Department's blanket copyright for such materials.

When the North Louisiana Supplementary Education Center was established in the summer of 1967, Superintendent W. J. Dodd granted to this organization permission to revise these Guides to bring them up to date and, hopefully, to make them more useful to teachers and school officials to the end of improving the conservation education being carried on in the schools of the State. This bulletin is the first of the four revisions. The other three will follow as rapidly as possible.

The revision was made by the Conservation Education Division of the Center. It is still considered tentative, and all teachers and school officials who use it are urged to submit to the Center any and all their suggestions for improving it in such ways as may be found to increase its usefulness.

The Conservation Education Division of the Center acknowledges its indebtedness to members of the State Department staff, Dr. Stan Shaw and Mr. Jack Ensminger, and to Messrs. Ralph Wall and Roland Treubig of the Louisiana Forestry Commission for their valuable assistance in the task.

Howard P. McCollum, Director
North Louisiana Supplementary Education Center

Natchitoches, Louisiana
October, 1967

PHILOSOPHY

Conservation is an attitude; it should become a way of life. Beginning emphasis is upon a problem-solving approach to the wise use of materials in the school and home communities. Children should learn about trees as individuals and parts of a plant community, how they make the outdoor surroundings more attractive, how forests are used for outdoor recreation, how they fit into Nature's balance, how forests contribute to the economic well being of Louisiana, and how the conservation and management of our forest resources are vital to our state.

Conservation is one part of the total instructional program. Accumulating information is basic to the development of desirable understandings, appreciations, and attitudes toward the use of our natural resources. Conservation education, therefore, includes reading, writing, reporting, watching, and listening. Conservation can become more realistic and meaningful through doing in which everyone participates in school and community projects.

TO THE TEACHER

This GUIDE is a revision of the one you have been using for help in teaching forest conservation. The revisions of those on Soil and Water, Minerals, and Wildlife will follow as rapidly as they can be effected.

To give continuity to the progressive teaching of forest conservation through the junior-high-school grades, the concepts have been arranged in the same sequence for all three levels--primary, intermediate, and junior high. That sequence is as follows:

1. Identity
2. Parts
3. Life needs
4. Reproduction
5. Community
6. Enemies
7. Recreation
8. Wildlife
9. Conservation
10. Utilization

In the primary grades only the first nine are used, and they are applied to green plants in general. At the intermediate level all ten appear, and the application is to trees and forests. At the junior-high-school level number five is combined with number three and the application, in each case, is further advanced than at the preceding level.

The concepts are differently stated at the three levels, but the general idea of each is the same as the list above.

In preparation and, hopefully, to be issued at an early date, are two bulletins that should be helpful in using this and the other Guides for Teaching Conservation. These are: a listing of available films appropriate for conservation teaching, and a list of free and inexpensive materials that are useful in teaching conservation.

This GUIDE is prepared for the teacher's and school officials' use only. The "discussions" that follow the statements of the concepts have been prepared to provide the teacher with a brief overview of the inclusiveness of the concept and the extent to which it should be limited for the children at the different levels. The "suggested activities" are really just suggested. No teacher should feel obligated to carry out all of them, nor should any teacher feel that any of his or her own ideas for learning activities are in any way precluded by them. It is hoped that every teacher will understand that it is expected that many will need adaptation to local conditions. The "possible

outcomes" are included as mere suggestions of overall objectives that might be realized from study of a particular concept. They should not be considered as exhausting such possibilities.

This revision should be considered tentative, and each person using it can contribute to its improvement for final form by suggesting additional appropriate activities, achievable outcomes, or any needed changes that will make it more useful. Your help is earnestly solicited.

PRIMARY

1. CONCEPT: THERE ARE MANY DIFFERENT KINDS OF PLANTS.

Discussion: It is felt that, for the primary grades, some basic understandings about plants in general should precede consideration of trees and forests in particular. Many children may not yet realize that a tree is a plant. Hence, the need for background.

Green plants show wide variation in most of their characteristic features. For example, they vary in size, from the modest violet to the largest tree in the forest, with thousands in between. They vary in shape from such extremes as the prostrate bermuda grass runner, to the bushes and shrubs, to the full grown tree, with many more in between. They also present variety in shades of green to be found in their leaves. Often other pigments will dilute the chlorophyll to provide leaves of different hues, for example, the coleus. Perhaps no variation among green plants is greater than that of the differences observable in size, shape, margin, venation, and surface texture of leaves. It is almost limitless.

All these differences are characteristics upon which names of plants are based. Names often reflect some of these characteristics and are as numerous as the features of plants are heterogeneous. It should also be noted that the change of seasons sometimes bring about changes in some parts of green plants.

Suggested Activities:

1. Take exploratory field trips in the immediate vicinity at different times of the year. Observe the variety of plants, noting sizes, shapes, colors, foliage, flowers, and fruits.
2. Write a group story or compose experience charts about the field trip.
3. Collect and paste up pictures of plants from magazines, etc. Emphasize difference in size and shape.
4. Bring in flowers from the garden or field. This activity should continue throughout the year, thereby students can see the different flowers at different seasons.
5. Note that leaves are different in size, length, width, shape, and color. A class leaf poster may be appropriate.
6. Observe the change in leaf colors as season changes.

Possible Outcomes:

1. Development of an interest in plants and in the outdoors.
2. Development of some understanding that there are many kinds of green plants.
3. An elementary understanding that green plants differ from each other in many ways.

2. CONCEPT: PLANTS HAVE SEPARATE PARTS.

Discussion: For primary children, it is believed that an understanding of the parts of a green plant is adequate. The functions of the parts should not be presented until the children are more mature.

Green plants will usually show most if not all of the following: roots, stem, branches, leaves, flowers, fruit, and seeds. Of course, the seasons will determine the appearance of flowers, fruit, and seeds, while sometimes determining the appearance or even the presence of leaves. Roots are the parts of the plant that grow under the ground, while (with some exceptions) all the other parts grow above ground. Stems and their branches vary in their positions according to the individual plants. Leaves also show many variations. Flowers are sometimes difficult to find, but on most green plants are easily seen and identifiable at the proper time of year. Fruits are either dry or fleshy according to the type of plant and how it provides for distribution of its seeds. All seeds contain embryo plants along with enough food to get the young plant started. Most of them are borne above ground although the peanut is a notable exception.

Some plants provide food for man. The parts of a plant man eats will depend on where the individual plant stores its food at different times of the year.

Suggested Activities:

1. Make a chart showing roots, stem, and leaves of a plant.
2. In an outdoor area, identify the roots, stem, and leaves of several plants.
3. Review the chart made in No. 1 and check it against what was observed in No. 2.
4. Build a terrarium to provide a habitat for plants collected on an exploration trip. Take plants that are plentiful. Stress the conservation of plants.

Possible Outcomes:

1. An understanding that plants have parts just as we have different parts of our bodies.
2. Knowledge of the names of some parts of a green plant.
3. An understanding that some parts of a green plant cannot be found at certain seasons.

3. CONCEPT: PLANTS NEED WATER, SOIL, SUNLIGHT, AND AIR TO GROW.

Discussion: Caution should be exercised in attempting to build this concept for primary children. The danger lies in trying to

do too much, thus confusing the children with too many or too technical terms.

It is believed that, in the simplest fashion possible, the children should have made clear to them that soil, water, air, and sunlight are all necessities for green plants to have in order to grow and to continue growing. Just as we people have to have food and water to continue living and growing, so plants must have food. It should be explained that the food plants use is food that they make for themselves, and that they make it from water, a part of the air, and in the presence of sunlight only. The soil supplies needed minerals and holds the plant steady so that it can turn toward the sun with its leaves to absorb the light.

It might also be possible to point out that all the food man and other animals use is made by the green plants. In fact, we are dependent on them for every type of food we use, directly or indirectly. But for primary children this part of the concept should not be stressed.

In the activities that follow, a simple set of experiments will be suggested to show that green plants cannot survive without all these factors listed in the concept.

Suggested Activities:

1. Divide the class into groups. Have each group conduct an investigation to show the effects of depriving plants of any of their essential needs.
   a. Using two identical plants, water one as needed but don't water the other. Observe results.
   b. Pot two identical plants--one in soil, the other in pure, clean, builders' sand. Treat them the same and observe the effect of a lack of soil nutrients on the one planted in sand.
   c. Using two identical plants, water both but put one in a cabinet where it cannot receive light. Observe result.
   d. Using identical plants, water both but place one in an air-tight, transparent container and don't remove. Observe result.

Possible Outcome:

1. An understanding that green plants must have water, soil, sunlight and air or they will die.

4. CONCEPT: PLANTS REPRODUCE THEMSELVES.

Discussion: Most primary children have some concept of reproduction however immature it may be. They have seen babies of some of

their pets, or fledglings in a bird's nest, or they may have helped plant seeds in flower beds or gardens at home.

Green plants use either or both of two means of reproduction--seeds or vegetative propagation. A seed is a part of the plant that is produced by the plant for no other purpose than to reproduce the species. It contains a tiny baby plant (the embryo) and enough food to feed the new plant when it starts growing until leaves appear so that it can make its own food and be independent from that time on. All this is enclosed within a protective cover that will keep the embryo and the food supply safe until conditions are right for the seed to start growing.

Some plants depend on stems, runners, or leaves (either above or under ground) to put up shoots to make new plants. Examples are strawberry and bermuda grass above the ground, and irish potato or Johnson grass underground. Both grasses, however, use seeds also. The sweet potato is an example of a plant that reproduces from the root.

In most plants that are used for food, the storage of food by the plant for reproduction is the source of the food used by man or other animals.

Suggested Activities:

1. Collect seeds and bulbs. Give the children opportunities to learn that plants reproduce in several ways.
2. Visit an area in the school yard, park, or nearby woods where several similar plants are growing. Locate other plants. How did these plants get started? Did they grow from seeds, or did the plants get started in some other way?
3. Write group or individual stories about the experiences in activities 1 and 2.

Possible Outcomes:

1. An understanding that all green plants came from parent plants.
2. An understanding that some green plants produce seeds to start their young, while other plants use different means to multiply.

5. CONCEPT: PLANTS LIVE IN COMMUNITIES.

Discussion: Primary children will have little difficulty with understanding the variations of people who live in their own communities. As background, a little time might be taken to identify these variations, such as sex, size, age, occupation, disposition, religion, complexion, etc., etc.

In the same way plant communities exist with even more possible variations among them than those we can identify for people. Rarely is a plant found in isolation from other kinds

of plants. Variations in plant communities can be identified as size--such as height or even bulk, color,--shade of green, number,--alone or in colonies, flowers, fruits, seeds, or leaves.

For primary children just the observation and recognition of the fact that such relationships exist is probably sufficient. It is believed that no attempts should be made to show these youngsters the significances of such communities and the interdependence or competition between or within species. Such refinements in concept should be delayed until the learners are more mature.

Suggested Activities:

1. Take an excursion on the school grounds or some other nearby area where plants are growing. Observe that where one plant grows there are usually others of different kinds growing near.
2. Visit an area where plants of different heights can be seen growing together. Compare such plant communities to multi-storied apartment buildings.
3. Construct a diorama of first, second, and third level plants in a plant community.

Possible Outcomes:

1. An understanding that many kinds of green plants live together in plant communities.
2. A realization that plants in a plant community grow at different levels.

6. CONCEPT: PLANTS HAVE MANY ENEMIES.

Discussion: It is more than likely that primary children already know the meaning of the word "enemy". This background understanding should, however, be checked and, if necessary, explanations should be made.

The enemies of green plants can be grouped into a few classes. Children will readily grasp the fact that fire kills or injures plants because they have all observed that at one time or another in their lives. Disease should be easily understood as an enemy of plants because the children will have seen their parents or neighbors dusting or spraying roses or shrubs for leaf-spot, blight, or such diseases. Insects as plant enemies should also be in the children's experiential background. They have seen what potato beetles do in a garden, that webworms strip trees of part of their leaves, or any of many other examples. Many will know of the use of insecticides for fighting insect enemies in cultivated crops. Other animals that endanger plants should also have come to the attention of many children. Livestock must be

fenced out of growing crops. Gophers and moles play havoc with root crops in the garden, and perhaps some may have seen what nutria will do to a garden in a single night.

Man, too, must be included as an enemy of plants. He kills many plants that he calls weeds because they are using land areas on which he wants to grow other plants (crops). He clears wide areas of trees and shrubs so that he may make fields or pastures. Sometimes he cuts down trees just because they are in the way of some activity he wishes to carry on.

Suggested Activities:

1. Collect newspaper articles and pictures which indicate the damage of forest fires. Discuss the causes of forest fires.
2. Ask a Cub Scout or Boy Scout to demonstrate safe ways of building and extinguishing campfires.
3. Make a chart showing (a) putting out campfires, (b) putting out cigarettes and, (c) burning trash in a container.
4. Observe, on the school grounds, evidences of insect and disease damage to plants, such as partly eaten leaves, swellings on twigs, and leaf spot.
5. Discover evidences that natural forces, such as wind, water, and ice can damage trees and shrubs.
6. Learn to read and obey forest signs.

Possible Outcomes:

1. An understanding that plants are subject to enemies just as people are.
2. Elementary understandings that the enemies of plants include fire, insects, disease, some animals--including man, and weather.

7. CONCEPT: FORESTS PROVIDE RECREATION AND BEAUTY FOR PEOPLE.

Discussion: It should be noted that this is the first concept for the primary level that refers to forests instead of to plants in general. The term refers, however, to the forest as a plant community, not simply as a growth of trees.

Children in the primary grades, although too young generally to be involved in such sports as hunting or fishing, have already learned that it is fun to visit a forest. Many have enjoyed picnics in such areas, or have accompanied their parents or other adults on drives in the spring to see such beauties as dogwood, redbud, and the variations of green in young leaves. Others have enjoyed finding wild flowers in woodlands, or have discovered that it is fun just to wander and explore in such areas. Some may have had opportunities even to camp in forests.

It is believed that an appreciation of forest areas as sources of natural beauty to be explored and enjoyed should be developed when children are young. Communion with nature should be promoted as an individual matter from which both mental and spiritual uplift may be obtained. Any suggestion that such enjoyment is "sissy" should be well exploded.

Suggested Activities:

1. Plan a picnic at a park or nearby wild area. Assign group and individual responsibilities for demonstrating how to build a fire, how to put out a fire, how to carry home waste from the picnic.
2. Visit areas to enjoy the beauty of wild flowers.
3. Locate trees that would be good to climb in, hang a swing from, build a treehouse in, and give shade for picnics.
4. Participate in the following campaigns: Don't be a Litter Bug, Keep Louisiana Green, Keep America Beautiful.

Possible Outcome:

1. An appreciation of the pleasures that people can find in flowers, shrubs, and trees (singly or forests).

8. CONCEPT: FORESTS PROVIDE FOOD, SHELTER, AND PROTECTION FOR ANIMALS.

Discussion: This concept should be developed in only its elementary stages at the primary level. Technical terms should be carefully avoided.

It was noted under concept 3 that plants make food. This includes not only the food they need to grow, but also what they store for reproduction. The latter is the source of most of the food animals use. Animals depend on the food plants store in seeds, roots, and/or stems.

Many forms of wildlife make their homes among plants, not only for handy sources of food but for protection from weather and from their natural enemies. Wild creatures must have homes where they can live in comparative safety or they will not stay in any locality. Any cataclysm (such as wildfire) that destroys plant growth also kills or drives out all forms of wildlife. This is part of Nature's balance.

As the poet stated it

"There is never a leaf or a blade too mean
To be some happy creature's palace."

Suggested Activities:

1. Take a trip to the woods to learn which plants furnish food, shelter, and protection for wildlife. Look for evidences of
   a. Animals' presence, such as tracks in mud or wet sand, excreta, etc.
   b. Animals' feeding on parts of plants, such as seeds, buds, flowers, leaves, stems, or bark.
   c. Animals' homes, such as nests, den trees, or burrows.

Possible Outcome:

1. Some understanding that wildlife found in the forest is completely dependent on the forest for food, shelter, and protection.

9. CONCEPT: WE CAN WORK TOGETHER TO LEARN HOW TO CONSERVE PLANTS AND ANIMALS.

Discussion: At last we come to the term "conservation". Primary children are not too young to learn the word and its meaning. They may not be able yet to learn to spell it, but they can learn its meaning, and begin to build it into their lives. It is important that they learn it properly from the outset.

Conservation means wise use. Conservation is an attitude that influences or controls the individual's conduct just as do other attitudes and beliefs that become, collectively, the individual's philosophy of life.

As stated, the concept means that the children can, through discussion together, and with the teacher's guidance, consider their experiences, observations, and conclusions to learn how plant and animal resources can be used wisely. It should be stressed that "wise use" (conservation) implies using a resource but not wasting it, and always providing for its continued renewal.

Suggested Activities:

1. Make Arbor Day an annual event in the school and community.
2. Designate a nature area for the school. A fence row or corner with plants such as shrubs and grasses to provide food and cover for birds and other small animal life may serve as a nature area for a school that has no accessible woodlands, streams, or wooded trails.
3. Children may designate "nature spot" and prepare nature trails for their parents. Children may follow a favored trail, observe trees, grasses, wildflowers, outcroppings of rock, and place markers to guide others along the "nature trail".
4. Read and discuss A Living Christmas Tree. (see appendix)
5. During Christmas season, selectively cut a Christmas tree for the classroom, after securing permission from the owner of the property where it is growing.

Possible Outcomes:

1. A realization of the meaning of "conservation".
2. Some elementary distinctions between wise use and unwise use of anything that is used by man.
3. A beginning of an understanding of how animals in general are dependent on green plants.

INTERMEDIATE

1. CONCEPT: TREES HAVE DISTINCTIVE CHARACTERISTICS BY WHICH THEY CAN BE IDENTIFIED.

Discussion: Children in any classroom learn the names of their classmates and to identify them at any time or in any place they may meet. This is possible because they learn each child's individual differences that distinguish him from the others. People exhibit differences such as eye color, hair color, body build, facial features, sex differences, disposition, sizes, etc., that provide bases for identification.

In like manner, trees exhibit distinguishing characteristics that permit them to be identified and named as individual species. Perhaps the number of individual differences they show is smaller than those for people, but they are definite and observable. Distinguishing characteristics of trees consist mainly of such features as leaves, bark, buds, flowers, and fruits (or seeds), while occasionally the location in which a tree is growing offers a clue to its identity.

It is felt that children should learn to know the names of the trees that grow in their localities at least, and to recognize them as acquaintances or friends when they find similar species elsewhere. This is not difficult to achieve.

Suggested Activities:

1. Encourage the pupils to make a collection of leaves and to identify each. This can be done individually or as groups.
2. Take a field trip and identify some of the common trees of the forest. Use the bulletin "Commercial Trees of Louisiana" for help in identification.
3. Note the difference in the structure of the many trees.
4. The identification of the trees as to the places in which they grow best might be noted. (Example: The cypress tree as compared to the pine or oak.)
5. Make a tree and shrub census of areas around the school.
6. Observe trees in school yard for typical shapes. Using drawings, record the shape of each kind of tree observed. (Trees that grow in the open, often differ in shape from the same species growing in clusters.)

Possible Outcomes:

1. An understanding of what the several distinguishing characteristics of trees are.
2. Ability to identify most of the trees in the immediate neighborhood, at least to the extent of general species.

2. CONCEPT: SEASONS AFFECT SOME PARTS OF TREES.

Discussion: Children in the intermediate grades are fairly well acquainted with the seasons and the influences that seasonal changes have on their own lives in such matters as their needs for different clothing, the activities they can engage in, etc.

Doubtless, they have observed also that some trees change the color of their leaves in autumn and shed them soon afterward. Probably they do not know that the color changes in leaves are caused by the effect of temperature changes on the chlorophyll. All trees have a dormant season. Spring wood is developed during the spring and early summer and is usually light in color. Summer wood is developed during summer and early fall and is usually darker in color. These two types of growth form the annual ring used in determining tree age.

To be emphasized also, are the seasonal periods when trees shed the outer layers of their bark, when the buds are formed for spring opening, and other physiological effects of seasonal change in trees occur. Likewise, observations and study should be given to the variations among trees as to the periods when their fruits mature.

It is believed the terms deciduous and evergreen can be introduced here as characterizing hardwoods and softwoods, with some exceptions in each case.

Suggested Activities:

1. Collect leaves from a pine tree and leaves from an oak tree during the month of October. Discuss the difference.
2. Observe which trees shed their leaves in the winter.
3. Investigate the reasons for some leaves changing color in the autumn.
4. Observe the swelling and opening of buds in the spring. In mid-January get twig cuttings 8" to 10" long from several species of trees. To force budding, place the cut ends in water in the classroom. Observe and compare differences.
5. Have children observe trees in late autumn or winter. Let them decide which trees are evergreen and which are deciduous.

Possible Outcomes:

1. An understanding that seasons determine when some parts of a tree appear and can be seen. (e.g. flowers, fruit, seeds)
2. An understanding that seasons visibly affect deciduous trees more than they do the evergreen ones.
3. An elementary connection between deciduous and hardwood, and between evergreen and softwood.

3. CONCEPT: TREES NEED SOIL, WATER, AIR, AND SUNLIGHT TO GROW.

Discussion: At the primary level the children learned that these are essential needs for green plants in general. Trees are the largest of the green plants, so the basic understanding of the concept is already built. It is felt that children at the intermediate level could now be introduced to the reasons for the essential nature of these needs.

Soil provides an anchorage for the roots of the tree so that it can maintain an upright position and hold its leaves up to receive direct rays of sunlight. It also supplies the tree with a source of water and such minerals as it needs. Water and dissolved minerals are absorbed from the soil by the tiny roots, carried up the greater roots and the stem by capillary action to the leaves. The leaves take this water and combine it with carbon dioxide from the air, and in the presence of sunlight, make the basic food material upon which the tree depends for growth and for storage in its seeds to nourish the young embryo as it begins its growth in the next generation. Much of the oxygen the leaves take in is returned to the air. Hence, the air in or near a forest always feels, and really is, fresh and invigorating to us when we breathe it.

Fundamentally, this is the process of photosynthesis (photo=light; synthesis=putting together) upon which all living things on earth depend.

Suggested Activities:

1. Conduct a controlled experiment. Divide the class into five groups, each group to prepare five numbered pots of growing plants.
   - Control pot No. 1 - good soil, water, sunlight, and air.
   - Experimental pot No. 2 - pure, clean sand, water, sunlight, and air.
   - Experimental pot No. 3 - good soil, no water, sunlight, and air.
   - Experimental pot No. 4 - good soil, water, dark (no sunlight), and air.
   - Experimental pot No. 5 - good soil, water, light, and no air.

   Have the five committees compare results for needs of plants.

Possible Outcomes:

1. A reinforced understanding that trees, because they are green plants, must have soil, water, air, and sunlight to survive and grow.
2. An elementary understanding of the process of photosynthesis.

4. CONCEPT: TREES PRODUCE FLOWERS AND SEEDS.

Discussion: In effect, this concept concerns the way trees reproduce their species.

Trees are true flowering plants, producing flowers in the spring and seeds when they mature. In some species, flower buds precede leaf buds. Also, on some trees flowers are difficult to identify. But they do appear.

A seed is the ripened ovary of the flower. Seeds of trees offer as many variations as the trees that bear them. A seed always consists of an embryo plant, a quantity of stored food to support the baby plant until it makes sufficient leaves to support itself, and a protective covering to preserve it until conditions are favorable for germination.

Nature has also concerned herself with how plants (including trees) may manage to get their seeds scattered to places beyond the soil at the base of the plant. This is called adaptation for seed dispersal, and presents interesting differences. Such trees as pine, elm, and maple have wing-like structures on their seeds so that wind can scatter them. The seeds of trees that bear fleshy fruits are dispersed by animals that eat the fruit. Thus a bird may eat a berry containing seeds which are not digestible and pass through the alimentary canal of the bird, to be dropped perhaps miles away in the bird's excreta. The same principle holds for any fruit eaten by animals. Dry seeds, usually referred to as nuts, may also be dispersed by animals that eat them and fail to digest all that are eaten. Some seeds are actually planted by animals as they bury them for future use and for some reason fail to recover them later for food.

Though most seeds ripen in the autumn, some can be found at almost any period following the flowering time. Careful observation should be made as to the time seeds are ready for dispersal.

Suggested Activities:

1. Plant some live oak or mimosa seeds in a glass jar and watch germination process. (Barely nick the mimosa seed with a pocket knife) Also observe seedlings under a large tree.
2. Make a collection of seeds and try to determine the ways each kind is distributed.
3. In the spring, follow and record appearance of flowers, then seeds, on different species of trees.
4. Have the children take seeds (such as acorns) and dissect them to find and identify the three principal parts of the seed.

Possible Outcomes:

1. A realization that seeds are produced only by flowering plants, because a seed comes from a flower.
2. An understanding that trees use seeds as a means of producing a new generation of their species.
3. An elementary understanding of what a seed contains.
4. An elementary understanding that the form of seed and how it is related to the fruit differs among trees according to how their seeds are to be scattered.

5. CONCEPT: THE FOREST IS MADE UP OF MANY OTHER PLANTS IN ADDITION TO TREES.

Discussion: The forest is actually a community of many plants. In almost any forest several distinct levels of plant growth can be seen. Near the ground, and extending upward the shortest distance are such plants as mosses and liverworts. This kind of plant forms what is sometimes referred to as the first story of the forest community. The next, or second story is composed of such plants as grass, ferns, and wild flowers. The third story consists of plants that grow somewhat higher, like blackberry briers, shrubs, vines, and tolerant trees (can grow in the shade of larger trees) such as dogwood and redbud. The top or fourth story of the forest is made up of the trees, themselves, whether softwood, hardwood, or both.

The trees are first to receive the sunlight, but enough filters through their crowns to support the lower stories of the plant community. Should fire ravish the forest it is the lower levels of the growth that are first destroyed.

Suggested Activities:

1. Visit the forest to observe the many plants that grow in the forest. This includes the plants that grow on the ground under the trees. Identify the levels of growth.
2. Discuss the difference among mosses, ferns, grasses, and fungi.
3. Make a chart showing the levels of the forest community.

Possible Outcomes:

1. An understanding of the tremendous variety of plants to be found in the average forest.
2. A realization of how the various types of plants in a forest community occupy different levels of growth.

6. CONCEPT: FORESTS NEED PROTECTION FROM ENEMIES.

Discussion: The enemies of the forest can be roughly divided into two groups--its natural enemies, and those for which man is responsible. Natural enemies of the forest include insects, diseases, and weather. Usually it is the larva stage of insects that damage trees most, but some adult forms also continue their destruction. Some insects attack only a particular variety of tree but again, some are not so discriminating. Most diseases that affect trees are caused by some type of fungus that may be spread from tree to tree by wind or carried by flying insects or on the feet of birds. Severe wind storms or ice storms do much local damage to forests.

Man may sometimes do great damage to the forest when harvesting its products. This may occur when he uses unselective practices in lumbering. Overgrazing a pine forest, and grazing a hardwood forest by livestock can result in the destruction of much of the understory in the forest including most of the young trees.

Wildfire is perhaps the greatest single enemy of forests. While fire can be started by lightning accompanying storms, it is nearly always the result of man's carelessness or indifference to its possible results.

Since forests constitute one of Louisiana's most valuable natural resources, we should be diligent in discovering ways of reducing the damage done to them by any and all of their enemies.

Suggested Activities:

1. Make a chart showing the causes of forest fires, and the types of damage done.
2. Invite a forester to talk to the class about the enemies of the forests.
3. On a field trip look for evidences of damage to the forests by insects, diseases, fire, and weather.
4. Study and report on all the ways you can find in which man is an enemy of the forest.
5. Suggest that each child become a Junior Forest Ranger. Write to Smokey Bear Headquarters, Washington, D.C.

Possible Outcomes:

1. An awareness of the variety of the natural enemies of the forest.
2. Some discernment of the ways man can inflict injuries on a forest.
3. Some understanding of the devastation that is caused by a forest wild fire.
4. A realization that forests need protection from their enemies, natural and man-caused.

7. CONCEPT: FORESTS FURNISH RECREATION AND BEAUTY.

Discussion: This concept involves the multiple use to which forests can be put. With the exception of lakes and streams, forests are unique among Louisiana's natural resources in the variety of recreational opportunities that they provide for the citizens.

Forests can be used to provide many recreational activities for people while at the same, producing wood. They offer unlimited opportunities for the study of nature--both plant life and animal life. Because of the wildlife sheltered in the forest, hunting for sport or for pictures is naturally carried on there.

If the forest encloses or borders streams or lakes, such forms of recreation as fishing, swimming, water skiing, and camping can be accommodated there. With more and more people occupying urban homes now, the multiple-use possibilities of Louisiana's forest areas should be developed to an extent not previously imagined.

Suggested Activities:

1. Talk about, locate, and utilize picnic areas, places for hiking and nature trails, fishing streams, and camping areas as related to forests.
2. Help develop in the students an appreciation and understanding of the beauties of the forest
3. Encourage each student to write a description of, or make a report on, his experiences in outdoor activities. (Send the better ones to the school or local newspaper.)
4. Encourage the students to join local scout or campfire organizations, and to participate in sponsored outdoor activities.
5. Have the students participate in such campaigns as "Don't be a Litterbug", "Keep Louisiana Green", and "Keep America Beautiful".

Possible Outcomes:

1. An understanding of the meaning of forest-oriented recreation.
2. Some perception of the variety of ways forests can serve as sources of recreation for people.
3. An appreciation of the types of natural beauty to be found in forests at different times of year.

8. CONCEPT: FORESTS PROTECT AND PROVIDE FOOD, SHELTER, AND COVER FOR OUR WILDLIFE.

Discussion: Nature's balance of plant life, animal life, soil, and water can best be seen in a typical forest, particularly if it includes streams or lakes. Wildlife will reside only where food supplies and shelter from their natural enemies exist. Forests provide these essentials for many species of wild animals. Varying kinds of these creatures find their favorite habitats in the several levels of the plant community that form a typical forest. A list of such species would be long and would vary according to the kind of forest, the presence of water in quantity, the climate, and the continued protection from fire.

Discovery of the variety of animals that occupy any forest area is both interesting and informative. Furthermore, such investigation can be carried on repeatedly without exhausting the possibility of new discoveries.

Suggested Activities:

1. Make two-hour surveys in a forest, at different times of year, to discover evidences of the presence of wildlife.
2. Discover and report how the forests provide shelter and cover for our wildlife.
3. Determine by reading, talking with farmers and sportsmen, and by actual survey, the variety of foods eaten by wildlife.

Possible Outcomes:

1. A realization that wild creatures can and will occupy only those areas where they can find food and shelter.
2. An understanding that forests provide the necessities of life for a variety of species of wildlife.

9. CONCEPT: THERE ARE MANY WAYS IN WHICH WE CAN CONSERVE OUR FORESTS.

Discussion: Since conservation means wise use, any study of forest conservation should consider the implications of that term. Certainly wise use of forests would imply using them for their products of economic value and at the same time enjoying their esthetic values.

Thus, forest conservation includes the multiple use of forests and the avoidance of wasting their products. It embraces also the study of protecting them from their natural enemies, and of reducing to a minimum the man-caused damages to them. The latter should obviously consist of fire prevention, proper harvesting practices, and control of grazing.

Since forests are renewable as a resource, methods of providing continuous supplies of forest products should not be omitted from any study of forest conservation. The Louisiana Forestry Commission and the U.S. Forest Service can assist in such a study and promote such practices.

Suggested Activities:

1. Some pupils have had opportunities to visit, or to have seen, a tree farm. Allow them to tell the class about this experience.
2. Pine tree seedlings can be obtained from the Louisiana Forestry Commission for planting on school ground. Secure some and plant them on your school ground or in your locality. (Cypress is the official State Tree.)
3. Trees are usually planted in rows eight feet apart, with the trees six feet apart. Let students draw a picture of a plantation of trees.
4. Have pupils sign or recite the conservation pledge. A copy may be obtained from the Louisiana Forestry Commission or other conservation agencies.
5. Make posters in your class or in your school about the prevention of forest fires.
6. Selective cutting means cutting each tree for the best product it will make. Invite a forester or other qualified person to discuss this subject.
7. Visit a Louisiana Forestry Conservation installation, such as fire tower, nursery, or headquarters to learn things it does.
8. As a culminating activity, the pupils may be interested in making a booklet on this unit.

Possible Outcomes:

1. An elementary understanding that conservation of forests includes protecting them from their enemies, managing them for income-producing crops, and enjoying their recreational values.
2. An acquaintance with the work of the Louisiana Forestry Commission and its importance.

10. CONCEPT: FORESTS AND THEIR PRODUCTS PROVIDE US WITH MANY DAILY ESSENTIALS.

Discussion: Forests in Louisiana perform at least two services for its citizens that would have to be called non-economic. They function in Nature's balance by helping other green plants to maintain the supply of oxygen in the air, and they are particularly helpful in sustaining the underground water level and also in retarding soil erosion.

From the economic viewpoint, forests provide us with many valuable products. Among these should be listed lumber, paper pulp, plyboard, naval stores, and some fuel. To these should be added the gainful employment of thousands of men who are engaged in harvesting the forest products and processing them in the industrial plants that change them into the forms in which they appear on the market. In Louisiana, only the petrochemical industry yields higher economic returns than does the forest-based chain of activities.

Suggested Activities:

1. Make a list of items used daily derived from forests and their products.
2. If possible, try to schedule a visit to a papermill.
3. Invite a forester in your area to discuss products of the forest.
4. Have students prepare booklets showing useful products of trees. Illustrate with pictures.
5. Prepare a bulletin board for the same purpose.
6. Have a Boy Scout discuss survival possibilities in the forest.

Possible Outcomes:

1. A partial perception of the variety of ways forest products touch the lives of each student daily.
2. An elementary realization of the tremendous money value of forests to the people of Louisiana.
3. A realization of the various types of work connected with forests and their products, and the large number of families that are supported by such employment.

JUNIOR HIGH SCHOOL

1. CONCEPT: TREES CAN BE RECOGNIZED BY CERTAIN CHARACTERISTICS.

Discussion: At the intermediate level the distinguishing characteristics of trees were presented in a rather elementary fashion. The features by which identification could be made were listed as bark, leaves, flowers, fruit, and possibly, location. It was suggested that no attempts be made at that level to differentiate within the broad groups.

At this level, it is felt that students are mature enough to learn to identify different kinds of oaks, pines, hickories, etc. For this purpose, more detailed observations and deeper study will be necessary, particularly of the bark, leaves, and fruits of the trees. Leaf shape and margins will need to be given careful scrutiny. Bark must be observed for color, surface, and shedding. Fruits, dry or fleshy, will need to be given close observation for differences that distinguish certain species.

Students will need adequate literature, such as handbooks or manuals to guide them in the differentiation of the various species that appear in Louisiana.

Suggested Activities:

1. Observe and identify trees in your immediate area. Use handbooks and manuals.
2. Make a leaf collection, noting the differences among species and between leaves of the same tree.
3. Have students make reports on different trees. Make a chart:
   (a) name of tree
   (b) drawings of leaf, tree shape, flower, bark pattern, etc.
4. Have students bring specimens of tree parts such as twigs, fruit, flowers, etc., for identification.
5. Observe and compare bark differences among various species of growing trees.

Possible Outcomes:

1. The ability to identify species of trees common to the area in which the students live.
2. Sharpening of observation skills to detect different characteristics that identify species of trees.
3. Skill in using manuals and handbooks in the identification of trees.

2. CONCEPT: DIFFERENT PARTS OF A TREE PERFORM SPECIAL FUNCTIONS.

Discussion: At the primary level, the children learned the distinctive parts of green plants. Trees present these same parts, so students at the junior high-school level will need to review this list. It includes roots, stem and branches, leaves, flowers, fruits, and seeds.

Here, the students should learn the functions of the several parts as they appear among trees. Briefly, the roots of the tree hold it in place and absorb water and minerals that will dissolve in water. This is done by a process known as osmosis. Through tiny tubes in the roots, stems, and branches, this water is carried upward to the leaves by a process called capillary action. The functions of the stem and sub-stems (branches) are to transmit the water to the leaves, and to hold the leaves up to receive rays of sunlight. The leaves take carbon dioxide from the air and combine it with the water delivered to them and, in the presence of sunlight, manufacture the basic food substance called starch. Starch may be converted to fats or proteins by further chemical action within the leaves. This is the process called photosynthesis.

A complete flower contains both stamen and pistil, male and female organs respectively. Some species bear incomplete flowers, that is staminate (male) flowers on one tree and pistillate (female) flowers on another. In such a case, the pollen from the former must reach the flower on the latter, if seeds are to be produced. The only function of the flower is to produce seeds. If the tree depends on wind or gravity to cross pollinate the flowers, they may be fairly inconspicuous. But if the flowers must be pollinated by insects, they will be fairly gaudy in appearance and will contain nectar to attract the insects.

A seed is a ripened ovary of a pistillate flower or, of a complete flower. The seed contains an embryonic plant with enough food stored in it to support the embryo through germination and until adequate leaves are developed to make the baby tree self supporting. All this is enclosed in a protective covering that may vary with the species.

Fleshy fruits appear on trees that depend on animals to disperse their seeds. In such cases the seed coverings within the fruits are generally impervious to digestive juices of animals so the seeds will be dropped elsewhere after the fruits have been eaten. Formation of flowers, fruits, and seeds constitute the reproductive functions of the tree.

Suggested Activities:

1. Show that the stem carries water to all parts of a plant.
   Examples: Put a cut flower or celery stalk in colored water and observe color change.

2. Study diagrams of parts of a tree. Use the chart made in activity no. 3 under Concept 1.
3. Demonstrate photosynthesis.
   (photo=light, synthesis=putting together) Carbon dioxide and water produce sugar and starch, using energy from light.
   A simple experiment can convince us that this is true. You can cut a square in a piece of aluminum foil. Use the foil to cover one of the two primary leaves of a young bean plant growing in a pot. (Be sure the cotyledons have been shed.) Let the plant photosynthesize for a few days by keeping it under the same good conditions under which it grew before you started the test. Now, cut off both leaves and plunge them into boiling alcohol. (CAUTION: DO NOT BOIL ALCOHOL OVER AN OPEN FLAME.) You will notice that the green pigment dissolves in the alcohol. The decolored leaves should then be removed from the boiling alcohol and placed in a shallow dish containing a dilute solution of iodine in potassium iodide. After a while, you will notice that the leaf that remained uncovered turns blue. This indicates the presence of starch. In the other leaf, only the square appears in blue. Starch was formed only in the portion of the leaf that received light. This demonstration could be conducted in another way. Cover a square on growing leaf in full sunlight and test after one hour. Compare results and draw conclusions.
4. Roots synthesize (produce) organic compounds and take in water through the process of osmosis.
   Osmosis may be demonstrated either of two simple ways. (a) Cover the mouth of a thistle tube with the membrane (skin just next to the shell) of a boiled egg. Secure it tightly with a rubber band. Fill the thistle tube with water so that it barely comes up into the narrow part when the whole is inverted. Mark the level in the tube. Then secure it in an inverted position with the bulb partly immersed in a strong solution of salt water. Let stand until next day. Observe to see height of water in tube compared to original mark. (b) Pull a growing carrot from the soil, being careful not to disturb the tiny root hairs more than necessary. Cut off the leaves. Bore a small hole in the top about an inch deep. Insert a glass tube (6" to 8" long) in the hole and seal around it with paraffin. Immerse the carrot in water up to about an inch of the top. Secure it in this position. Next day look for water in the tube. Draw conclusions.
5. In order to observe the parts of a seed, soak large lima beans overnight, open next day and find the embryo, the cotyledons, and the covering.

Possible Outcome:

1. Further understanding of the biological functions of the roots, trunk, branches, leaves, flowers, fruits, and seeds of a tree.

3. CONCEPT: TOPOGRAPHY AND CLIMATE INFLUENCE THE FOREST COMMUNITY.

Discussion: Generally speaking, forests are composed of hardwoods or softwoods, though many forests include the two types. The difference does not refer to actual hardness or softness of the wood itself. Roughly, the two types may be distinguished by the fact that softwoods bear their seeds in cones (such as pine and cypress) and are called conifers for that reason. Hardwoods bear seeds separate from each other. There are other differences, but they are technical and need not be considered at this level. Hardwoods usually grow in bottom lands in Louisiana, while softwoods may be found more frequently in the upland regions of our state.

Like all other living things trees exhibit the struggle for existence and survival of the fittest. This is Nature's way of providing that the strongest individuals of any species will be the progenitors of future generations of that species. Trees compete with each other and other plants for land areas in which to sink their roots to take water and minerals from the soil. They also compete for space to obtain light, so necessary for their continued life and growth. Always this competition is ruthless. The stronger survive, the weaker perish.

The climatic factors such as temperature, rainfall, and direction of prevailing winds influence the growth of trees. In Louisiana, these factors are not very important as determiners of the types of forests that occur or the rates at which they grow. The average rainfall in south Louisiana is greater than that in the northern part, and this makes some difference in the rate of growth of the forests, but not much. Prevailing offshore winds cause trees along our coast to lean inland but these are not usually forests.

Elevation above sea level, a topographical factor, varies so little within Louisiana that it has slight influence on forest type or rate of growth. The higher sections of the state show different types of forest from those in the lower elevations but soil types and rainfall are probably the determiners of these differences to a greater extent than elevation.

Suggested Activities:

1. Use maps of the United States to show relationship between climate, soils, and forests.

2. Use a Louisiana map in the same manner to show relationship between climate, soil type, and types of forests.

3. Take a field trip to compare a wooded area to an open area with respect to temperature, humidity, and wind velocity.
4. Biotic factors of competition.
   a. Note evidences of competition for light by comparing the shape of trees growing in the open, to that of trees of the same species growing in a dense stand (thicket).
   b. Find evidence of competition for soil area by looking for seedlings in a grass-covered opening in a forest. Compare the number of seedlings in the grass-covered opening with the number of seedlings to be found in an unsodded opening in the forest.

Possible Outcomes:

1. A further understanding of the differences between hardwoods and softwoods.
2. A realization of the ways trees struggle for existence by competing with each other for soil area, water, and sunlight.
3. A perception of ways climatic conditions influence forest growth and types in Louisiana.
4. An understanding that elevation has little effect on forest types in Louisiana.

4. CONCEPT: MAN SUPPLEMENTS NATURAL FOREST REPRODUCTION.

Discussion: In this concept we reach the practice of reforestation. Artificial reforestation, one of the most important practices in renewal of forest resources, consists of man's actual planting of forest trees. It was developed as a solution to the problem presented by millions of bare acres that had been denuded by "cleancut" lumbering by early exploiters of the forests.

As it has developed in Louisiana, it includes the production of tree seedlings in nurseries where seeds are planted under huge garden-like conditions. Seeds of desired species are harvested in the fall and planted in the nurseries where conditions of soil and water supply are carefully controlled. Millions of seedlings (baby trees) are produced annually.

In the early stages of reforestation practices, seedlings were planted by hand. This was a laborious and expensive practice. Modern means employ machines that are tractor drawn and can plant thousands of seedlings daily. A fairly recent innovation in reforestation practices employs an airplane that sows tree seeds treated with repellents over open land areas. Although this method saves much time and labor there may be loss of seeds from unfavorable germinating conditions and late summer drought.

Suggested Activities:

1. Invite a forester or nurseryman from the Louisiana Forestry Commission to discuss site preparation, seeding, and nurseries.
2. Plan a field trip to a nursery or tree farm to study methods of reforestation carried on there.
3. Have students write an illustrated paper on reforestation.
4. Make a scrapbook of newspaper and magazine articles dealing with forestry.
5. Plant trees on school ground. Have Arbor Day celebration.

Possible Outcomes:

1. An awareness of the need for, and value of, reforestation in Louisiana.
2. An understanding of the different steps in the process of reforestation as practiced in Louisiana.
3. A realization of the functioning of the Louisiana Forestry Commission in the State's efforts to restore its forests.

5. CONCEPT: (INCLUDED IN NO. 3, AT THIS LEVEL)

6. CONCEPT: FOREST PROTECTION IS AN INDIVIDUAL AND PUBLIC RESPONSIBILITY.

Discussion: At the intermediate level the students were made aware of the types of enemies that inflict damage on forests. Here they now consider the protection of forests from those enemies. There is no way to protect forests from the natural forces of severe wind or ice storms, but except for these, both individuals and public organizations can do much to decrease the effects of the other enemies on forests.

Smokey Bear's statement that, "Only you can prevent forest fires," is familiar to all and rings with eternal truth. Every man, woman, and child can help to prevent fire in the forest and should realize that fact and accept the responsibility of making it a personal one. All timber workers and lumbermen should be impressed with their individual and collective responsibility for harvesting trees for lumber, pulpwood, or plywood in such fashion that the forest is not unduly damaged in the process. Farmers and cattlemen should be made aware of their responsibility in preventing forest damage by overgrazing of livestock.

The Louisiana Forestry Commission is a state organization that exists to help protect and improve the forests of the State. Among the functions performed by the Forestry Commission are fire detection and suppression, advising owners of woodlands on, and assisting them with, destruction of insects and diseases that damage trees, research and assistance in forest management, preparation of educational materials about forests, and presentation of informative lectures about forests to schools, clubs, or other interested groups.

Suggested Activities:

1. Discuss and explain the work of the Louisiana Forestry Commission.
2. Make charts, graphs, or drawings of sections of the Southern United States. Show comparison between extent of forests when the white man first came and that of today.
3. Have members of the class prepare reports or displays showing contrast between burned forest and unburned forest.
4. Have students bring in samples of burned, diseased, and/or insect-damaged wood.
5. Make reports on causes of forest fires and damages done by them.
6. Visit a hardwood forest area. Find evidences of trees damaged by fire. (Such damage is more permanent than in pine forests.)

Possible Outcomes:

1. An awareness on the part of each student of his individual responsibility for protecting the forest, and of how he can discharge that obligation.
2. An understanding of the facilities provided by the Louisiana Forestry Commission for the protection of our forests, and of how they function.

7. CONCEPT: FORESTS PROVIDE POSSIBILITIES FOR MULTIPLE USE.

Discussion: "Multiple use" means using land for more than one purpose in the same period of time. Applied to forests, it implies use of woodlands for recreational facilities while wood is being produced. The general idea is not new, but it is being emphasized much more at present than was formerly the case.

Conditions throughout the country, and which exist in Louisiana too, that bear on this emphasis could be listed as (1) the migration of rural residents to urban areas; (2) the tremendous increase in population; (3) increased leisure time; (4) the fact that forest areas are being reduced by building of new super highways, new reservoirs, and by power and pipe line rights of way.

But people want much of their recreation out of doors. A survey carried out a few years ago showed that of the seventeen favorite outdoor activities of the American people, seven of them could be enjoyed in forested areas and, if the forest borders lakes or streams, four more of them could be accommodated.

Most publicly owned forests and many privately owned ones are being equipped nowadays with facilities to provide recreation for the public. Forest lands are becoming sprinkled with picnic areas where tables, barbecue pits, water wells, trash cans, and toilet facilities are prepared either at public or private expense. All-weather roads are usually being built to such areas.

On both public and many private woodland areas, wildlife authorities are developing management of wildlife to restore native species and to provide better hunting grounds for more people who seek that type of recreation.

It should be noted, that outdoor recreation is not the only concomitant service provided to man by the forest in addition to its supplying him with wood products. Forests also contribute to the prevention of soil erosion, to the conservation of water supplies and prevention of floods within a watershed, to the renewal of wildlife resources, and to meeting grazing needs for livestock.

Suggested Activities:

1. Find and identify wild flowers in a forested area. Photograph or diagram (color and label) such flowers, while leaving them for others to enjoy.
2. Find and identify flowering shrubs in a forested area. Photograph or diagram (color and label) such shrubs, while leaving them for others to enjoy.
3. Consult physical education or scout personnel for information concerning outdoor recreation with special emphasis on camping.
4. Discuss possible correlation of knowledge of forests with other curricular areas.
5. Survey the community for possible outdoor recreation clubs. If none exist, consider promoting some.
6. Develop a nature trail in the vicinity.
7. Try to borrow slide lecture on multiple use of forests from Louisiana Forestry Commission. (with accompanying guide)
8. Have students tell how they used the forest for recreation--examples: picnics, camping, boating, hunting, etc.

Possible Outcomes:

1. An understanding of the meaning and implications of the term multiple use.
2. A realization of the variety of possible uses of woodlands in addition to the yielding of wood products.
3. An awareness of the ever-increasing demands being made on our forest lands by an exploding population becoming more urban constantly.

8. CONCEPT: FORESTS AND WILDLIFE ARE INTERDEPENDENT IN THE NATURAL STATE.

Discussion: Nature's balance between plants and animals can best be observed in forest areas, especially if the forest includes streams or water bodies. Many wildlife species prefer to make their homes in the forest because it provides them with food and shelters them from weather and other natural enemies.

Mast in the forest, consisting of seeds and fruits of various plants making up the several levels of the forest community, provides food for most birds and non-flesh eating species. The flesh eaters find abundant prey among the smaller animals and insects. The vegetative growth supplies seclusion for animals where their young can be reared in comparative safety and where they can hide to sleep in day or night according to their habits.

In a small way also, the balance between plants and animals in a forest area exhibits Nature's carbon cycle and oxygen cycle. Of course, this extends far beyond the borders of the forest, but it can be studied there. No air pollution would likely be found there and even water pollution would be rare. Students at this level should be made increasingly aware of modern threats to the disturbance of such natural balances so important to man's health and continued existence.

Suggested Activities:

1. Have each student select one species of wildlife and show how it is dependent on the forest for shelter and food.
2. Collect and identify as many as possible of the wildlife foods provided by the forest in your area.
3. Make a picture board showing native wildlife and birds found in surrounding forests.
4. Locate existing brush and shelter for wildlife. Try to determine which animals use it.
5. Interview early settlers to find out which wild animals have disappeared and why.
6. Observe several farm fence rows for presence of trees or shrubs that may have grown from seeds dispersed by animals.
7. Discuss Nature's balance. Emphasize food production vs oxidation, the carbon cycle, the oxygen cycle, and the water cycle.
8. Prepare a diorama of a typical nature scene, which includes wild flowers, birds, trees, shrubs, and other plants and animals of the forest. Emphasize interrelationships to each other and the environment.

Possible Outcomes:

1. A reinforced concept of Nature's balance between plants and animals, particularly in the areas of photosynthesis vs oxidation, the carbon cycle, the oxygen cycle, and the water cycle.
2. An awareness of the place forests hold in these cycles that make up Nature's balance.

9. CONCEPT: FOREST CONSERVATION EMBODIES FOREST MANAGEMENT.

Discussion: Two basic understandings should be reviewed here: (1) conservation means wise use and, (2) forests are renewable. Forest conservation, then, implies wise use of a renewable resource. Amplified, this statement indicates that forests should be used to supply man's need for wood products while, at the same time, assuring a recurring and continuing replenishment to meet man's need for such products tomorrow.

The science of forestry is fundamentally the science of forest management to the end that these very objectives (just stated) may be realized. The science of forest management is built around the ideas of growing forests best suited to certain land types, maintaining the best possible stands of trees, and reaping the highest possible financial returns from this kind of land use. Forest managers have developed practices in four categories that have been proved to be desirable for achieving the best results from forests. These are reforestation, protection, selective harvesting, and multiple use. The first, second, and fourth of these have been treated briefly at this grade level already.

Selective harvesting implies selling the forest products harvested but doing the cutting in a way that will improve the remaining forest and help it to yield more and better products later. Such management provides for thinning trees that grow so close together that they cannot obtain sufficient sunlight and soil water, removing cull trees to make room for more valuable ones, removing diseased trees or those infested by harmful insects to prevent further spread of either, and controlled burning in pine forests to kill young weed trees. There are other methods of harvesting besides selective cutting. Their use is largely determined by the industrial ownership needs and preferred markets. For example: a pulp and paper industry may choose to grow a plantation to age 25 or 30, then clear cut and replant to obtain the greatest volume of cellulose fiber that can be grown on that area. Needless to say, all these practices should be directed by trained foresters equipped with all safety devices necessary.

Suggested Activities:

1. Discuss and stress the importance of prescribed burning and reforestation.
2. Note the difference in run-off of water from cultivated land and forest land after a hard rain. Give reasons for the difference.
3. Observe a locality in which the land has been over-grazed. Note that seedling trees have been damaged or destroyed.
4. Illustrate by drawings how forests help prevent erosion.

5. Prepare two flats of soil lined with tar paper or aluminum foil to make the bottoms waterproof (one flat has soil with no humus, only sand or clay; the other flat is arranged with humus from the forest--leaves, litter, and several branches with many leaves to stimulate trees); two pieces of tar paper or foil to catch and direct the runoff water; two jars with wide mouths; one sprinkling can. Tilt the flats slightly. Sprinkle water as "rain" and catch the runoff in the jars. Compare the amounts, and draw conclusions.
6. In order to provide a graphic display of one method of forest improvement, construct a pegboard forest. See instructions in appendix.
7. Invite a forester from a pulp-paper industry to show and explain the difference between selective cutting and other methods of harvesting.
8. Establish a Conservation Club in your school or community.

Possible Outcomes:

1. An understanding that forest management includes reforestation, forest protection, harvesting, and multiple use.
2. Advanced understandings of the practices of reforestation, forest protection, and multiple use of forests.
3. An awareness of the meaning of selective harvesting and how it improves Louisiana's forests.
4. Further awareness of how the science of forestry influences the perpetuation of forests as a renewable resource.

10. CONCEPT: UTILIZATION OF FOREST PRODUCTS IS BASIC TO LOUISIANA ECONOMY.

Discussion: The forests of Louisiana rank second only to the petrochemical industry as producers of economic wealth in the state. This includes the value of the products themselves and the amount of gainful employment needed to harvest and process the raw products into ultimate forms for the consumers of them. It is claimed that one of every three workers in Louisiana industry is engaged in employment based on forests.

Students at the junior-high-school level should be guided into studies of the variety of finished products obtained from Louisiana's forests.

Suggested Activities:

1. Find out what nearby industries are dependent upon trees. Determine the number of citizens employed and the importance of forests to the community.
2. List recreational areas of Louisiana in state and national forests.
3. Discuss difference between state forests and state parks. Use state park maps.

4. Do library research to determine exactly how important forest products are to Louisiana's economy.
5. List jobs in the state that are affected by or dependent upon forestry products.
6. List important uses, and make a display, of tree products.
7. If possible, try to arrange a visit to a pulp or paper mill.
8. Have a simple demonstration of making paper. (See appendix)
9. Visit a house being constructed. List the wood products being used.
10. Visit a forest industry in your vicinity. Write a report on observations made and understandings gained.

Possible Outcomes:

1. Advanced understanding of the values of Louisiana's forests to the whole economy of the state, including values of the raw products, the investment in processing industries, the transportation of products, and the employment in all of these.

GLOSSARY OF TERMS

ARBOR DAY:
A day observed by planting trees. The date varies in different places.

BALANCE OF NATURE:
A condition existing in the animal and plant population of a region when relatively few changes occur in the environment.

BIOTIC:
Refers to life, living.

CARBON CYCLE:
Circulation of carbon from carbon dioxide in the air to plants and animals and back to the air.

CATACLYSM:
Any great change such as flood, earthquake, or other violent change.

CATEGORY:
Class, group, or division in a general system of classification.

CHARACTERISTICS:
Special qualities or features.

CHLOROPHYLL:
Green pigment found in green plants.

COLEUS:
Foliage plant belonging to the mint family, often grown for their showy colored leaves.

COMMUNITY:
A group of plants in a common place.

CONCEPT:
Idea; general notion.

CONCOMITANT:
Service provided to man in addition to or coming at the same time as another service.

CONIFEROUS:
Belonging to or having to do with trees bearing cones.

CONSERVATION:
Wise use; using a resource but not wasting it.

CORM:
A short, firm, enlarged, fleshy underground stem as in the crocus.

DECIDUOUS:
Shedding leaves annually.

ECONOMY:
A system of managing the production, distribution, and consumption of goods.

EMBRYO:
A young organism in early stages of development.

ENEMY:
Anything harmful.

EROSION:
The detachment and movement of particles of the land surface by wind, water, ice, or earth movements.

EVAPORATION:
The process by which a liquid becomes a gas.

EVERGREEN:
Having green leaves all the year round, yet continually shedding leaves.

FUNGI:
Plants lacking chlorophyll, such as molds, yeasts, rusts, and mushrooms.

HABITAT:
The locality or external environment in which a plant or animal lives.

HARDWOOD:
A nonconiferous tree having broad leaves.

HUMUS:
Organic matter in the late stages of decay.

IDENTIFY:
To prove to be a certain thing.

INTERDEPENDENT:
Dependent on each other.

LIVERWORTS:
Any of various plants that grow mostly on damp ground, the trunks of trees, etc. (somewhat like mosses)

MAST:
Seeds and fruits of various plants of the forest community used by animals for food.

MULTIPLE USE:
Using land for more than one purpose during the same period of time.

NURSERIES:
Places where young trees and plants are grown for reforestation.

OSMOSIS:
The movement of fluids through a membrane.

OUTDOOR LABORATORY:
An area used for outdoor learning.

OUTDOOR RECREATION:
Participating on a voluntary basis in outdoor activities that are enjoyable and creative.

OXYGEN CYCLE:
Circulation of oxygen among plants, animals, and air.

PHOTOSYNTHESIS:
(Photo=light; synthesis=putting together) A process of food making by green plants, upon which all living things on earth depend.

POLLUTION:
Making impure, or unfit to inhabit, the place where a plant or animal naturally lives or grows.

PROGENITORS:
Forefathers.

PROPAGATION:
Increase in number of plants by use of seeds, bulbs, corms, cuttings, or other plant parts.

RENEWABLE RESOURCE:
Any supply which can be replenished.

RURAL:
Referring to the country--outside of the city.

SEED DISPERSAL:
Getting seeds scattered to places beyond the soil at the base of the plant.

SOFTWOOD:
A conifercus tree with needle-like leaves.

SPECIES:
A unit of classification of plants and/or animals.

SUPPLEMENT:
Something added.

TERRARIUM:
Small, indoor, glass-enclosed garden containing growing plants and animals.

TOPOGRAPHY:
The surface features of a place or region.

URBAN:
Belonging to or having to do with the city.

VENATION:
System or arrangement of veins in leaves.

WATERSHED:
An area of land with a common drainage outlet.

WEED TREE:
Any tree undesirable or unwanted for a particular location.

WILDFIRE:
Uncontrolled fire in the forest.

APPENDIX I

HOW TO MAKE PAPER BY HAND

Many variations in this procedure can be introduced. It is not the purpose here to give a hard-and-fast set of instructions, but to provide general guidance, with the idea that the student will experiment and perfect his own process of papermaking. It is the student's ingenuity that counts!

HERE IS YOUR EQUIPMENT:

1. Fine-meshed screen wire.

2. Metal pan. An old biscuit pan, refrigerator tray, aluminum frozen food container, etc., can be used. Trim the wire to fit inside the pan. Then cut out the bottom of the pan, leaving a ledge of about one-half inch wide to support the wire, which then becomes the bottom of the pan.

3. Forming rack or mold. This can be made from a second pan that will fit inside the first. Cut out the ENTIRE bottom, leaving only the sides. The rack can be made of four strips of wood fastened together, or of Erector Set parts.

4. Basin that will hold at least 10 quarts of water.

5. Pulp samples from a pulp company. Or, you can use facial tissue, provided it is not wet-strength tissue.

6. A supply of white blotters or blotting paper.

7. Laundry starch. One tablespoon of instant starch in two cups of water will provide what commercial papermakers call "size".

8. Rotary egg beater or Waring blender.

9. Household electric iron.

10. Scissors to trim your paper.

STEP No. 1 - Assemble your materials. Tear up one ounce of pulp and put small pieces in 10-quart basin. Cover with two quarts of water and stir.

STEP No. 2 - Pour in the starch and additional water to make about 10 quarts. Beat until thoroughly mixed.

STEP No. 3 - Prepare the paper machine, consisting of pan, wire and forming rack. An old refrigerator ice tray and rack may be used.

STEP No. 4 - Hold forming rack firmly on the wire, and dip sidewise into the pulp mixture.

STEP No. 5 - Clean off pulp outside forming rack. Lift out the wet film of pulp on the wire.

STEP No. 6 - Dry the wire and film between two sheets of blotting paper.

STEP No. 7 - The film will stick to the blotter. Iron the pulp between blotters.

STEP No. 8 - You now have dry paper, which may be trimmed with scissors.

STEP No. 9 - You can now write on the paper with a ballpoint pen. You can carry your experiments further with the aid of your science teacher, who will assist you in bleaching the pulp by the use of a household product like Clorox. You can also color the pulp mixture and therefore the paper.

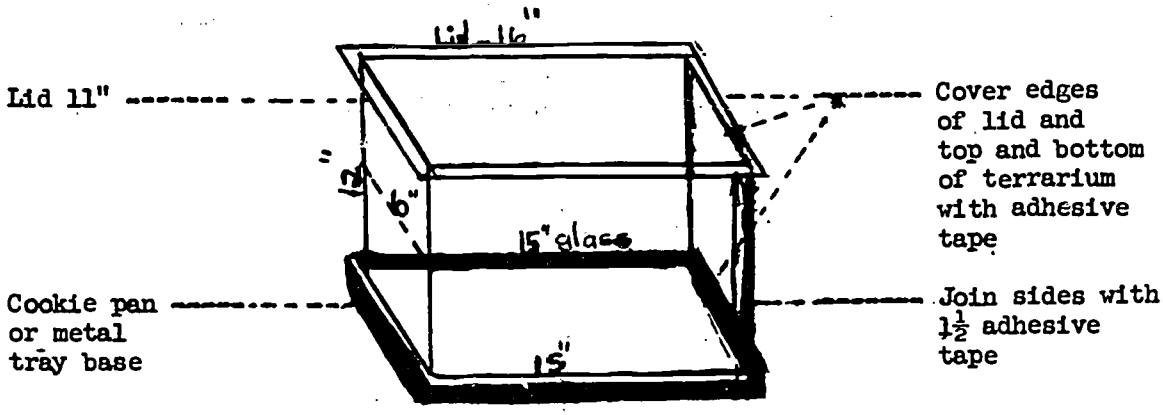
(Adapted from illustrated booklet prepared by The Chesapeake Corporation of Virginia)

APPENDIX II

Building Terrariums

Partial outdoor communities may be reproduced in various types of terrariums to provide a spot of beauty and to "spark" interest in developing concepts of time, change, adaptation, variety, and the interplay of forces. Different parts of the earth, such as a desert, a meadow, a swamp, the bank of a stream, and a forest or woodland, may be duplicated in terrariums. In addition, a terrarium can do almost anything a hothouse can do.

A terrarium may be made in a gallon-sized mayonnaise or pickle jar, an aquarium tank, or a glass bowl. The teacher, or the teacher and the children, may make the following container for less than two dollars:



Materials:

Glass - Use double strength glass if it is available. The size of the terrarium depends upon the use for which it is intended. An adequate workable type may be 10" x 12" and 15" x 12". The lid which helps hold moisture and keeps dust out and animals in, should extend ½" on all sides of the terrarium.

Screen wire - Cover the top of a desert terrarium with screen.

Cookie pan or metal tray for the base - Covering the base with aluminum foil will prevent rusting. However, an unprotected tray will last about three years, and the rusting metal tray will provide minerals for plants.

Plaster of paris - Plaster of paris may be used around the edge of the pan or tray.

Directions for construction:

Tear adhesive about ½" longer than the sides. Join sides by pressing the tape first with fingers, then with scissors. Don't put tape

on the inside if water is to be used. Cover edges of the top and bottom with a continuous piece of tape to give support.

Stocking Terrariums

Woodlawn and garden terrariums - Place gravel, which permits air to circulate through the soil and provides for drainage, in the bottom of the container. Next, put in wood charcoal to help drain the soil and to keep the soil "sweet" by retarding the growth of bacteria and molds. Soaking the charcoal overnight helps remove acid. Put the sand on top of the charcoal. Use soil from the plants' environment. Place tall plants in the back of the container. Lily-of-the-valley may be placed at the back and dwarf tulips in the front. Pine seeds or seedlings, acorns, pansies, violets, fern, moss, and so on may be included. A small dish of water emulates a pool or a puddle. Tree frogs, salamanders, toads, snakes, earthworms, turtles, and insects may be included.

Swamp or bank-of-a-river terrariums - Basic materials are one-third each of sand, gravel, and peat. Bogs and swamps usually have acid-soil conditions, and peat provides this necessary acidity. A bowl or a wash basin may be used for frog eggs. Plants may include cattails, watercress, liverwort, and so on. Tree frogs, salamanders, toads, snakes, alligators, and insects may be added.

Desert terrarium - Use sand or sand mixed with ordinary garden soil. Include various kinds of cacti and several rocks. Small snakes and horned toads will help provide a stimulated partial desert community. Water about once every two weeks.

The most desirable way to stock a terrarium is for the teacher and the children to make a trip to obtain plants and animals from the environment. In addition, parents and children may contribute plants and animals. Some plants, such as cacti, may be purchased. About two weeks after the plants have been introduced into the terrarium, their root systems will be developed enough to add the animals.

The desert terrarium should have a screen top; the other types, glass tops. The desert terrarium should have much light; the others need subdued light.

Caring For Terrariums

"Care must be taken not to use too much water in any terrarium. If there seems to be too much moisture, the glass top may be removed for a time, permitting some of the excess to evaporate. Molds sometimes appear if there is too much moisture. They may be eliminated by the use of a little powdered sulfur or slaked lime. If aphids appear, the animals should be removed from the terrarium and the plants sprayed with a solution of nicotine sulfate, which may be purchased from any drugstore and used according to the directions furnished with it.

"Salamanders and turtles should be removed from the terrarium when they are to be fed. They will live on small earthworms, swatted flies, raw fish, or small pieces of raw meat which have been finely ground. Toads will eat flies placed in the terrarium; horned toads and other lizards must have living food. They will eat meal worms, cockroaches, grasshoppers, and ants. Small snakes will eat cockroaches, earthworms, and small fish."*

*Gerald S. Craig, Science for the Elementary - School Teacher (Boston, Ginn and Company, 1947), p. 257.

Note: Some of the ideas about terrariums were drawn from Teachers Manual for Science Everywhere by Craig and Lembach, Ginn and Company, 1956.

APPENDIX III

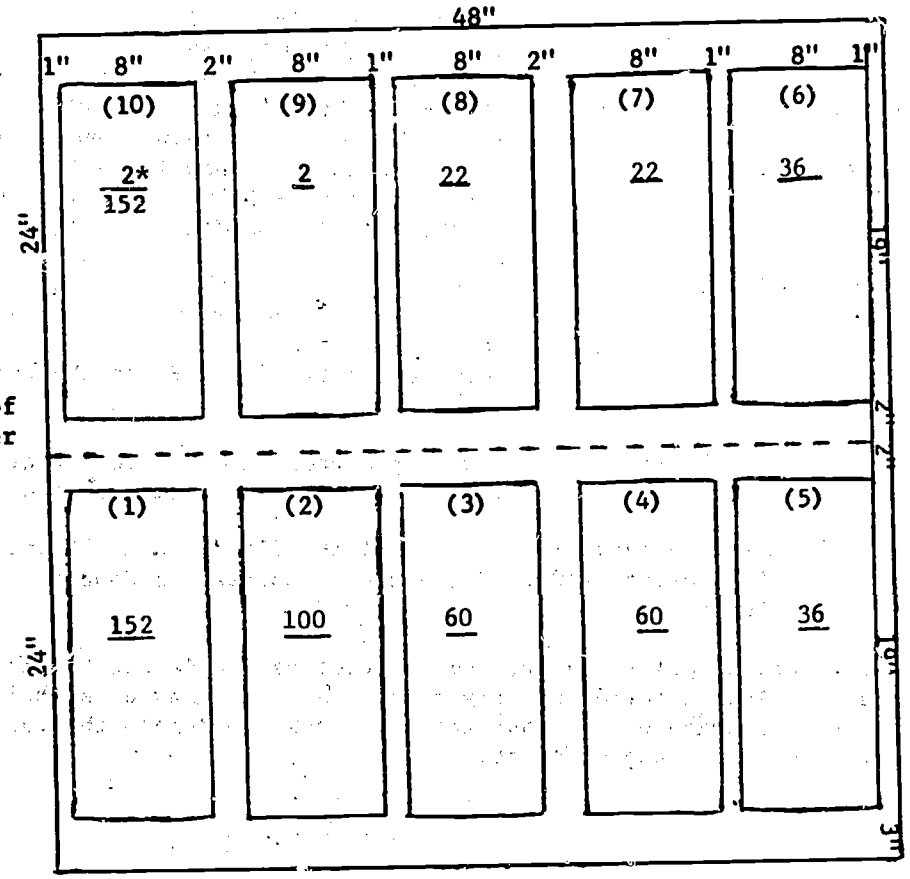
CONSTRUCTION OF THE PEGBOARD FOREST

Purpose To provide a graphic display of the periodic cuttings and treatments in a forest stand throughout one rotation.

Materials

1. Two 2' x 4' pegboards 1/8" thick with 3/16" diameter holes on a 1" x 1" spacing.
2. 100 wooden dowel rods 3/16" diameter x 3' long
3. 200 sheets dark green construction paper 9" x 11-3/4"
4. One-half pint flat white enamel
5. One-half pint flat tan enamel
6. One-half pint brown wood stain
7. Masking tape
8. 1' x 2' sheet poster paper
9. Cellophane tape

Total cost about $10.00



*Number of trees per block.

Procedure

1. Paint pegboards with white one side.
2. Border blocks (1) through (10) with masking tape and paint tan.
3. Stain dowel rods with brown wood stain.
4. Cut tree trunks from dowels to lengths and form cone from semicircle of construction paper for crown according to the following dimensions:

Block No.	Trunk (in.)	Semicircle Diameter (in.)	Cone Base Diameter (in.)
(1)	1	1-1/2	1/2
(2) (3)	4-3/4	4	1-1/2
(4) (5)	6-1/2	6	2
(6) (7)	8-1/4	7	2-1/2
(8) (9)	9-1/2	8	3
(10)	The 4 seed trees same size as (9) The 152 seedlings same size as (1)		

5. Distribute trees systematically in the appropriate blocks. Even spacing is possible only in blocks (1) and (10).
6. On 3" x 6" cards of poster paper print explanation for blocks reading as follows:

Block No.		
(1)	1 - 14 years	Size - seedling to 35' high - Cull tree control; Fire Protection.
(2) (3)	15 - 20 years	Size - Height 40', Dbh 5" - 8" First Thinning - Pulpwood and posts.
(4) (5)	25 - 30 years	Size - Height 55', Dbh 8" - 10" Second Thinning - Pulpwood and small poles.
(6) (7)	35 - 40 years	Size - Height 70', Dbh 10" - 14". Third Thinning - Pulpwood, poles and sawtimber. Brush Control - Chemical, mechanical or prescribe burn.
(8) (9)	45 - 50 years	Size - Height 80', Dbh 14" - 18" Harvest Cut (Seed tree) - Sawtimber, poles and Veneer logs. Seedbed Preparation - Prescribe burn or mechanical.
(10)	50 - 55 years	New crop established - Fire protection. Seed tree removal - Sawtimber and veneer logs.

7. Arrange cards in front of blocks (1) through (5) and behind blocks (6) through (10). These can be mounted on dowels cut to appropriate lengths.

Note: The colors of paint, paper, and ink used may be varied to please individual taste. Also, a series of bright colored arrows may be stenciled in a counterclockwise oval across the ten blocks to denote the continuous nature of the managed forest.

Conservation Pledge

I GIVE MY
PLEDGE AS AN AMERICAN
TO SAVE AND FAITHFULLY TO
DEFEND FROM WASTE THE
NATURAL RESOURCES OF
MY COUNTRY — ITS SOIL
AND MINERALS, ITS
FORESTS, WATERS,
AND WILDLIFE