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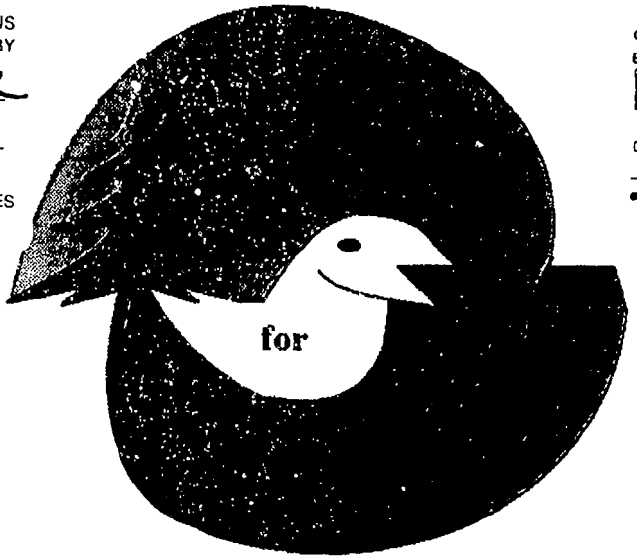
ABSTRACT

The "Kids for Trees" program described in this guidebook is a hands-on natural resource management experience where students raise trees from seedlings to harvest and manage other natural resources in a sustainable manner. Sections of the book include key concepts, getting started, needs of different kinds of trees, learning about potential growing sites, caring for the tree, raising willows, maximizing the educational value, and keeping the program going. Appendices contain a discussion of record keeping and a list of resources. (MKR)



"Kids for Trees"

Student Projects in Real-Life Natural Resource Management

Oxford County Soil & Water Conservation District, South Paris, Maine
in cooperation with the
U.S. Forest Service

Logo:

The "Kids for Trees" logo reflects some of the key concepts it is trying to promote. The outside hand and tree represents the students planting and caring for trees as a continuous renewable cycle of natural resource management. The bird in the center represents the total ecosystem emphasis of the program; that natural resources must also be managed to allow for the needs of other plants and animals.

Cover photo:

SAD #44 student studying the tree he planted in Bethel, Maine.

Acknowlegements

I would like to acknowledge all the assistance I recieved on this project and preparation of the manual. Thanks to all the school staff that put in many hours of preparation and stayed with the project all these years. Special thanks to Shirley Merrill, Lenny Hoy, Linda Wheeler and Nancy Sienkiwicz, and others on the staff of SAD #44 and SAD #72 who served as the lead teachers on this project for many years. Many community groups and organizations, including P.H. Chadbourne and Western Maine Nursery, all assisted greatly in the project. Special thanks to Donna Peare, who planted the idea in the first place, and Merle Ring, Maine Forest Service who has served all these years as technical adviser and has helped plant trees every year. Also thanks to Joel Swanton and Joyce Baker who first started planting trees in Bucksport and inspired this program. Thanks to all the reviewers, staff, and Board members who put up with me and assisted this program over the years. Final thanks to the United States Forest Service for their generous grant that allowed for the creation of this manual. "Kids for Trees" is truly an adventure in reality. We all continue to learn a great deal and have managed to have fun along the way. Thanks!

Jim Chandler, Oxford Co. SWCD

"Kids for Trees"

Student Projects in
Real-Life Natural Resource Management

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Forester assisting in a "Kids for Trees" planting - the adventure begins!

INTRODUCTION

Much of environmental education is done through the integration of supplemental curricula into existing courses. This has many advantages due to the interdisciplinary nature of environmental studies. However, with this approach, oftentimes the background students gain tends to be spotty. Students need a complete, realistic environmental management experience for understanding the workings of ecosystems and the sustainable interaction between humans and natural resources. Humans depend upon natural resources for their survival. We cannot eliminate our use of natural resources. The key is to help students develop an understanding of how resources can be utilized without destroying the resource for future generations or for the use by other plants and animals. To address these issues the "Kids for Trees" program described in this guide sets out to develop an ongoing focus for environmental studies that could be easily integrated into the school program without excessive demands on the existing curriculum. In order to give students a realistic view of environmental issues it was determined that one of the best formats for this framework would be a **real-life, hands-on natural resource management project with the focus both on the natural environment AND the sustainable utilization of natural resources by humans and other plants and animals.**

What is "Kids for Trees"?

"Kids for Trees" is a hands-on natural resource management experience where students raise trees from seedlings to harvest and manage other natural resources in a sustainable manner. The goal of the program is to help students learn in a realistic way how to balance the needs of a healthy environment with the human need to utilize natural resources.

Description of the "Kids for Trees" program:

The original projects involves students growing Christmas trees, however there are several other options also discussed in this manual. Students have been planting Christmas trees in the third grade with the goal of harvesting them during their senior year. Each year the students come back and care for the trees. In the process they learn about the challenges of the sustainable management of natural resources.

The project originated with a program starting in 1986 at the JH Hewett School in Bucksport, Maine. The 4th grade class planted Christmas trees which they raised to be harvested in their senior year. The teacher, Joy Baker, worked with a forester, Joel Swanton, to develop the program for this class. I have expanded upon this program involving all the students, starting in 3rd grade, from SAD #44, in the Bethel, Maine area, and SAD #72 in the Fryeburg, Maine area starting in 1989 and 1990 respectively. Since that time hundreds of students have been caring for hundreds of Christmas trees. The students visit the site once or twice each year. This schedule allows the program to be easily incorporated into the academic year with little disruption of existing programs.

The model used in this program involves the care of trees which includes planting, weeding,

The first class of third graders planting their trees in 1989.

mulching, liming, fertilizing, measuring, pruning, and harvesting. Students also have to be concerned with such issues as fundraising, soil fertility and moisture, insects, frost, weeds, and the characteristics of tree growth. In addition, students have built bird and bat houses and have participated in activities focusing on various parts of the environment. Observations are kept in a cumulative notebook that have been passed from year to year. In their senior year, the Christmas trees planted by the students will be harvested, with the proceeds going to help fund Project Graduation activities, a chemical free graduation celebration benefiting all the students. As the trees of one class are harvested, a new class starts the process all over again in a sustainable cycle. The opportunities for learning in the context of a unifying natural resources experience are endless. The long-term nature of the program and the high level of student involvement enhances the impact of the program. The advantage of having a real-life example can gives students a much more complete view of environmental and natural resource management issues. They can't ignore the challenges of weather, insects, weeds, the human need to utilize natural resources and the impact on other plants and animals. In dealing with a complete experience their view of environmental issues becomes less simplistic and challenges them to look at a wide range of considerations.

The purpose of this guidebook is to help your school to start and successfully implement a "Kids for Trees" program tailored to your needs. The program is quite flexible and several different variations will be discussed throughout the guide. We are very grateful for all the assistance we have received to develop this program, including the US Forest Service grant which culminated in this guide. We will discuss how to organize a successful program and some of the pitfalls you should avoid. I have not only drawn from my own experience but also from other similar programs that are underway in Maine. What we have tried to do here is to provide a balanced framework for environmental studies and share our experience with this approach. We encourage you to start simply and then expand the program as you develop the ability to do so. There are many potential ways to develop the program beyond the basics. All of us are learning all the time through this real-life experience. Please feel free to contact me at my office, Jim Chandler, Oxford County SWCD, 1 Main Street, South, Paris, Maine 04281, (207) 743-7019. We would love to hear about your plans or experiences with a "Kids for Trees" project and offer our assistance to encourage this approach to environmental education.

Jim Chandler,
District Manager/ Education Coordinator
Oxford County Soil and Water Conservation District
1 Main Street, South Paris, Maine, 04281-1598
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Forester describing planting techniques to students.

KEY CONCEPTS OF 'KIDS FOR TREES" PROJECTS

Environmental education is a complex and very broad area of study. As a minimum we need to help students develop a framework for understanding environmental issues and concerns. The "Kids for Trees" approach tries to accomplish this by incorporating several major concepts which will be discussed in this section. There are many different ways of adapting the "Kids for Trees" approach to your setting. However it is important to keep the essential ingredients of the program in mind in order to maintain a balanced framework for the experience. Below are some of the key concepts of "Kids for Trees" projects:

Include some aspect of human utilization of a natural resource:
This concept is mentioned first because it is a key to a complete understanding of the environment and our relationship to the environment. This components rarely addressed in school "nature area" projects. In order to get a total view of environmental issues, students need to study an environment that includes people and their dependence on natural resources to survive. This is the arena in which students will effect the environment. If this ingredient of the environmental framework is left out students will develop an unrealistic view that puts people in a category separate from the environment. This encourages the idea that humans can survive without utilizing natural resources. One of the best ways to accomplish this goal is to involve students in the experience of managing a natural resource that in part is being utilized by people.

Encourage a total ecosystem management approach: Environmental systems are interconnected. Most often environmental problems are created by considering only one aspect of a situation and not keeping the whole picture in mind. For example much wildlife habitat is destroyed by development that is only focused on providing adequate housing. Likewise excessive regulation of manure spreading can result in a waste disposal problem rather than be used as an enhancement to soil fertility. In order to get a balanced view of environmental problem solving, students should be encouraged to look at all aspects of the environment as an integrated whole. Students involved with a "Kids for Trees" program are encouraged to study and allow for the needs of all the various aspects of the area. This includes soils, water, air, wildlife and other plant life. The area should not be just considered a "garden" for Christmas trees, but also a habitat for other plants and animals along with concern for the soil, water and air. Examples of this involve taking an inventory of local plants and wildlife, leaving buffers next to streams, building bird houses and bat houses, and studying stream life. The model for good stewardship of the land should include concern not just for one's "crop", but also the other plants and animals in the area or "downstream". You cannot maintain the sustainable use of a resource without maintaining the ecosystem.

Sustainable use: Sustainability has been defined many different ways but the basic concept stays the same: managing resources in such a way that they can be continue to be used for generations to come, providing natural resources needed to survive without comprimising the integrity of the environment. Any environmental practice that is sound should be sustainable over a long period of time. As a framework for environmental stewardship, the practices used on the school site should strive to be sustainable. In the "Kids for Trees" program a new trees are planted each year. These will serve as replacements for the trees that are harvested each year. Students can see in a very graphic manner the lesson of not harvesting more than is being regenerated. Practices should be taken to maintain the integrity of soil, water, air, and other plants and animals. For example, fertilizer rates are applied in accordance with soil tests and the rate of uptake by plants and wildlife habitat is maintained or enhanced. Keeping practices sustainable provides a foundation for environmental decision making in accordance with balancing the needs of the environment and the need for humans

to use natural resources. The long-term nature of "Kids for Trees" projects also encourages students to think towards the future and the benefits of conserving resources for generations to come. This process in itself is an excellent learning opportunity. As students develop a greater understanding of the care of the environment they can better develop their role as stewards in the utilization of natural resources.

Integrating awareness, knowledge, attitudes, and action: As described in A Guide to Curriculum Planning in Environmental Education (Published by and available from the Wisconsin Department of Public Instruction, 125 Webster Street, PO Box 7841, Madison, WI 53707) environmental education objectives should include developing awareness, knowledge, attitudes, skills, and participation (or action). This is a sound basis for developing the skills for effective environmental decision making. An effective "Kids for Trees" project should keep these objectives in mind. If we develop awareness without knowledge, the actions taken are often simplistic and may be misguided. Knowledge without action does not accomplish any results. Actions without an awareness of the importance of environmental stewardship or without conservation attitudes is often meaningless and short-lived. "Kids for Trees" projects that develop all these objectives will be much more effective. The hands-on nature of the project takes students beyond the awareness stage, and helps them develop first-hand knowledge and skills in the care of natural resources. The project goes beyond the "talk" stage and gets students involved in concrete actions. Time should be spent on developing attitudes that value conservation and the long-term care of the environment, while sustainably utilizing natural resources for human needs.

Real-life, hands-on experience: Hands-on experience with natural resource management will encourage a more complete and realistic view of environmental issues. Not only are trees planted but students have to deal with the reality of weeds, insects, frost, drought, as well as seeing the unexpected hawk circle overhead, and the tiny seedling turn into a real tree. Real life experiences go beyond awareness and develop knowledge and skills for natural resource management. "Mother Nature" is good at providing challenges and experiences that result from poor management decisions that can be glossed over in a textbook example. Real life projects help insure that the experience considers the total ecosystem; encouraging students to develop a multi-faceted view of environmental issues. This gives them constant feedback or a "reality check" for their developing approach to environmental issues.

Explore how the lessons learned can be applied to other environmental issues: Time should be spent on generalizing the lessons of the "Kids for Trees" program. This is necessary in order to insure that the lessons learned won't be tucked away as information only needed if one plans to grow trees. Spend time discussing the the concepts of sustainable natural resource management based on a total ecosystem approach that can be illustrated by the "Kids for Trees" program. Have the students apply these lessons to other case studies and local environmental issues. Such an exercise contributes to the development of long-term attitudes about care of the environment.

GETTING STARTED

When getting starting there are many different options to consider. One key piece of advice at this stage of the game is to **"KEEP IT SIMPLE INITIALLY."** It is easier to add new features as you progress through the project than to deal with an overly ambitious program. One of the biggest challenges we have encountered in the "Kids for Trees" program is to keep it to a manageable scope. In the original design of the program there are two school districts where 100-150 trees are planted annually. Each third grader plants at least one tree. Notebooks have been kept for every student and passed from class to class at the end of the year. As the years progressed this became more complex to manage. Having experienced these complications it is highly recommended that you plan carefully for the long-term management of the program. The original approach requires a team of educators at all grade levels and resource advisors to be sucessfully implemented over a long period of time. However, several variations have been developed that will make management of this program easier. These can be handled on the scale of a single class, all the way up to affecting an entire school district. Pick the approach that best fits your needs and available resources. To give you some idea of the general operations of a "Kids for Trees" program, three basic variations of the project are shown below.

Basic Organizational Options:

Option #1 (Based on the original program design):
Students in the primary grades plant Christmas trees to be harvested 9 years later. The number of trees to be planted should be approximately 1.5 times the number of students in the class to allow for trees that die or are poorly formed. The current program has students in the third grade plant Christmas trees to be harvested in the fall of their senior year. Some schools have students plant the trees in the kindergarten year to be harvested in the eighth grade. Students come back to the site each year to care for the tree and learn about various aspects of the environment.

Each class takes care of different sections of the forest plot and share information so they can track the growth of the trees as a whole. Information about each plot is kept in a notebook and passed on from year to year. Initially each student followed the growth of "their tree" recorded in individual notebooks. However this became a major paperwork headache. It also encouraged students to think of the project as a "pet tree" activity rather than a forest management project. Focusing on managing the plot as a whole works out much better and is more in keeping with the overall goals of the program.

Option #1 takes a large space to implement (approximately 1 to 2 acres for a school that has about 100 students at a given grade level) and involves students and teachers over a nine year period. This has the advantage of having the students follow the trees they planted and involves them over a long period of time. has the advantage of reaching every student in the school district. However it is more difficult to coordinate and maintain.

Option #2 (Planting fewer trees): An alternate approach would be to plant only 1 row of 10 to 20 trees each year and gradually develop a plot of 10-15 rows of trees, each planted in a different year. In this way a school or a single class would eventually have a rotating plot of Christmas trees where students could see all stages of growth. From this plot 5 to 10 trees could be harvested each year and new trees could be planted each year. The plot could be cared for and studied by one class or by many classes. This would make the plot more manageable reducing the need to focus on the logistics of caring for the trees. This also requires less space to implement.

If you wish to get the entire project going more quickly, you could purchase trees of various ages and plant several rows the first year. In this way you could have harvestable tree in fewer years.

Option #3 (Using different species of trees or shrubs): Another options for reducing the scope of the project while still maintaining the complete planting to harvest aspect of the program would be to use different plant species. Included in this manual is the description of growing willow shrubs to be used in erosion control plantings and as basket making material. Willows can be harvested in a 2 to 4 year period rather than 9-10 years. After the willows are cut they resprout providing new growth. Other possibilities include growing plants such as highbush cranberries, blueberries, chestnut, or hybrid elms starting with small seedlings. These could be sold after several years for landscaping purposes or buffer areas near water bodies. I also know of one high school that has a woodlot where the students annually harvest pines to provide wood for the woodworking classes. In the process the students learn about sustainable management of a woodlot. If your school owns a woodlot classes could be involved in the management of the woodlot rather than planting trees.

The Planning Process:

There is much to consider when planning a "Kids for Trees" project. An excellent planning reference for projects of this nature is the Wild School Site guide from Project Wild.
Consider the following steps when planning:

Organize an action team

Organize an action team to help you plan the project. Make sure you have a wide range of people involved covering the various parts of the program. You should include a forester or Christmas tree grower, other teachers, community members, and possibly someone from your school building and grounds department. Administrators also need to be consulted and kept abreast of your planning.

Questions to Consider

- What are the your goals and objectives for the project?
- Who will be involved in the project? Will this include one class, one school, or the entire school district?
- How will the program be structured? (Consider the various organizational options described above)
- Where will the trees be planted? and What kind of tree or shrubs should we plant? For help in answering these questions consult the sections on "The Needs of Different Kinds of Trees" and the section on "Learning about Potential Growing Sites". Also seek the assistance of a forester, tree farmer, landscaper or Cooperative Extension Educator.
- Completely consider the process of growing the trees when choosing how to organize your program. One good way to do this is to develop a sequence of steps from planting the tree to harvesting the tree. By looking at all the steps involved you are more likely to make wise choices. Be very comprehensive and go through the process step by step so you will have a complete plan of action.
- How can the project be tied into or strengthen existing curricula? The more the program is designed to tie into your educational goals the more useful it will become. (See the section on maximizing the educational value of the program)
- How will the initial costs of the program be financed? The current programs utilize a combination of community donations and fundraising. One school district has had trees donated by a local nursery. Other schools have fund-raisers such as contribution letters to local businesses and a "Kids for Trees" pencil sale. These efforts have been so successful that each class has raised enough funds initially to cover the costs of fertilizer and other materials throughout the remaining years of the project.
- Who will be in charge of the long term maintenance of the site?

THE NEEDS OF DIFFERENT KINDS OF TREES

When deciding on which tree species to grow you can either look at available sites or start with the species you wish to plant. If you start with the site, you want to learn about the characteristics of the site (i.e. soils, frost potential, sun exposure, etc.) and then match the site with a tree species that will grow in that area. If you start with a tree species, first learn the growth requirements needed by the plant and then find suitable plots in the area where you can grow that species. Below is a checklist of things you should consider:

Although all plants have the same general needs, each species has specific growth requirements for optimum growth. The table below lists the characteristics of trees used for Christmas trees. I have also included information on willows used for erosion control plantings that could be raised for a "Kids for Trees" projects, with a shorter growing time. Generally Christmas trees take from 5 to 10 years to grow a mature tree. Willows for erosion control can be harvested in 2-3 years. If you choose to manage an existing woodlot, growth rates in the Northeast average around 1/2 cord of growth per acre each year.

When deciding on what kind of trees to plant here are some of the questions you should consider:

- What do the trees require to grow?
- What is the tolerance of the tree to adverse conditions such as shade and frost?
- What is needed to care for the trees?
- What pests or weeds effect this kind of tree? Are there pest resistant varieties?
- How much space should be allowed for each tree?
- What is the end result I want to have for the project?

The following pages contain information on a variety of species used for Christmas trees and erosion control that would be suitable for a Kids for Trees project:

Here is some information on a variety of species used for Christmas trees and erosion control that would be suitable for a Kids for Trees project:

***Growth Characteristics of Various Tree Species Used as Christmas Trees.**
(* adapted from Southern New England Christmas Tree Growers' Manual, edited by Dr. John F. Ahrens, University of Connecticut Cooperative Extension System, (203) 486-3336.

Tree Type	Soil-Site Preferred	Growth Characteristics	Preferred Aspect	Shade-Tolerance	Frost-Tolerance
Balsam Fir (*Abies balsamea*)	Intolerant of dry sites, well on wet sites, Does not tolerate weeds well.	Slow and irregular growth, good conical shape,	North or East facing slope preferred	Fair-Good	Poor
Canaan Fir (*Abies balsamea phanero-lepis*)	Does well on moist sites, grows faster than Fraser Fir. Can tolerate more moisture than Fraser Fir.	Similar to Balsam Fir, much more tolerant to frost due to later budding.	Any	Fair-Good	Good
Douglas Fir (*Pseudo-tsuga menziesii*)	Moist well drained loam, Avoid dry or poorly drained sites, Nutrient demanding.	Basic shape good, cold-hardiness varies depending on seed source.	Any, best on cool north or east facing slopes.	Fair-Poor	Poor, avoid hollows and frost prone areas.
Fraser Fir (*Abies frasieri*)	Does best in moderately well drained sandy loam. Does not tolerate very wet or dry sites.	Conic shape is good, growth is similar to Balsam Fir.	Best on north or east facing slopes.	Good	Excellent
Colorado Spruce (*Picea pungens*)	Grow well on a wide range of soils, best on moist, well-drained sites, Less tolerant to wetness than White or Norway Spruce.	Good form, slower growth than Norway or White Spruce.	Any	Poor	Fair-poor

***Growth Characteristics of Various Tree Species Used as Christmas Trees continued..**

Tree Type	Soil-Site Preferred	Growth Characteristics	Preferred Aspect	Shade-Tolerance	Frost-Tolerance
White Spruce (*Picea glauca*)	Moist, moderately well drained to well drained soil.	Good growth rate, good form, double leaders common.	Any, may winterburn on western slopes.	Fair-Poor	Fair
Eastern White Pine (*Pinus strobus*)	Wide range of soils, best on moist, well drained sandy loam.	Fast growing, but basic conical shape is poor. Timely pruning required, as soon as terminal bud is evident. (June or early July in New England)	Any	Fair	Good
Scotch Pine (*Pinus sylvestris*)	Grows on all sites but the wettest areas. Needle fungal disease may be problem in low lying sites.	Very fast growing, but basic conical shape is poor. Timely pruning required, as soon as terminal bud is evident. (June or early July in New England. Some seed sources have crooked stems. (Stake the trees or consult with the nursery.)	Any, may do poorly on exposed north slopes.	Fair-poor	Good

SELECTED SHRUBS THAT CAN BE USED FOR EROSION CONTROL PLANTINGS (*information from "Conservation Plants for the Northeast" and "Conservation Plant Sheets" 31 and NE-71, United States Department of Agriculture, Natural Resources Conservation Service, 1991, Program Aid 1154.)

Tree Type	Soil-Site Preferred	Growth Characteristics	Shade-Tolerance	Frost-Tolerance
Streamco willow (*Salix purpurea*)	Medium-fertility, acid, clayey to sandy soils, tolerates poorly drained soil but does not do well in very dry soils. Doesn't do well when planted directly in grass.	Grows to 10-12 feet high, grows quickly and withstands flood and ice. Roots well from cuttings. Useful for erosion control, wildlife habitat, and basket making.	Good shade tolerance but should be planted in areas that receive at least 4 hours of sunlight each day.	Excellent, Zones 3-8.
Bankers willow (*Salix cotteti*)	Grows well in a variety of soils, best on wet sites subject to periodic flooding. Poor drought tolerance. Young cuttings compete well with grass.	Max. height: 6 feet, dense semi-prostrate growth which root in moist soil. Soon forms a dense cover. Good for erosion control on small streams with average velocities of no more than 6-8 feet/sec.	Moderate shade tolerance.	Grows in areas from northern Penn. to Tennessee. Zones 5-8.

** Note: Other species are suitable for bank stabilization. More information can be found by consulting your local office of the Natural Resources Conservation Service and Conservation District. Consult your phonebook either under the name of the local Conservation District or under the United States, Department of Agriculture, Natural Resources Conservation Service. A good reference that each office should have is Chapter 18 of the Engineering Field Handbook: "Soil Bioengineering for Upland Slope Protection and Erosion Reduction.", 1992, USDA.

LEARNING ABOUT POTENTIAL GROWING SITES:

(much of this material has been adapted from "Southern New England Christmas Tree Growers' Manual, University of Connecticut, Cooperative Extension.)

- **Is the site on or close to your school property? (and other accessibility issues)**

Generally sites on or near your school site are the best for several reasons. Most importantly the closer the site is to a school the more access students can have to use the site in their classes. In addition, maintenance staff will often assist with mowings if the trees are on school property.

General accessibility to the site is another consideration. If the site is hard to get to it is less likely to be used. Make sure it is possible to access the site by needed equipment, such as mowers and trucks delivering supplies. Other considerations include traffic patterns and vandalism. If the trees are at the edge of a dugout or other high use areas there is an increased risk they will be trampled. Make sure the trees are planted in an area that is not prone to vandalism.

- **Who owns the site?**

"Kids for Trees" projects involve long-term use of a site. You need to be certain that the site can be utilized by your program over the length of time needed to grow the trees.

- **What are the soils like in the area?**

The best source of soils information is your local Natural Resources Conservation Service or Conservation District office. The telephone number can be found in your phone book under the United States, Department of Agriculture. Most regions have soils maps that describe the soils in your area and their suitability for various tree species. Soils maps also contain information about the average depth of the soil, how well drained it is, flooding potential and other useful information. Most trees, except for some of the pines, also require at least six inches of topsoil. Pines in areas of poor topsoil may not grow as quickly as those with good topsoil. The soil should also be tested to determine the need for lime and fertilizer.
Soil test information is available through your Cooperative Extension office.

- **What is the lay of the land and what is it prone to early frost?**

If the land is in the bottom of a valley or in a hollow the area could be prone to early and late frost. Cold air sinks and collects in the bottom land in "frost pockets". You should avoid these areas because the frost will damage new growth and cause misshapen trees. If you are uncertain about the area you can observe similar trees on the site to see how they are growing or observe the area early in the spring and fall for additional clues. If you are restricted to planting trees in an area that is slightly prone to frosts you should plant trees that tolerate frost well (such as Canaan Fir)

What direction does the land slope (This is called the aspect of the land.) North and east facing slopes tend to be a little more shaded and warm up later in the spring. Trees on these slopes tend to bud later and are less susceptible to frost problems.
Steep land also creates problems. Slopes greater than 30-35 % should be avoided.

- **Exposure to wind and sun.**

Trees need sunlight to survive and grow. Trees for Christmas tree growth do better in full sun. Stay away from areas that are shaded most of the time by buildings or other surrounding trees.

Trees benefit from good air movement in order to reduce the risk of frost. However excessive wind can dry out or damage the trees, especially in the winter. If excessive wind is a concern windbreaks can be established.

- **What are the existing vegetation conditions at the site?**
  Open field areas are best for planting trees. If the area is growing up with shrubs you will first need to cut the brush. Weed control will also be more challenging. If the site is already forested you may want to consider a forest management program based on an existing woodlot. Several area school have programs using an existing woodlot.

- **Is the site big enough for the complete planting cycle under consideration?**
  THE SIZE OF THE SITE REQUIRED GREATLY DEPENDS ON THE SCOPE OF THE PROGRAM YOU ARE PLANNING. I have seen sites planted in as small an area surrounding the playing fields of a school and as large as a 2 acre field. Wherever you plant the trees it is easier if they are all in one general location.

  If you are interested in planting willows to produce erosion control material (and basket making material using Streamco Willow), the planting distance is 2 feet apart in the row with 6 to 15 feet between rows depending on the needs of equipment used to harvest and mow the area. A 100 foot row will yield a fairly good amount of material. At full production, after about 3 years, willows produce about 10-20 bundles of branches each year (50 stems/bundle, known as a wattle or a fascine). Each bundle is about 6-8 feet long. These stems can also be used to produce unrooted and rooted cuttings that can be grown into plants or planted directly on the bank for erosion control.

  - **Determine the number of trees you would like to plant each year.** (Currently we are planting 150 trees for 100 students. This number each year gets to be a large task logistically. Initially an easier management strategy would be to plant a row of trees each year rather than a whole plot of trees each year. You should probably plant 50% more trees than you would like to eventually harvest. This will allow for mortality (10% is what commercial growers plan. When you are first getting started you may have higher mortality. We have found that once you have adequately prepared the site, with the right species for your site, and careful planting technique, it is not too difficult to get mortality down to 10% or less.) The rest of the "extra" trees will account for trees with slow or misshapen growth. The percentage lost to these causes can vary a great deal. However a 50% overplant should give you a reasonable chance of having satisfactory results.

  - **Determine the number of rows or plots you want to plant over the course of the growing cycle of the trees.** It will probably take you anywhere from 8 to 10 years to grow Christmas trees that are 6-8 feet tall. Plan to allow trees in a given row or plot 3-4 additional years of growing time before replanting in that area. This will allow small trees some extra time to grow and be harvested and allows for 1 year "fallow" period needed to prepare the site for the next planting cycle.

New trees planted in a grid marked with construction flags.

  - **Determine the planting distance between trees you are going to use.** Christmas trees are generally planted in a grid of rows 5 feet apart with 5 feet between trees. With this spacing you can plant approximately 1700 trees per acre under ideal conditions. At the sites we have been planting we have been planting the trees in a 2 meter x 2 meter square grid. This encourages the students to use metric measure. Under this arrangement you can plant 2500

trees/hectare (10,000 square meters= 2.741 acres) or a little more than 1000 trees/acre under ideal conditions. It is important to note that conditions are rarely ideal. There will always be sections of property that are unplantable. It is also desirable not to plant the entire site to allow for wildlife study, identification of other tree species and other environmental education activities. Also, plan for the spacing you need to get mowing equipment between the rows.

- **Determine the overall space needed** by multiplying (the number of trees you plan to plant each year) x (the number of years you plan to plant before completing an entire cycle and begin to replant again) x (spacing between trees in a row) x (spacing between rows) x 1.5. The 1.5 factor at the end allows for areas on the site that may be unplantable and also allows for areas you can use to study the other plants and animals in the area. (Buffer zones, bird houses, wetland areas, a variety of native tree species, etc.)

An even more accurate way to allow for variations of site conditions would be to measure the amount of space needed to plant the trees for one year, and then map out where the plots can be placed on the site until you have enough plots for the complete growing cycle (including 3-4 years for extra growing time.) Allow for areas on your site for additional environmental studies as mentioned earlier. This method better allows for site-specific conditions. For example, on one of the sites being used, we currently avoid a large area in the middle of our plot because it tends to flood in the spring.

CARING FOR THE TREES

To successfully grow trees there are a number of tasks that need to be considered. THIS IS A BASIC DESCRIPTION OF THE CARE REQUIREMENTS AND NEEDS FOR GROWING CHRISTMAS TREES. I have included all the essential considerations for successful tree growing. However there exists more complete and detailed descriptions of tree growing. One good one is Southern New England Christmas Tree Growers' Manual, edited by Dr. John F. Ahrens, University of Connecticut Cooperative Extension System, (203) 486-3336. Cooperative Extension will have publications which cover tree growing in your area. Whenever I have problems I consult this book or contact the local Cooperative Extension Educator or expert from the state forest service. It is very useful to have a forester or tree farmer on your planning committee as a technical adviser. You should also see if there is a chapter of a tree growers association in your area. In some parts of Maine the Farm Bureau chapter has been very helpful in promoting Christmas tree planting projects at schools.

CHRISTMAS TREE CARE CALENDAR:

(See more detailed description of each activity below.)

Tasks for the first year:

- Site preparation (fall or spring prior to planting)
- Order new trees (winter)
- Layout the site and plant trees (spring)
- Begin weed control . (spring and summer)

Yearly tasks :

- Order new trees to be planted. (winter)

- Fertilize (spring)
- Weed control (spring and summer)
- Be aware of the growing condition of the trees and look for signs of poor growth, pests, or disease. Deal with problem areas as needed. (throughout the year)
- Prune any double tops (leaders). (summer)
  If the top leader has been damaged, one of the side branches can be encouraged to take over as the leader. Some growers will train this branch to become the leader by tying it to a stick so that it extends straight up. However it will generally grow straight on its own.

After trees grow taller than 3 feet:

- Prune leader if greater than 10-12" and trim side branches as needed (see specific directions below)
- TIMING IS CRITICAL ESPECIALLY FOR PRUNING PINES.
  Prune pines when leader growth ("candles") is to its full extent, as soon as the terminal bud is formed. (LATE JUNE in New England) If done later a new terminal bud will not form.
- Spruces and Firs are best pruned in late July in New England but can be pruned in fall or in spring before buds open.

Site Preparation:

The major goals for site preparation are to assist in controlling weeds and making the site more manageable for mowing and other activities. Cut any brush off the area. If growth is excessive you may want to consider having someone come in and apply a mild herbicide. Consult with your Cooperative Extension Educator for recommendations. At our sites we have had a volunteer rototill up the entire site prior to planting. This has also been useful to smooth the site so it is easy to mow in later years. This has also been a good time to lime the area prior to rototilling. Take a soil test to determine the appropriate amount of lime. (See the section on "Liming and Fertilization".) Our sites have been in flat areas. If the site is sloped you may want to only till or apply herbicide in rows where the trees will be planted leaving grass strips between the rows. Make the rows 3-4 feet wide to cut down on weed competition. These rows should be made on the contour across the slope to prevent erosion. Remove any stumps and rocks to facilitate mowing. (However, try not to lose too much humus as topsoil is essential to good tree growth.)

The next step in site preparation is to layout the rows. Measure out the overall area needed and mark the corners. Use a compass to make sure the corners are square. This will insure that the rows will be placed accurately. Students can do the rest with teacher assistance.

Student helping set out the planting grid.

In Bethel, the students come to the site a week before planting the trees for "Grid Day". Strings are run along the sides of the plot perpendicular to the rows. These strings are used as guides for the beginning and end of each row. Students then place a stake at the corner and run a string to a stake at the corner across from the plot. This process is similar to laying out rows in a garden. Students should

work in pairs to mark out the location for each tree using grade flags (a wire with a small plastic flag, used on construction sites). Christmas trees are generally planted at least 5 feet apart. To give students experience in metric measures we have been planting trees 2 meters apart. Stress the importance of accurate measurement. If the rows are uneven trees may be inadvertently mowed down..

After all the trees in one row have been located the string has to be moved to locate the next row. Measure 2 meters on each end down the strings marking the edge of the plot and reposition the staks marking the new row. Make sure the string is stretched tightly between the stakes. Now you are ready to measure out the next row.

We have found it useful to plant in rows and columns to facilitate record keeping. For permanent markings hardwood stakes can be painted and marked with the letter and a number for each row and column. This allows for each tree to be located on a grid. For example the first tree in the grid is A1. Subsequent trees in the row are A2, A3... The trees in the next row are B1, B2, etc. After the flag has been placed you should periodically check if the rows are staying lined up. Look down the rows and columns to check the alignment and redo any that are out of line by a significant amount.

Obtaining Plants

There are a number of nurseries that provide tree seedlings to plant. Your local Conservation District may also have an annual tree sale. Check with Christmas tree growers in your area, your local Conservation District, area nurseries or Cooperative Extension. It is best to get trees that are grown in climates similar to your area. It is highly recommended that you use
2-2 stock or P+2 stock. The first number indicates how long they were grown in a seedbed or greenhouse and the second number is the number of years they have been in a transplant bed outdoors. (ie. 2-2 stock has been grown 2 years in a seedbed or greenhouse and 2 years in a transplant bed.) The P indicates they started out growing in trays as a plug. I recommend these ages of trees or larger, as they are a good size for planting. Smaller seedlings or plugs can easily get overrun with weeds and take too long to grow. You could start out with larger stock to cut down the number of years before you harvest your first trees. However, larger trees are more expensive.

Planting

When to plant? Planting should be done soon after the frost leaves the ground in the spring. Trees should be planted while they are still dormant. In Western Maine we generally plant the trees in early May. Do not plant or transplant trees after their buds open. It is also possible to plant in the fall before October, but this is not as desirable.

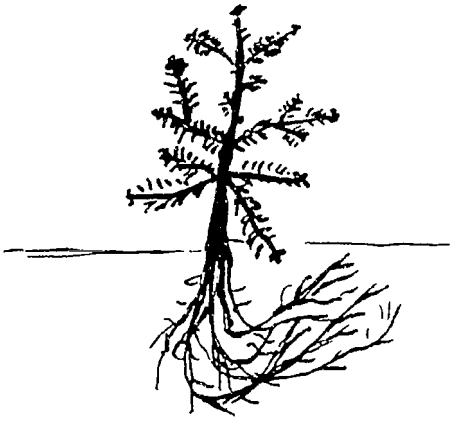
Planting day!

Handling the trees before planting: Order your trees to arrive just before you need them for planting. When the trees arrive keep them in a cool location and make sure the roots stay moist. If you will be planting the trees soon then it is best to keep the trees in their original packing material. Keep checking to make sure

the roots stay moist. If the trees come packed in a plastic bag, take them out of the bag but keep the packing material. Plastic bags tend to encourage mold formation. Shredded newspaper, peat or sphagnum moss, or sawdust make good packing materials. The trees should NOT be soaked for any length of time in a bucket of water. The roots need air and soaking for long periods of time will kill the roots. If you have to keep the trees for any length of time before planting you should follow any directions that come with the trees or dig a trench and bury the roots in the ground. Make sure not to plant the roots any deeper than they were planted in the nursery. Make sure the soil is packed down tightly around the roots. Push down around the tree with your foot. Air pockets will allow the roots to dry out.

Handling the trees at the site: When you go to plant the trees it is important that the roots stay moist. On a windy day if a tree is left exposed its roots can dry out in less than a minute. For this reason it is important that an adult is in charge of the trees and that students only get a tree after their hole has been dug and is ready for planting. On the "Planting Day" you should get several volunteers to assist with the planting (especially if young students are involved). Go over the planting procedure with students and stress the importance of not exposing the tree roots too long.

Planting the trees: Proper planting technique also makes a great deal of difference in the survival rate of the trees. There are 2 basic styles of planting: the slit method and the hole method. The slit method is when a slit is made with a shovel and planting bar and the tree is placed in the slit. This is very fast and is used by professional tree planting crews. However for school use, THE SLIT METHOD IS NOT RECOMMENDED. It is too easy to get the roots exposed to the air or bent in a "J" shape. This was a leading cause of seedling death in the early years of our project. To plant a tree, using the hole method, dig a hole large enough for the roots to extend downward and spread out. Pick a consistent side of the flag marker to plant the trees; otherwise the trees will be planted on a variety of locations relative to the flag and the rows will not be straight. The tree should be planted so the place where the top roots come off the trunk (the root collar) is just below the surface. You can also judge by the dirt stain on the trunk where the tree was planted in the nursery. If the tree is planted too deeply then the roots may not get enough oxygen. If it is too shallow, the roots will be



exposed and will dry out. The tree roots should stick down into the hole and spread out. If the roots stick up towards the surface (as in the letter "J") ,or are all balled together in one spot, the tree will not grow well or will die. "J-rooting" is a problem even if the ends of the roots are completely buried. Do not put any fertilizer on the tree when it is first planted unless it is in a tablet form. Inquire about fertilizer tablets from the nursery where you purchase the trees. After the hole has been dug, the student can go and get a fertilizer tablet and tree from the adult in charge. Imbed the tablet in the side of the hole before you plant the tree. Put the tree in the hole. If the roots are extremely long they can be trimmed with a pair of scissors. The roots can be pruned to the length of the tree above the ground. Put the roots in the hole, spread them out and then push the soil back into the hole. It is not necessary or recommended to put extra peat or other materials in the hole. Let the trees grow in the soil at the site. Make sure the soil is packed tightly around the roots with no air pockets.

Tamp the soil as you go. When the hole is completely filled the student can push down on the soil with their foot. (Be careful not to step on the tree!) Try and get the tree planted so the trunk is standing straight up. If the soil is very dry it may be desirable to water the trees. This is not necessary in most years. Once the tree has been planted the student should record observations about the tree and measure the tree height. These measurements are to be kept in a master notebook for comparison over the years.

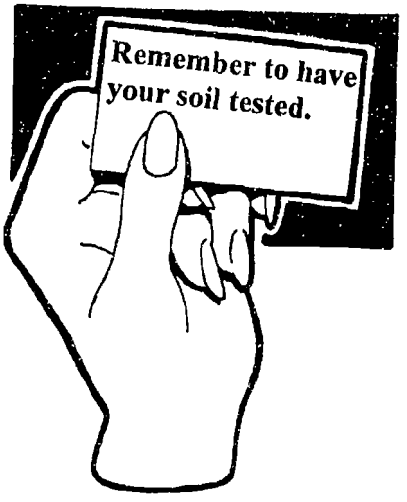
Liming and Fertilizer

Soil nutrients play a very important part in the success of tree growing. The important nutrients for tree growth are nitrogen, phosphorus and potassium, or N, P, and K. Nitrogen promotes rapid growth and dark green needles. (Deficiency can be indicated by slow growth or yellowish. green needles.) Phosphorus encourages good root growth and development. (Deficiencies can cause retarded growth and poor root development.) Potassium is needed for the growth of new shoots and frost hardiness. (Deficiencies can be indicated by short and yellowing needles especially on new tips.) Other essential nutrients include calcium, magnesium and sulfur.

Another factor which plays a direct role in sucessful tree growth is pH, affecting the availability of all of the nutrients. pH measures the acidity of the soil. ph of 7 is neutral, below 7 is acid, and over 7 is alkaline or basic. Conifers do best when the pH is between 5.7 and 6.0. You should add lime if the pH is below 5.5; however be careful not to overlime.

Before you plant a site you should get the soil tested to determine the amount of lime and nutrients needed. Follow the recommended rate of liming to raise the pH to the desired level. If your soil needs calcium or magnesium use dolomitic lime. You can lime and add phosphorus to the soil, as indicated by the soil test, when first preparing the site. It is best to do this in the fall to allow the lime time to work., but it can be done in the spring before planting. The other nutrients should be added later as fertilizer. During the first year you should not add additional fertilizer to the site.

Once fertility values are up to the desired levels annual maintenance applications are required. Recommendations for annual amounts of fertilizer are 1 oz. of 10-10-10 for each tree for the first year. A 35 mm film canister is an excellent measure for 1 oz of fertilizer. (fertilizer weighs about 8 oz. per cup of fertilizer.) Granular fertilizer is the easiest to handle. The fertilizer should be spread around the tree at the drip edge. Caution the students against getting the fertilizer on the tree. After the first year 2 oz. of 10-10-10 can be applied around each tree. If the tree is not showing signs of good growth, or is yellowish in color, you can put more, especially on larger trees, up to 4 oz. per tree. However the best recommendation is to have a soil test done every few years or when the trees show signs of poor growth. Follow the recommendations given on the soil test. Students can also test the soil using a home test kit obtained from your local garden store. These are not as accurate as a soil test through Cooperative Extension, but will give adequate results, with the advantage of allowing the students to be involved in the testing.



Commercial weed control. Mow grass and kill weeds next to the trees with mulch or herbicide.

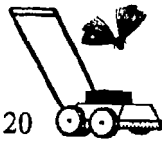
Weeding and Grass Control

Weed control greatly influences the growth of the trees. To get the best growth you should control weeds within 2 feet of the trees. Most growers use a combination of mowing and herbicides. One of our sites gets regular mowing along with the school grounds, while another site is mulched and mowed once or twice a year. On both of these sites we have had acceptable but it is not optimum growth. The site with mulch has done fairly well. We used bark mulch donated by a local paper mill but any mulch material would work well. With more frequent mowing, the combination of mulch and mowing works fairly well. The mulch should be put down thick enough to choke out the weeds (at least 4" thick). Students can also pull or cut any weeds or brush near their trees. For optimum results, a herbicide can be used to eliminate weeds in a band around the trees. Many modern herbicides are biodegradable and provide little risk if used properly. The proper choice and timing of the herbicide is important. Students would not be qualified to apply these chemicals. Check with your local Cooperative Extension Educator for further information. You might also get a local grower to assist with this step.

Pests and Diseases The key to pest and disease control is to be aware of the potential pest problems that can affect your trees. Check with your Cooperative Extension office or the "Southern New England Christmas Tree Growers' Manual, University of Connecticut, Cooperative Extension. From these sources you can find descriptions of the common pests that may affect the tree species you are growing.

Throughout the growing season periodically check for pests and disease and their signs. Students can also periodically shake the branches over a cloth and observe the insects present. If pests are present in large numbers or if your trees show dying tips or poor growth, check with Cooperative Extension for control measures. The goal is not to totally eliminate pests but to control them when their populations become large enough to cause damage. For many crops scientists have developed "Integrated Pest Management" strategies. Pests are monitored by sweep nets, traps, and other means of systematically collecting pests or their signs. When the population get too large (determined by IPM guidelines) proper control measures are taken. Check with the Christmas tree growers association or Cooperative Extension regarding the development of IPM strategies for the trees you are growing. The implementation of such a program will be very instructive for your student because it involves careful observation and measurement, as well as an understanding of the interaction between various organisms.

Another key to pest management is choosing your tree species carefully. Some species are more prone to pests than others. The balsam fir we have been growing has had very few pest problems. White pine grown in the area are susceptible to the white pine weevil which kills the top leader growth. Trees can also be more susceptible to pests and disease if grown on poor soils. If you pay attention to proper soil conditions and site preparation you will be less likely to have pest problems.



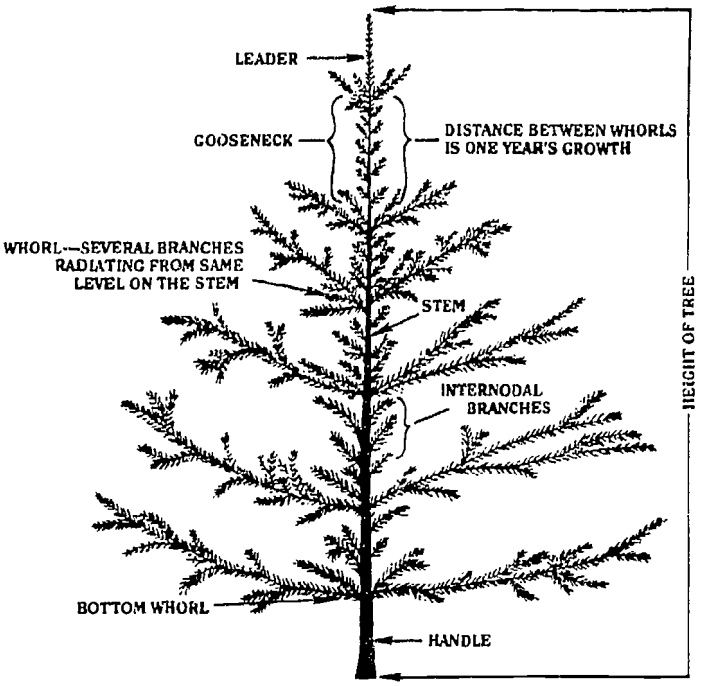
Over the course of growing the trees it is probably inevitable that you will have some pest or disease problems. In these cases consult with the Cooperative Extension pest specialist for the proper control measures. Not all control measures involve sprays. In some cases other insects or biological methods of control can be used. For example, one way to mitigate the damaged caused by pine weevil is to prune off the dead leader and train one of the side branches to become a new leader. There are often several different options. It is instructive to go through the process of decision making regarding pest control with the students as it involves many different interconnected parts of the environment. This is part of the real life experience of natural resource management. In part of the discussion it is also important to discuss the consequences of inaction as well as the various control options. When a given strategy is chosen BE SURE TO FOLLOW ALL THE DIRECTIONS CAREFULLY. SAFETY NEEDS TO BE A PRIME CONSIDERATION. If a pesticide is to be used be aware of any licensing requirements needed to apply the material. You may want to have a forester or Christmas tree grower to do the application of any pesticides.

Pruning

The purpose of pruning is to develop a particular shape to the tree that we associate with Christmas trees. Pruning also helps determine the spacing of the branches and helps the trees fill in the spaces. This can be used to teach many different concepts. Pruning requires tree identification (as different trees require different pruning strategies), an understanding of tree growth and bud formation, and can involve measurement of the taper of the tree.

Pruning tools: There are a wide variety of tools that are used for pruning including pruning shears, electric trimmers and knives. However for safety sake I would only recommend shears for school use. It is a more time consuming but much safer. It is important that the shears are sharp enough to make a nice clean cut. Instruct your students to take care when pruning.

Christmas Tree Terminology



Growth characteristics of conifers: Trees grow out from the ends of the branches and upward from the buds on the end of the leader (the center branch). At the end of the growing season (in late summer) new buds form at the end of each branch. The new growth on each branch will come from these buds. At the top of the tree buds will form on the end of the leader. The center bud from the leader will form next year's growth of the trunk of the tree. The other buds at the top will form the new side branches. The bud at the ends of the branches and in the center on top of the leader are called the **terminal bud**. The buds surrounding the terminal bud are called **lateral buds**. They will form a circle of branches around the leader. Where each circle of branches come out is called the **node.** The circle of branches is called a **whorl.** On some trees species, such as spruce and fir, there are a series of buds on the trunk and branches between the nodes. These buds are called **internodal buds**. Pines do not have these internodal buds which makes a big difference on how they are pruned.

Pruning Spruces and Firs: Prune the leader back to 10-12". This will allow for a good spacing between whorls of branches. Prune the leader directly above an internodal bud, just above a cluster of internodal buds. The top bud will replace the terminal bud and the cluster of buds will form a whorl of branches, similar to the original growth pattern of the tree. Spruces and firs are not as particular as pines about the timing of pruning. You can prune them anytime after the end of the growing season in late July till the following spring before they bud. You should not prune trees in the coldest part of the winter. Even though it is possible to prune trees over a wide range of time, the best time to prune spruces and firs is in late July after the terminal buds have formed and the growth has stopped for the summer. At this time a new terminal bud is forming and the tree will store food from the rest of the season in these buds. Pruning at any other time will be clipping off the large terminal buds which causes the tree to lose much of the energy stored in the large buds.

Pruning of pine trees is much more exacting. If the terminal bud on a pine gets pruned there are no internodal buds to take over. Because of this characteristic **the timing of pruning of pines is critical.** The branches on a pine must be pruned during the period while the pine is still growing. The best time to do this is as soon as the terminal bud is evident and after the shoot extension has stopped. In New England this is at the end of June or early July. When the pine is pruned at this time, dormant buds (fascile buds) at the base of the needles will form a new terminal bud. If the pine is pruned after the growth stops the new bud will not form.

During the first couple of years (until the tree is about 3 feet high) you do not need to do any pruning except for removing any double leaders. If something happens to the center bud on the leader the side buds in the same whorl will try and take over as the top leader. If this happens you should prune the top allowing only one branch to become the leader. The other branches can be cut back or removed to only allow for one leader. Some growers will train the remaining branch to become the leader by tying it to a stick so that it extends straight up. However in most cases it will grow straight up on its own.

Leader that has been pruned. Note how new growth has formed a new leader.

For trees greater than 3 feet tall: As the tree gets bigger you now need to begin thinking about shaping the tree. BE CAREFUL NOT TO OVER PRUNE THE TREE. The major consideration initially is that there is not too much space between limbs (or between nodes). As the tree grows it will sprout up a new leader each year. The growth of the leader determines the distance between the major branches. Spacing of more than 12" between branches would leave the tree with too much open space. **THE PRUNING METHOD USED DEPENDS ON THE SPECIES OF TREE YOU ARE GROWING. (Consult the sections above on pruning spruce and fir and pruning pines.)** Trim leader to 10-12" and the top ring (whorl) of branches to about 2/3 the length of

the top leader. Prune lower branches to maintain a conical shape. Generally the ideal shape to shoot for is a cone that is about 4 feet wide at the base for a 6 foot tree. This is a 66% taper, where the base is 66% of the height of the tree. To calculate the taper divide the width of the tree by the height and multiply by 100. Pines are generally pruned for a wider taper (60-90%) than spruces and fir (40-70% taper). In areas that need thicker growth, consider pruning off the tip to encourage more budding and branching. Prune very lightly, or not at all in the growing season preceding harvest. This will allow for a more natural look to the tree without cut ends. Just before harvesting you may want to cut off branches from the bottom 6-10" of the trunk. This allows for a good handle to go into the tree stand. These trimmed branches can be used in garlands or wreaths.

Harvesting

Harvesting and selling the trees can take place in a number of ways. Not all the trees planted will be harvestable. Many of the trees will take a couple more years to mature and can be sold by future classes. In addition some of the trees will never be harvestable. These trees could be used for wreath material or garlands or be replaced by new trees when the site is replanted.

Trees could be sold on a pre-order basis so the students know how many trees to harvest. Purchasers could either pre-mark the tree they want, or choose from a list giving the height and sizes of trees available. Trees would then be harvested at a given date and picked up at central location. Other options could include cutting the trees with sufficient size and acceptable shape and having them available at a local Christmas fair, or sold at an auction for parents and community members. Generally people like to see what they are getting. If the choice is made at the site before the trees are cut, you are left with the option of continuing to grow the unsold trees. This allows for the least amount of wasted trees. Taylor the operation to best meet your particular needs.

Harvesting could be done with a handsaw by students or with the involvement of a forestry class, older students or parents. **TAKE EVERY PRECAUTION THAT THE TREES ARE HARVESTED SAFELY.** Make sure you have adequate supervision for the harvesting and thouroughly discuss safety rules.

Proceeds of the "Kids for Trees" project in Bethel, Maine are designated to go to their graduation expenses, especially Project Graduation, a non-alcoholic graduation celebration. Students can be encouraged to decide as a class how best to utilize the proceeds. Some classes have suggested that some of the money act as "seed money" to help fund the upcoming classes "Kids for Trees" project. This has the advantage of encouraging students to contribute to their community as well as having the project benefit their own class.

RAISING WILLOWS FOR EROSION CONTROL PLANTING (ALSO A SOURCE OF BASKET MAKING MATERIAL)

Another option for the "Kids for Trees" program is to raise a tree species that takes less time from planting to harvest. An example is raising willows for erosion control plantings and basket material. Techniques for the use of plants in erosion control have been developed by the USDA Natural Resources Conservation Service. Described below are some of the basic guidelines for raising willows for these purposes. The species of willows mentioned do not grow into full sized trees and can be kept under control by mowing around the area. The Streamco willow in particular has been chosen in many situations because it does not easily spread from the area where it is planted. In any case some care should be taken not to plant the willows or other shrubs in areas near water pipes or drainage fields of septic systems, so that the roots well not become a nuisance. With these few restrictions the willows mentioned are easy to grow rapidly.

Planting and Care of Willows

(The following guidelines have been adapted from instructions

"Commercial Production Of Streamco Purpleosier Willow (Salix Purpurea L.), Cuttings Rooted Cuttings, And Whips", prepared by Martin van der Grinten, Mgr., Big Flats Plant Materials Center, NY and John A. Dickerson, Plant Materials Specialist, Syracuse, NY., 1989. Both work for the USDA Natural Resources Conservation Service.)

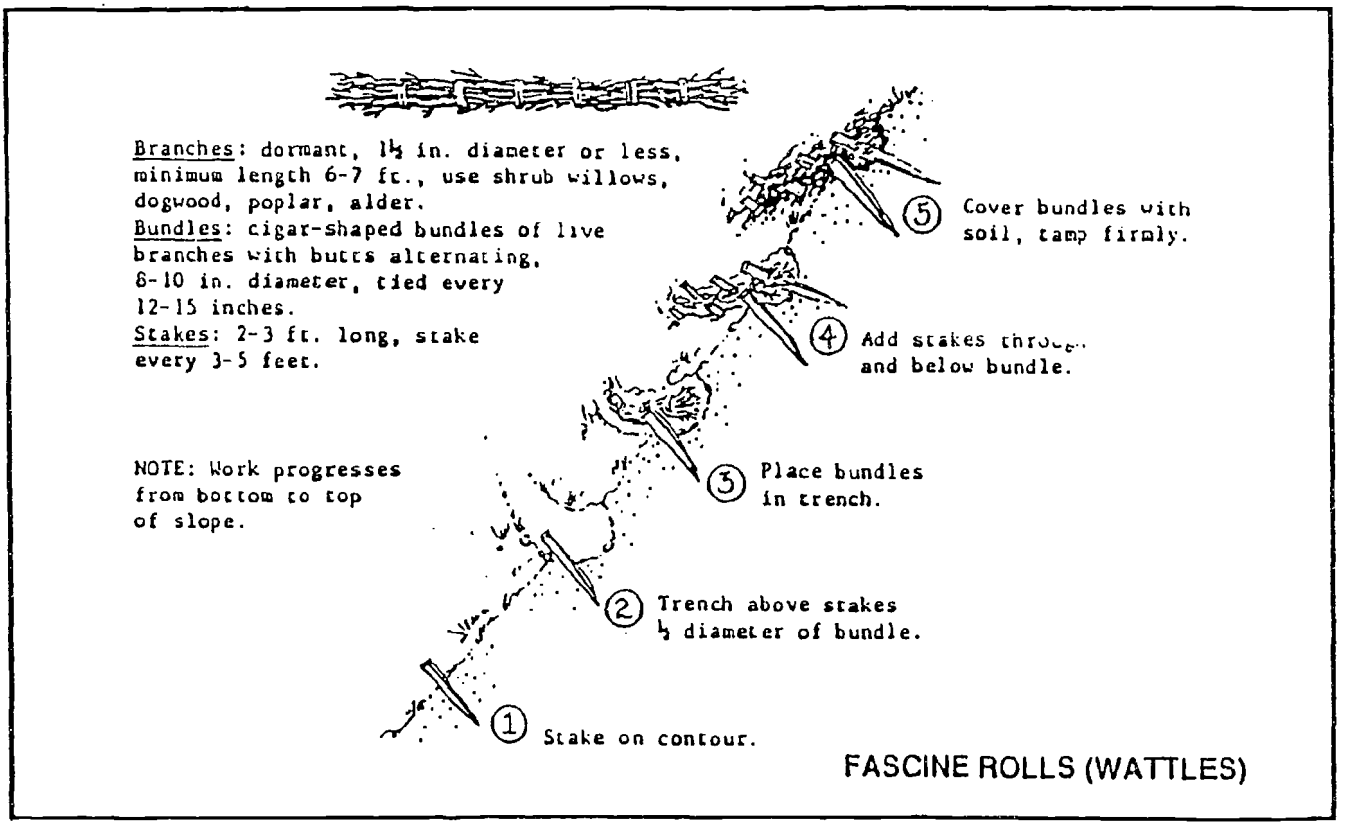
1. Planting is either done in the spring before the willows bud or in the fall after the leaves have dropped off the plants. Plant rooted cuttings or plants two to three feet apart in rows 6 to 15 feet apart in well-cultivated area free of competitive weeds. Before planting till up an area 3-4' wide to discourage the weeds. After planting you can mulch the area. The mulch should be pushed back in the fall to discourage mice.

2. Cultivate as with any row crop and keep weed-free. Fertilize with five pounds of 10-10-10 per 100 feet of linear row in the spring. This should be sprinkled along the rows. Care is advised not to over-fertilize the first year.

3. At the end of the first year, while the plant is dormants (after the leaves have dropped), cut each plant back to two to four inches above ground. This is essential. Some usable cuttings may be produced the first year. The second, and succeeding years, long, twig-free whips will be produced.

4. By the end of the second year, adequate whips should be produced to allow for harvesting. Harvest is most easily accomplished by a sicklebar mower. However clippers are good for students. For school purposes the willows are best cut after the leaves drop and planted for erosion control purposes in the fall. You can also harvest in the early spring before the buds open and replanted while they are dormant. If the willows are planted right after they are harvested you may have some luck planting at other times of year but it is not the best timing. These cuttings can either be used for erosion control plantings or restoring streambank habitat, put in beds to develop rooted cuttings for more plantings (see directions below), or used in basket making. If the cuttings are not to be used soon they can be stored in a cool, sheltered area.

5. If cuttings are to be used for planting unrooted into streambanks, they should be 9 to 12 inches long and average one-half inch in diameter. Recent plantings on streambanks with longer cuttings are showing promise-especially where existing sod provides competition. If they are to be used for producing rooted cuttings in the nursery, make the cuttings six inches long. Cuttings can be bundled and the ends dipped in latex paint or paraffin if they are not to be used right away. Keep cuttings in cool, dark place until used. Do not allow to dry out.



FASCINE ROLLS (WATTLES)

6. This process is repeated yearly. It is essential to cut the production block back each year to just above stool height if long, twig-free canes are to be produced. If two-year old wood is allowed to persist side branches or twigs will develop, which require hand trimming if the canes are to be used. However, when cuttings of larger diameter are desired, two-year old wood can be utilized. Some weed control should be practiced.

7. Fertilize rows annually with 10 to 20 pounds of 10-10-10 per 100 linear feet of row. Full production occurs in about three to four years. Each 100 feet of row will produrce at least 1,000 to 1,500 nine inch cuttings per year.

Production of Rooted Cuttings :Once you have a productive row of willows you can continue to harvest new sprouts each year. However if you would like to start a new plot you can cut sections of branches and produce rooted cuttings in the following manner:

1. Stick four to six inch hardwood cuttlngs in bed of loose soil as early as possible in spring. These cuttings should be approximately 5/16 inch in dlameter."

2. Plant the cuttings one to two inches apart in the row, with rows six to nine inches apart. Leave one half to one inch of the cutting out of the ground, oriented with the buds up.

3. Water as needed; keep weedfree and fertilize to produce desired growth. Shoot and root growth is rapid and the rooted cuttings are ready for planting the following spring. Usually 10 to 16 inches of top growth is produced. Dig cuttings in dormant state and trim top growth to 10 to 12 inches. Replant or store in the manner described above.

How to use Willows for Erosion Control and Buffer zone plantings (adapted from Ch. 18 of Engineering Field Handbook, "Soil Bioengineering for Upland Slope Protection and Erosion Reduction" produced by the USDA Natural Resources Conservation Service (formerly SCS). For additional information on these planting techniques consult with your local Natural Resource Conservation Service and this handbook.)

Willows can be used effectively to prevent erosion on exposed banks. They can also be used to create buffer areas around bodies of water preventing water pollution and creating wildlife habitat.

Site conditions: Willows will not do well in sites that are heavily shaded or are trampled by livestock. Banks being planted should be a 2:1 slope or gentler. Steeper slopes will not hold the vegetation. If needed get some assistance to make sure the slope is suitable. If earthwork is involved check with your state Department of Environmental Protection and local authorities for the proper permits. On streambanks it may be necessary to protect the slope below the water line with rock riprap. Consult with your local Conservation District and Natural Resource Conservation Service for technical advice. On sites with poor soil conditions you will need to work lime and fertilizer into the soil for adequate growth. Fertilize carefully so as not add additional nutrients to nearby water bodies.

Planting methods: The willows can be planted in a variety of methods.

1. In areas with little flooding or erosion potential the willows can be planted as a buffer area in the conventional method. Plants or rooted cuttings should be planted when they are dormant either in the early spring or late fall as described above. Plant the willows 2-3 feet apart in a triangular pattern. Rooted cuttings should be planted vertically in the bank with only 1-2" showing.

2. In areas more prone to erosion additional measures need to be taken to keep the willow material in the ground and stabilize the site until the willows have a chance to get established. Two methods of doing this are live staking or planting willows in fascines or wattles. Other methods are also described in the Engineering Field Handbook.

a. Live Stakes: If you grow 2 year or older willows you should be able to get thicker trunks that 1/2 to 1 1/2 inches in diameter. When the tree is dormant cut the trunk, leaving a 1 foot high stump that will resprout. Cut the trunk and branches that are greater than 1/2 in diameter into 2-3' long sections. Sharpen one end of each section so it can be pounded into the ground. Plant the live stakes every 2 to 3 feet in a triangular pattern by hammering them into the ground so that 4/5 of the live stake is buried. Replace any split live stakes. In firm soil you can use an iron bar to start the holes. The stakes should be placed into the ground with the buds oriented up.
The stakes will sprout during the next growing season and establish roots.

If the area is prone to water erosion and there is a lot of exposed soil you should plant rye grass (1-2 lbs. per 1000 sq. ft.) and cover with a jute mat or mulch. Do the seeding before the live staking and use the stakes to hold the matting in place.

b. Wattles or Fascines: Further slope protection can be gained by planting willows in bundles called wattles or fascines. The wattles are constucted in the following manner:

1. Cut long sections of willow stems that are less than 1/2 inch in diameter. Put them in a cigar shaped bundle. Keep the stems oriented with butt ends in the same direction. Alternate the ends of the cuttings so the tops are distribute evenly throughout the bundle. Make the bundle 5 to 30 feet long depending on the needs of the site and the limitations to handling. Tie enouigh stems into a bundle to make a 6-8 inches in diameter at the butt end. Secure the bundle with twine tied every 12-15 inches.

2. Starting at the bottom of the slope dig a trench across the slope on the contour. The trench should be deep enough for the wattle to be place into horizontally. Place the wattle in the trench. Use stakes made from 2 1/2 foot long 2x4 lumber cut diagonally. Put the stake through the wattle every 2-3 feet along the length of the wattle. In between the stakes you can also put a live stake on the downhill slope below the wattles to help keep them on the slope. Cover the wattle with moist soil so the top is barely visible and tamp firmly. Go up the slope 3 feet of vertical gain and repeat the process. Do this all the way up the slope. In the growing season the wattles will sprout forming

a rows of willows along the contour of the slope. The bundling of the willows provide extra protection and help stabilize the slope until the willows can get established well.

Willows for Basket making

The Streamco Willow is also known as the "basket willow". Most other willows are also suitable for basket making. You can cut the thin shoots and soak them in water for making baskets. Consult your local library or book store for instruction in books on making baskets with natural material.

MAXIMIZING THE EDUCATIONAL VALUE OF A "KIDS FOR TREES" PROGRAM

The goal of the "Kids for Trees" program is to involve students in hands-on resource management so they can explore overall concerns for utilizing natural resources while conserving the integrity of the environment. Thought needs to be given to how you can develop your "Kids for Trees" program to maximize the educational value to your students. This program has many different features that help provide for a sound framework for the study of natural resource management. (See the program above on the section related to "Key Concepts...") Below are a variety of suggestions on ways to develop the educational benefit of "Kids for Trees". As mentioned earlier it is best to develop a basic program first and then add additional activities to your program as the program matures and expands. The educational opportunities are limited only by your imagination. "Kids for Trees" involves many different aspect including the economics of the project, mathematical anaiysis and record keeping of the plots, local history, creative writing, and many other opportunities. Choose the approach and activities that make the most sense for your program. Start out simply and develop your program with time.

Tie the program to the scope and sequence of your existing curriculum

The easiest approach for developing your "Kids for Trees" program is to make ties to existing curricula. Listed below are the suggestions developed by one school district regarding activities the classes could do at the "Kids for Trees" site that tie into their curriculum:

3rd grade: tree identification , set up the planting grid, plant trees, graphing, journal writing, money and fundraising activities

4th grade: Water: watershed, aquatic insects, stream measurements

5th grade: Wildlife: Project Wild activities (ie. Oh Deer) , habitat hunt (What habitats are found on the site? Which animals would find these habitats suitable?)

6th grade: erosion control, bird houses, entering data into the computer (keyboarding and spreadsheet activities)

7th Life Science: plant survey: different kinds of plants (vascular/non-vascular), deciduous key

8th Physical Science: soil chemistry and site preparation in fall

9th Earth Science: study site characteristics for site selection and mapping, data analysis

10th Biology: growth characteristics of the trees related to pruning

11th Chemistry: further work on soil chemistry

12th Grade: accounting and financial analysis of the project.

Students learning about tree growth with Conservation District staff.

A Problem Solving Approach to Natural Resource Management

Another approach for "Kids for Trees" is to engage the students in progressively more complex questions and activities regarding the care of the trees. This approach will stimulate the student's understanding of natural resource issues as the trees grow. Below is a list of some possible questions: (The sequence is generally taken in order of complexity as a progression of ideas. However, there is no "correct order" for these questions. They can be dealt with over the years as the trees grow or during different times of the year.) Along with these questions are some suggested activities you can do to explore these concepts.

1. What do plant and animals need to survive and grow?

Suggested activities: Have the students raise small animals and plants in the classroom. Discuss the basic needs of these organisms and relate it to what trees and other plants and animals at the "Kids for Trees" site will need to grow and how these needs will be met.

2. What are the current conditions at the site? (sunlight, climate conditions, soils, topsoil depth, drainage, fertility, plants and animals, unique features, etc.)

Suggested activities: "The More You Look the More You See!": Share with the students the chapter on site selection and the needs of various trees. Break the students up into groups to study the various characteristics of the site. Students can visit the site, map the site, take measurements on site conditions and transfer their findings to the map. For example, the students could develop maps to show the following :current vegetation types, topsoil depth at various locations on the site, topography, unique features, etc. Students could also get soils maps of the area from their local Soil and Water Conservation District or Natural Resource Conservation Service. Have the students look at the site on different scales starting with the overall site and how it is located on the globe and then going progressively finer and finer.(ie make a map of the overall site, study what is found in a square meter, and in a square 10 cm x 10 cm plot) Discuss what can be learned from each level of observation.

3. What guidelines should we use to grow trees that provide a continuous supply of wood while still maintaining the environment? How can we best manage our area to insure the continued health of all parts of the environment? What principles can guide our decisions?

Suggested activities: "For Generations to Come": Discuss the concept of sustainability. Have the students raise a pan of grass. Measure the growth rate of the grass and try different rates of harvest to see what effect it has on the plants. Discuss the term renewable resources and discuss the similarities and differences between the growth of the grass and the growth of trees. Invite a

forester to the classroom to discuss how they manage a forest to provide for a continuous supply of trees (sustainable yield management) which allows for the needs of other plants and animals in the area (total ecosystem management.) Have your students write an essay or story about how they feel we should balance our need for natural resources and the need for maintaining a healthy environment.

4. What are the growth requirements of various kinds of trees that could be grown on the site?

Suggested activities: " Is it a Match?": Have students research the various kinds of trees, their differences and what they require for growing conditions or share with them the section of this book on the needs of each tree species. Have students assess the current site conditions and the growth requirements of the trees to see which trees best match the site and what would be needed to make the site suitable for other species (if possible).

5. What are the needs of the existing plants, animals and other natural resources found on the site? (ie. nesting sites, habitat requirements, water quality protection, or unique areas)

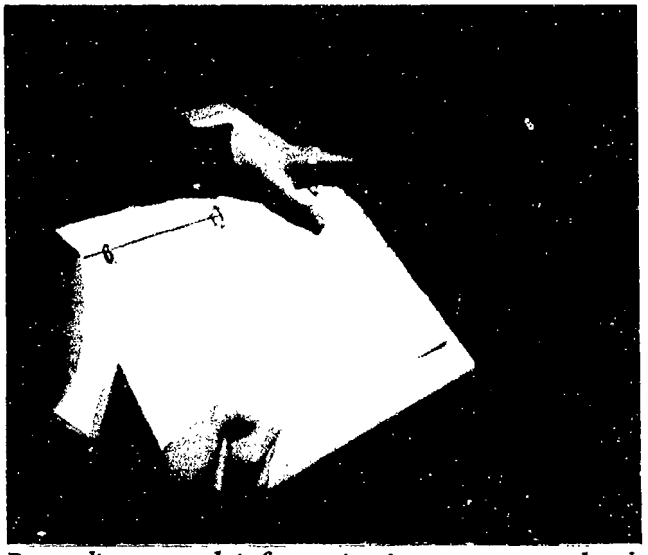
Suggested activities: Have the students look around the site and identify the general vegetation and wildlife that is present. Also look for any unusual or unique organisms or features. Hints about wildlife can come from listening for birds, especially when they first get to the site, looking at vegetation types, and looking for tracks, droppings or other signs of wildlife. Research the needs of wildlife in your area. For older students the Wildlife Habitat Evaluation Handbook developed by the National 4-H Council is an excellent resource.

6. What changes need to be made to the site to help the trees grow? How could these affect the existing and surrounding environmental conditions?

Suggested activities: Discuss the section on the care of trees with your students. What changes can be made to the site to improve growing conditions. Develop plans to deal with weeds, soil conditions, insects (as needed) . You might want to set up growth trials for different practices (ie different methods of weeding, the effect of poor fertility and good fertility, the growth of different kinds of trees .) Be aware that the growth of trees is affected by the surrounding area. Therefore you need a cluster of trees with a given treatment to account for the effect of the surrounding trees. Also set up trials with enough trees in each category to allow for the differences between trees. This is a good exercise in helping students understand the complexity of setting up and interpreting the results of experiments. Observe the trees frequently to gauge the health of the trees and areas where there may be problems as indicated by poor growth. Be aware that growth will be slow at first and picks up as the tree gets established.

7. What changes or adjustments can be made to enhance the growth of other plants and wildlife found in the area? (e.g. avoiding nesting areas, constructing bird houses, or leaving buffer areas near streams.)

Suggested activities: Visit the site with a biologist and get information from them on ideas about ways to allow for the needs of other plants and wildlife at the site. Project Wild has an excellent resource guide: Wild School Site to help you enhance wildlife habitat and study area around your school. Contact your state department of conservation or fisheries and wildlife to find out how to get information on this program. Students can build bird houses at home as extra projects to be put up around the site. Each year these bird houses should be cleaned out in the fall or before the nesting season. Students can keep track of the birds that inhabit the boxes.



Recording growth information in a master notebook.

8. What records can you keep to better understand the trees and their growth?

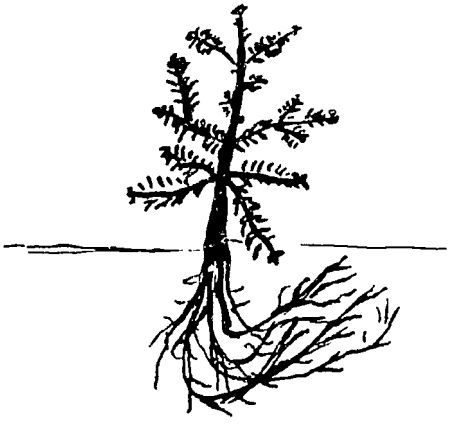
Suggested activities: To monitor the progress of your trees it is very useful to keep records you can compare. Height records, observations on tree growth and color, soil tests, and observations on tree mortality, insect problems or frost damage can be very helpful. It is best to keep these records in a master notebook so that the teachers and students involved can get a good overview of the health and growth of the trees. Entry of this information into the computer can be a positive, real life example to how to use computers to better store and analyze data. Video tape records of the trees and the activities are useful tools. These will also be useful and fun for the students to view in later years of the project to get some perspective on the changes in their trees and the site over time. (Note: in the earlier years of the program the records for each tree were kept in a separate notebook and were passed from one grade to the next. This became very cumbersome. It is much more useful to keep the records in one notebook.)

9. What is the life cycle of the pests that could affect the trees? How can understanding the life history help control or monitor the pests or other insects in the area? How does integrated pest management differ from other forms of pest and weed control?

Suggested activities: See the section on pest control. Consult with your local Cooperative Extension office and other publications to become familiar with potential pests. Study insects and potential pests by sweeping the area with nets, shaking branches over a paper or cloth, or with insect traps. Discuss the possibility of an integrated pest management system with your Cooperative Extension specialist. You can also diagram a food web for area plants and insects. Look at the mouthparts of the insects to get clues about how they eat.

10. How well are the trees growing? Project the growth of the trees till the year of harvest. Will the trees be of the proper size and quality for the planned use?

Suggested activities: Analyze the growth records and look for trends in the tree growth. Use average growth figures to project future growth. Be aware that the maximum growth should be no more than 10-12 inches per year. Growth beyond this point will be pruned back. (See the section on tree pruning and shaping.)



Avoid "J-Rooting" due to improper planting technique.

11. What are the major causes of mortality and unmerchantable trees? What can be done differently to reduce these concerns? Is it desirable or possible to have all the trees the same?

Suggested activities: "Tree Detective": Observe the trees as often as possible with your students. Look for dead trees, poorly shaped trees, or trees that are not growing well. Look for clues as to the possible cause of the problem. Dig up dead trees and look for "J" shaped roots that would indicate poor planting procedures. Look for signs of insect damage, poor fertility, or dead tips that might indicate frost damage. Visit the site with a Christmas tree grower, Cooperative Extension specialist, forester, or plant pathologist from the state department of forestry or nurseries. They may be able to assist you in analyzing problem areas. Put your plan to work to enhance tree growth and reduce problem.

12. How do the techniques of professional Christmas tree growers differ from the practices used by your class? What other careers are involved in natural resource management?

Suggested activities: Have a professional Christmas tree grower or other natural resource professional visit your class or go to visit them where they work. If you can't take your class to a tree farm you can make a "video field trip". Visit a tree farm or other natural resource managers where they work with a video camera and make a tape of their activities at work. Have your students research various careers in natural resource management. Christmas tree growing associations may also have instructional videos that you could borrow.

13. How does the tree grow? How do I shape and prune the tree to get the proper growth?

Suggested activities: Bring twig samples into the classroom. Have the students look closely at twigs and buds. Discuss the growth patterns of the trees (see the section on pruning). Have the students draw various budding arrangements or give them drawings of different bud problems (i.e. normal budding patterns, damaged leader, double tops, etc.). Give students a budding pattern and have them draw their prediction for the new growth. Have the students draw how these trees could be pruned and how this would affect the new growth. Demonstrate pruning procedures and have the students carefully prune their trees.

14. Are there other potential environmental problems at the site that need attention? (ie erosion, runoff problems)

Suggested activities: Discuss possible environmental problems of abuse or overuse. Have the students discuss potential problems that could occur on their site if it was not managed properly. Look over the site for possible problem areas (e.g. litter, areas of erosion or degraded habitat). Develop a plan with the class to deal with these problems. Students involved in growing willows can take the "willow whips" they harvest and use them to stabilize a nearby bank on a roadside or a stream.

15. How is a tree plantation different from a forest?

Suggested activities: Compare and contrast a forest to your plantation. Discuss the pros and cons. Where are plantations appropriate? Where are other approaches to forestry appropriate? How can the plantation environment be modified to include some of the features of a less managed forest?

16. How much time and cost was spent to grow the trees? What options are there for marketing the trees? Uses for byproducts? (e.g. chip used Christmas trees)

Suggested activities: Have the students list all the inputs and outputs of the project, both financial and otherwise. This can be an exercise in monetary budgeting as well as looking at the environmental inputs and outputs. Students should brainstorm with regards to the best use of the trees and the marketing options.

17. What is needed to regenerate trees on the plot? What have we learned about managing our area to insure the continued health of all parts of the environment? What principles should guide our decisions?

Suggested activities: "Sustainability Revisited": This is a follow up to the original discussion on sustainability. Students should explore how the next generation of trees will be planted to create a renewable resource. Focus on the long-term viability of the proper management of natural resources.

18. How has the site changed over the years? Are we being good stewards of the area?
How can we spot overuse or abuse of a natural resource and deal with these problems?

Suggested activities: Compare old records and photographs of the site to current conditions. How has the site changed? This could lead to discussions of succession (inevitable change) and the long-term impact of humans on the site. Is the project being a "good steward" of the site? What could be improved or done differently? Students can also take temperature and other measurements to show how the trees have modified the microclimate and environment around them. Students can also observe wildlife changes over time.

19. What can we do to help future classes (and generations) grow trees and understand how to care for the environment?

Suggested activities: Encourage the students to think about their responsibility and assistance to future classes planting trees. This is a good exercise for the students to reflect on what lessons they have learned. What "wisdom" could they pass onto the next class. A useful "service project" could be to have the outgoing class assist the next group in planting new trees. Other possibilities could be for the class to develop a learning station at the site to enhance the educational value of the area. For example, they could plant a variety of trees for a mini-arboretum, build bird houses, a bird blind, construct a sign for the site, give tours for community groups, etc.

Classroom management note: Some of the investigations suggested by this problem solving approach may be more conducive to small group investigation. In such cases the class should be broken up into several small teams. Another approach, such as building bird houses, would be to have the students take on an individual project as an independent or extra credit project or to involve other classes such as the industrial arts program. The closer the site is to the school more options for study will be available.

A good way to explore these issues is to introduce several of these questions in a brainstorming session with students. Have the students discuss what they could do to explore the questions generated. Develop an action plan and follow through with the plan. Students should be encouraged to come up with their own questions to explore. One method of management to deal with this kind of long-range problem solving would be to set aside one class period a week to work on the program.

There are many excellent resources regarding an action-oriented problem solving approach to learning. One that I would recommend is Education in Action, A Community Problem Solving Program for School, by Dr. William Stapp, School of Natural Resources, 430 E. University, The University of Michigan, Ann Arbor, Michigan 48109-1115, 1988, Thomson-Shore Printers, 7300 Joy Road, Dexter, Michigan, 48130.

KEEPING THE PROJECT GOING

Like any long term project, your program will ultimately have challenges to deal with along the way. The following are some suggestions for keeping the project going and on track.:

- Maintain a strong steering committee representing all the parties involved with the project. This is an excellent tool to keep the lines of communications open, plan the current years activities, monitor the progress of the project, and provide support. Meet as a committee at regular intervals to deal with upcoming activities and issues.

- Monitor the site regularly. At least once a season take a walk through the growing area. Note how the trees are growing. Are there any problem areas or signs of problems? If problems arise develop a direct plan to deal with the problem. Regular trips to the site can also be quite gratifying to see the progress the trees have made.

- Build and maintain community support. Publicize the progress of the project regularly in the local media. Include community members on your planning committee and in assisting students at the site. Community members can also be very helpful in performing tasks beyond the time constraints of school and the abilities of the students. Community members might assist with mowing of the site in the summer, rototilling the new site, and assisting with pest control.

- Plan ahead. Keep looking ahead and start preparing for each phase of the project well in advance. In this way you can keep on top of the changing needs of the trees and insure a more successful project.

- Celebrate your successes and learn from the failures. "Kids for Trees" is a learning project and very few of us are professional Christmas tree growers. Don't get discouraged if your first trees do not do as well as you might have expected. Talk with a professional grower

about the first trees they grew. The most important goal of the project is the learning that takes place as a result of the project. Sometimes there can be more learned by problem areas than successful growth. This project is also real life. Not every tree in a forest grows tall and perfectly shaped. This is an important lesson for students to learn. As the years progress, there will be much that your students can be proud of. With patience there is much to be learned about our renewable natural resources and their care.

"Kids for Trees" projects can be quite challenging. However it is very important that students have a good understanding of natural resource management issues in a real-life, hands-on environment. Growing trees is an experience that can last a life time.

APPENDIX

Record Keeping

Consistent record keeping is very helpful and an excellent educational activity. When students visit the site take yearly measurements of heigth. Students collect results from individual trees and report the results to a key person for each grade level. It is best to keep a master notebook for each plot of trees so the information can be kept and analyzed over the course of the project. To facilitate record keeping each tree is designated with an identifying number. We have found that the easiest way to do this is to have a letter for each row and a number for each column in the plot. For example the first tree in the plot is A1.

Your records will generate a lot of information over the years. We found that it is not useful to have data stored for each tree in a separate notebook. Individual records are hard to manage and the data is spread throughout too many notebooks. Using this approach in the early years of this project led to lost information. It was also difficult to collect the information to analyze the growth of the entire site.

A better approach to handle this information is to keep the records in a computer spreadsheet. Each row of the spreadsheet represents one tree. The columns in the spreadsheet represent each year the trees are measured. As the students get older they can set up the spreadsheet and enter each year's data. This not only facilitates record keeping but is an excellent excercise in computer literacy. Below is a sample of some of the our growth records:

Class of 1998 trees (Balsam Fir) 100 trees planted at SAD#44

Mortality after the first year: 19%
(Note: many of the trees that died were replanted the first year or replaced by Scotch Pine the second year. The Scotch pines have nearly caugth up in growth due to their faster growth rate.)

Heigth in cm. (measured from the base to the top of the leader)

	1989	1990	1991	1992	1993	1994	1995
Average growth	23.78	26.95	31.46	39.40	47.02	64.46	78.45
Best growth (C10)	21	24	31	34.5	40	60	132

RESOURCES

Kids for Trees Assistance

Jim Chandler, Oxford County SWCD, 1 Main Street, South Paris, Maine 04281, (207) 743-7019.

Christmas Tree Growing Information

Southern New England Christmas Tree Growers' Manual, edited by Dr. John F. Ahrens, University of Connecticut Cooperative Extension System, (203) 486-3336.

Using Willows of Erosion Control Plantings

Ch. 18 of Engineering Field Handbook, "Soil Bioengineering for Upland Slope Protection and Erosion Reduction" produced by the USDA Natural Resources Conservation Service

Educational Activities Related to Trees

Project Learning Tree, The activity guides of this excellent project are distributed through training workshops. Contact either your state department of forestry or the American Forest Foundation, 111 19th Street NW, Washington, DC 20036 (202) 463-2455 for information on the PLT coordinator in your state.

Site Planning for a School Outdoor Education Area

Project WILD School Site, : Contact your local Project WILD Coordinator or
Project WILD
c/o WREEC
4014 Chatham Lane
Houston, TX 77027
(713) 622-7411

Community Problem Solving

Education in Action, A Community Problem Solving Program for School, by Dr. William Stapp, School of Natural Resources, 430 E. University, The University of Michigan, Ann Arbor, Michigan 48109-1115, 1988, Thomson-Shore Printers, 7300 Joy Road, Dexter, Michigan, 48130.

Notes:

"Kids for Trees"

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Conservation District
South Paris, Maine 04281
(207) 743-7019