ODC (74/75) : 945.4 : (047.1)

1975 AT THE NORTHEASTERN FOREST EXPERIMENT STATION

USDA FOREST SERVICE GENERAL TECHNICAL REPORT NE-24
1976

FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE
NORTHEASTERN FOREST EXPERIMENT STATION
6816 MARKET STREET, UPPER DARBY, PA. 19082

FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE, UPPER DARBY, PA.

1975 AT THE NORTHEASTERN STATION

CONTENTS

NORTHEASTERN FOREST EXPERIMENT STATION
F. BRYAN CLARK, STATION DIRECTOR • 1976

1975: GENERAL

RENEWABLE FOREST RESOURCES contribute to our lives in a variety of ways. They provide wood for myriad products; they provide water, wildlife, recreation, and scenic beauty; they provide many amenities that make living more pleasant. The challenge for us is to manage our forest lands as an all-purpose renewable resource that will bring the greatest good to the greatest number, now and in the future.

For forest-resource managers, the challenge demands a mix of professional training, practical knowledge, hard work, and creative ideas. For developing the new scientific information needed to meet the challenge, a vital role has been assigned to research.

Space does not permit a review of all our research projects, so we have selected a few activities and accomplishments to highlight our diverse research program. You will also find in this report a list of the research results published in 1975.

We have recently expanded our research program in two areas. At our laboratory at Orono, Maine, research in silviculture of northern conifers—with emphasis on spruce-fir—has been expanded to include the spruce budworm and wildlife habitat considerations. We hope this combined thrust will help solve critical problems in management of millions of acres of important northern forests.

The second area of expansion deals with backcountry recreation such as hiking, backpacking, and ski-touring, and their impacts on forest ecosystems. The capacity of backcountry areas to support recreation is unknown. Management systems are needed for providing a variety of dispersed recreation opportunities, while maintaining a quality environment and meeting other resource needs. A research work unit at our Durham, New Hampshire, laboratory will develop and test management systems for insuring compatability between dispersed recreation and forest ecosystems.

Our continuing research on high-priority problems also reflects the multiple pressures on forest land. The Nation's energy crunch emphasizes the importance of our research at Berea, Kentucky, in which we are seeking better ways to rehabilitate areas strip-mined for coal.

Our gypsy moth research and development program, centered at Hamden, Connecticut, continues to focus on a comprehensive scientific approach to protecting our hardwood forests from damage by gypsy moth epidemics.

Logging research on the Fernow Experimental Forest in West Virginia is adapting skyline cable systems to the operating conditions in the Appalachian hardwood forests where slopes are steep and forest ownerships and operations are fairly small. Skyline systems have the potential of being environmentally acceptable, especially on steep slopes where logging operations are highly visible and chances of soil erosion and silting of streams are high.

Hardwood sawtimber stands in the Appalachians contain a surplus of low-grade material. Production of standard-grade lumber from grade-3 logs is generally unprofitable, so our researchers at Princeton, West Virginia, are investigating the potential for producing and marketing construction-grade plywood from grade-3 logs. Researchers there are also working with the economic and marketing problems in getting more use out of the materials usually left in the woods as logging residues.

One energy-related study deals with using old railroad crossties for fuel. U. S. railroads replace about 20 million ties annually, and

railroads have a costly problem in disposing of old ties. Princeton laboratory studies indicate that 1 ton of crossties has the heating equivalent of 100 gallons of No. 2 oil, or ½ ton of high-grade bituminous coal, or 12,000 cubic feet of natural gas. Practical ways of using this potential energy resource are being pilot-tested.

Research on marketing maple syrup at our Burlington, Vermont, laboratory has caught nationwide attention and is being coordinated with our Canadian neighbors. Maple syrup is an important source of income to thousands of farmers and woodlot owners in the Northeast and in Canada. The Station and the International Maple Syrup Institute (IMSI) recently signed a memorandum of understanding providing for cooperation in research. IMSI is supported by both the Canadian and American industries and cooperates closely with the Canadian Government.

Watershed-management research by the Station continues to get international attention. Our Hubbard Brook Experimental Forest in New Hampshire is the location for important studies by both Forest Service scientists and several cooperating scientists. Related work is under way at our Parsons, West Virginia, laboratory. Research there has developed valuable information on nutrient cycling, water quality, and forest-management alternatives as well as water yields. Watershed scientists at Pennington, New Jersey, are researching problems of managing watersheds used for urban water supplies.

Within the Pinchot Institute for Environmental Forestry Research, the Consortium for Environment Studies—nine universities and the Station—continues to pursue an active cooperative research program. The Consortium also organized and sponsored three symposia in 1975: Planning and Management of the Metropolitan Physical Environment; Selection and Breeding of Trees for Densely Populated Urban Areas; and The Meaning of Natural Environments to Children.

RESEARCH HIGHLIGHTS

Northern Conifer Research Expanded To Include Wildlife and Spruce Budworm

Our research on the northern conifers (with emphasis on spruce-fir forests) has been expanded to include wildlife habitat and spruce budworm research. The research already under way in silviculture, nutrition, and growth and yield is being augmented with the addition to our staff of scientists trained in wildlife and insect research.

This multifunctional approach is designed to explore the interaction of the many factors in the forest ecosystem, ranging from intensive silvicultural practices to the effects of natural disturbances such as spruce budworm attacks and the effects of budworm control practices.

The wildlife research will emphasize the evaluation of habitat types as created or modified by other practices and events. The budworm research is designed to: (1) develop forest-management practices, consistent with sustained yield, that will limit buildup of budworm populations; (2) evaluate management systems to minimize budworm damage by taking advantage of new chemical and biological control techniques; and (3) develop an effective long-term reional forest- and pest-management system.

Progress in Reclaiming Strip-Mined Lands

A growing public concern for environment —in the face of national energy needs—has given new impetus to efforts to reclaim strip-mined lands. Our researchers at Berea KY found that shredded bark mulch, used with lime and nitrogen and phosphorus fertilizers, promoted a complete quick cover of both grasses and legumes on extremely acid (pH 2.2 to 3.5) mine spoils in eastern Kentucky.

Without mulch, only a sparse cover of grasses was obtained *(Vogel 1975)*.

In another study, Virginia pine seedlings inoculated with *Pisolithus tinctorius*, an ectomycorrhizal associate, showed better survival and growth on highly acid spoils than uninoculated seedlings did. And a photographic method—employing a background micro topographic profile gage—was developed for measuring the progress of erosion on spoil banks *(Allen and Curtis 1975)*.

Gypsy Moth Egg-Mass Sampling

In our gypsy moth program, reliable estimates of egg-mass density help in identifying potential hazard areas. We are now field-testing a point-sampling system like those used in forest inventory. Preliminary trials show that such a system not only provides reliable egg-mass density estimates at reasonable cost, but also is well suited to proiding other important diagnostic information such as tree defoliation, species composition, and timber volume and quality. Additional work is planned to increase the cost-effectiveness of the system and to modify it for use in preliminary quick scouting of potential hazard areas.

Remote-Sensing Technique Used To Measure Gypsy Moth Defoliation

Measuring the severity of defoliation done by the gypsy moth is a key tool in our research for ways to control this pest. Several methods have been tried. Last year we used a patented photometric interpretation technique developed by Calspan Corporation of Buffalo NY.* With this technique, density measurements made from camera film can be converted mathematically into reflectance values for various ground objects (soil, water, foliage, etc.).

Using a microdensitometer, Calspan developed a defoliation measure that related reflectance measurements from color infrared photographs at a scale of 1:15,680 to ground defoliation estimates. We now feel confident that a defoliation map can be produced for any location or management unit.

* Mention of any commercial product is for information only and should not be considered an endorsement by the Forest Service or the Department of Agriculture.

Progress in Use of NPV For Gypsy Moth Control

Progress is being made on the use of the gypsy moth nucleopolyhedrosis virus (NPV) as a biological control for this insect. Persistence of the gypsy moth NPV after aerial spraying was studied. Natural virus persisted much longer than sprayed virus, indicating that the formulations lack the protective ingredients found in the naturally occurring material *(Mazzone 1975)*.

Meanwhile our package of data for the registration of gypsy moth NPV is nearly ready. Modification of the production system is the present main thrust. Although the data have not yet been completely analyzed, aerial efficacy tests conducted in Pennsylvania were very encouraging.

Marketing Construction Plywood From Low-Grade Hardwood Logs

Hardwood sawtimber stands in the Appalachians contain a surplus of low-grade material. But producing standard-grade lumber from grade-3 logs is generally unprofitable; so we have been studying the possibilities of producing and marketing construction-grade plywood made from grade-3 logs. Our initial study showed that the cost was about the same as the cost for producing southern pine plywood. However, laboratory and field tests were contradictory: though the plywood did not meet the glue-bond requirements for exterior plywood, it performed well in a variety of applications.

The research was extended to see whether plywood made from a mixture of hardwood species would meet the glue-bond tests. Six species combinations met the requirements for exterior-grade plywood, and seven other combinations met the requirements for structural C-D plywood. The most suitable combinations are red oak, hickory, and hard maple for outer plies and yellow-poplar, soft maple, and black gum for inner plies *(Craft 1975)*.

Grading System Developed For Hardwood Veneer Logs

Most hardwood veneer mills have their own log-grading systems. These grading systems are based on anywhere from two to six grades, and this is confusing for people who sell veneer logs to several mills. Also, changes in the marketing situation usually result in changes in grading procedures rather than adjustments in prices. A need has been felt for a standard log-grading system that is related to veneer yields.

A study was made to correlate face veneer yields with external characteristics of yellow birch and sugar maple logs. From this study, a preliminary grading system was developed by which veneer logs can be sorted into three distinct grades. The results suggest that a standard log-grading system can be used to predict face veneer yields *(Rast 1975)*.

Recycling Old Crossties For a New Source of Fuel

Railroads in the United States replace about 20 million crossties every year, and they have a costly problem in disposing of the old ties. Since the old ties are cut into pieces for removal, they cannot be used for fence posts or architectural purposes; so they tend to accumulate as trash along rights-of-way, where they impede drainage and create fire and safety hazards. Researchers at our laboratory at Princeton WV are studying the possibilities of using these old crossties for industrial fuel.

Laboratory studies of crosstie weight and heat of combustion have indicated that 1 ton of ties has the heating equivalent of 100 gallons of No. 2 oil, $1\frac{1}{2}$ ton of high-grade bituminous coal, or 12,000 cubic feet of natural gas. Projected on a national basis, this could mean a saving of $4\frac{1}{2}$ million barrels of oil, 1 million tons of coal, or 24 billion cubic feet of natural gas. A full-scale test of using old ties for fuel has been planned, including methods and costs of collection, processing, and combustion *(Church 1975)*.

Studies in Marketing of Maple Products

Two research studies in marketing of maple products were begun in 1975 at our laboratory at Burlington VT. One study was to determine consumer preferences for different grades of maple syrup. Outside the maple-producing region, distinct preferences were found among Fancy grade, grade A, and grade B. Grade B, the darkest syrup, was preferred over grade A and Fancy at a ratio of 1.52 : 1. Grade A was preferred over Fancy, the lightest syrup, at a ratio of 1.09 : 1. From the result of this study, our researchers recommended that the industry should promote the lighter grades more than the darker grades.

The other study was made to determine the effects of eight different types of containers on the quality of Fancy, grade A, and grade B syrups under normal marketing and storage conditions. Results showed that, for all containers tested, a Fancy grade syrup stored no longer than 6 months at a temperature of about 24°C will hold its quality well. However, syrups stored at temperatures higher than 30°C for more than 6 months may undergo a one-grade drop in color change, especially if the syrup was already dark for its grade.

Manipulating Types of Cells In Sugar Maple Wood

In sugar maple trees the starch, from which the sucrose of the sap is derived, is stored mainly in the vascular rays—multicellular conduits that extend horizontally through the tree. There is evidence that some sugar maple trees have more sucrose in their sap than others because they have a greater proportion of these vascular rays. Now we are finding that, by stimulating cambial activity, we can manipulate the tree silviculturally to produce a greater proportion of vascular rays. The production of this kind of wood seems to continue for several years, even after a decline in cambial activity.

Strip-Cutting Moderates Impacts On Hydrologic and Nutrient Cycles

At the Hubbard Brook Experimental Forest in New Hampshire, two contemporary forest practices—block-clearcutting and progressive strip-cutting—are being studied on small watersheds to determine how they affect water yield and the nutrient ion concentrations in the streams.

In the strip-cutting, one-third of the watershed was cut over during the first 2-year cycle (one of every three sets of 82-foot-wide adjoining strips was cut). Annual streamflow increased by an average of 32 mm—about one-tenth of the estimated increase expected if the entire watershed were clearcut. In the second 2-year cycle, when another third of the watershed was cut in strips, the annual increase was 114 mm.

Nutrient ions in the stream were also affected. In the first 4 years of strip-cutting, ion concentrations increased: nitrate 7 mg/l, calcium 0.9 mg/l, and potassium 0.3 mg/l. In contrast, block-clearcutting caused maximum increases: nitrate 23 mg/l, calcium 3 mg/l, and potassium 1 mg/l. The differences indicate that the impact of complete harvesting can be moderated by changing the time span and configuration of the cutting *(Hornbeck and others 1975)*.

How Forest Vegetation Can Moderate Noise Levels

Current studies by our researchers at Pennington NJ have shown that forest vegetation can reduce noise levels, even at the frequencies common in urban areas. These studies were designed to identify what it is about forest vegetation that absorbs sound, as a basis for recommending techniques for improving the ability of forests to reduce noise levels.

It is the forest floor that is most effective for absorbing sound. Tree boles scatter the sound, and this increases absorption of sound by the forest floor. The conditions that favor sound absorption are a moist litter layer and a friable well-structured soil—in short, what forest scientists consider good soil conditions. This suggests that well-managed forests provide maximum sound absorption as well as various esthetic benefits.

Dutch Elm Disease Research

Multilure, a synthetic pheromone that attracts the European elm bark beetle, carrier of the Dutch elm disease, was evaluated as a tool for beetle-population control at Fort Collins CO and Detroit MI. Though large numbers of beetles were captured on sticky traps (1.5 million at Fort Collins and nearly 4 million in a section of Detroit), there was no apparent reduction in Dutch elm disease in either area. Pheromone-baited traps were used again in 1975 to detect the beetle in new locations, and new state and county records for the beetle were established at a number of places in the United States and Canada.

Effectiveness of methyl 2-benzimidazole carbamate hydrochloride (MBC . HCl) pressure-injected into elms has now been evaluated for 3 years. In areas where all diseased and nearby healthy elms have been injected, elm losses have been only half of those in untreated areas. Treated diseased elms have recovered (about 60 percent of those with 10-percent symptoms and 30 percent of those with 20- to 40-percent symptoms). Preliminary results of more recent studies show that injection followed by removal of symptomatic branches results in an even higher rate of recovery.

A Guide for Regenerating Allegheny Hardwoods

Heavy browsing by deer on tree seedlings inhibits the regeneration of black cherry/maple forests on the Allegheny Plateau of Pennsylvania and New York. Only in stands where advanced seedlings are abundant before cutting is regeneration satisfactory after clearcutting.

Where advance seedlings are sparse, shelterwood cutting will usually increase the number of seedlings—if competition from grasses, ferns, beech root suckers, and strip maple is not excessive. Soil drainage and the importance of esthetic and recreation uses

also affect the choice of silvicultural systems and cutting methods. A recent report offers guidelines for evaluating the regeneration potential of forest stands and for prescribing the most appropriate treatments *(Marquis and others 1975)*.

A Composite Profile of the Typical Logging Operation in the Northeast

Though the wood-using industry depends on timber harvesting for its main raw material, less is known about the timber-harvesting business than about any other segment of the wood-using industry. So in 1974 an extensive survey was made of commercial logging in the Northeastern States. From the results we were able to compose a basic profile of the combination of men, equipment, and activities that operate to cut and move timber products from the forest to the mill. Here is the profile *(Herrick 1975)*:

> A 4-man logging crew, with equipment worth $38,700, moves 10 miles to a new cutting area 100 acres in size. They remove 700 cubic feet of timber products per acre. The total yield is 68,000 cubic feet, worth $440 per thousand cubic feet. The skidding and forwarding distance between stump and loading point is generally about ¼ mile, though on some jobs it may be as much as ½ mile. The hauling distance over a temporary road from the landing to a paved road is about ¾ mile, but sometimes as much as a mile. From there, the haul to a mill or purchase point is about 29 miles, sometimes as much as 34.

Results of the survey are being subjected to further analysis in an attempt to identify the key to profitable logging operations.

Nongame Birds Are Big Business

Nongame birds have something to crow about: they're big business. Our researchers at Amherst MA found that people who enjoy nongame birds spent $500 million dollars for this activity in 1974—95 percent of it for purchases of birdseed, binoculars, cameras, etc. *(Payne and DeGraaf 1975)*. This tops the $300 million spent in the same year by waterfowl hunters.

Growth and Quality of Stump Sprouts

Stump sprouts are abundant in many young even-aged Appalachian hardwood stands. Examining sprouts of red oak, black cherry, yellow-poplar, white oak, chestnut oak, and basswood, researchers in West Virginia found that a high proportion of the young stump sprouts had good stem form and had achieved excellent height and diameter growth. Stems of sprout origin should be considered strongly as future crop trees. As a follow-up to these studies, cultural practices were applied to 8- and 12-year-old sprouts selected as crop trees *(Wendel 1975)*.

Removing Understory Does Little To Improve Upland Oaks

After heavy thinnings, a vigorous and dense understory soon develops in upland oak stands, and some foresters believe that competition from a dense understory may retard growth of the overstory trees. Several long-term studies have shown that complete elimination of understory vegetation does not seem to be a very profitable forestry practice. In most of the upland oak stands studied, treatments to remove understory did not increase growth of overstory trees enough to justify cost of treatment. And there is a possibility that understory removal may have a bad effect on wildlife habitat.

Biological Control Of Decay in Trees

Our research in pathology has demonstrated that it is possible to prevent decay in trees through biological control. A common soil fungus, *Tricoderma viride*, was inoculated into artificially inflicted wounds on 200 red maple trees in New Hampshire and Maine. When the trees were dissected after 2 years, decay was found in very few of the wounds. Yet decay was found in many of the control wounds that had not been treated. Re-isolation of the fungus from most of the treated wounds indicated that the fungus did not become established in the tree: rather, it was confined within a small column of discolored wood associated with the wound *(Pottle and Shigo 1975)*.

Managing Forests to Provide Den Trees for Gray Squirrels

One of our wildlife scientists at Morgantown WV studied four different levels of management intensity for providing den trees for gray squirrels, one of the important game species of our forests. For dens, squirrels need tree cavities in which they can find winter shelter and can rear their young. The old notion that leaving old cull trees will provide enough dens has been modified, because these old culls sooner or later lose their usefulness as den trees. In his four options for management, our wildlife scientist sees also a need to provide younger and healthier trees that can be managed and treated to provide den sites. Though designed primarily for even-aged forest stands, the two more intensive options could be applied in any forest stand where dens are needed *(Sanderson 1975)*.

Multiple-Use for Watersheds? One Way to Find an Answer

Municipal water companies are coming under increasing pressure to operate their properties for a variety of uses. They dare not add activities that will jeopardize their major objective—to provide water in predictable quantities with acceptable quality. Can they do this and still respond to the pressures for multiple-use management?

At first glance multiple-use management seems incredibly complex to a watershed manager. But these complexities fall away when multiple uses are subjected one by one to a systematic evaluation and recommendation. In one research project we have adapted and expanded a general check system to develop a five-step approach that watershed managers can apply to their local needs and circumstances in the all-important preplanning stage. It is hoped that they will find this approach a useful guide, helping them to meet the water needs of their communities as well as the desires of the various groups that like to use watersheds for a variety of purposes.

A New Guide for Uneven-Age Mangaement of Northern Hardwoods

Most earlier work on uneven-age management of northern hardwood forests in New England dealt with silvicultural aspects rather than the entire managerial job. Now we have a new guide that updates the old concepts and broadens the management base to better meet current needs. This new guide gives detailed recommendations on choice of cutting method, control and prediction of yields, and removal of products.

The emphasis is on encouraging good regeneration through use of single-tree, group, and patch selection. Wide options are suggested for residual diameter distribution, depending on initial stand conditions and cutting policies. And guidelines are offered on removal and transportation of products—truck roads, skid roads, and harvesting precautions. The new guidelines provide for flexibility in practice of uneven-age management to meet a variety of owner objectives and situations *(Leak and Filip 1975)*.

First International Symposium On Acid Precipitation

A worldwide concern is growing about the increasing acidity of precipitation. In some parts of northern Europe, for example, streams once rich with fish and other aquatic life have become sterile. To explore this alarming global problem, the First International Symposium on Acid Precipitation and the Forest Ecosystem was held in May at Columbus OH, sponsored by the Experiment Station and the Ohio State University, Atmospheric Sciences Program.

The Symposium, which attracted a large international participation, focused on the potential magnitude of the problem, including interrelated topics such as atmospheric chemistry, transport of pollutants, and effect of acid precipitation on aquatic life, forest soils, and forest vegetation. The Symposium served to define the problem, its nature and extent, and to provide a basis for formulating research concepts and research direction.

PUBLICATIONS

in 1975 by staff members and cooperators of the Northeastern Forest Experiment Station, Forest Service, U.S. Department of Agriculture

In 1975, Station personnel and their cooperators were credited with more than 200 publications—in scientific and trade journals, popular periodicals, Department of Agriculture publications, symposium proceedings, and Station papers, notes, resource bulletins, and general technical reports.

Publications and reprints that are available, in limited numbers, are marked with asterisks (*). If you want a publication, ask for it by author's name, date, and title. Address requests to the Northeastern Forest Experiment Station, 6816 Market Street, Upper Darby, Pa. 19082.

*Allen, Rufus H., Jr., and Willie R. Curtis.
1975. **A photographic technique for moniing erosion on strip mined lands.** Photo. Appl. in Sci., Tech. and Med. 10(4) : 29-31, illus.

To measure the amount of sediment eroded from areas disturbed by strip-mining, the authors photographed a microtopographic profile gage precisely positioned on preinstalled stakes. The resulting photographs can be run through a chart reader and the information can be transferred onto punched cards.

*Allen, Rufus, H., Jr., and William T. Plass.
1975. **Influence of fertilizer on survival of shrub lespedeza planted on acid spoils.** Tree Planters' Notes 26: 12-13 and 24.

In the amount and manner used, application of dicalcium phosphate and triple-superphosphate was detrimental to the survival of shrub lespedeza. However, nitrogen, when applied with rock phosphate, seemed to be beneficial to survival.

*Anspach, John C.
1975. **Current management practices on the Bethlehem Municipal Watersheds.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13 : 98-104, illus.

Bethlehem, Pennsylvania, derives its water from two watersheds located in the Pocono Mountains, 30 miles north of the City. The Wild Creek and Tunkhannock drainage areas measure 25,500 acres, of which the City owns 72 percent. Water from the forested watersheds does not require filtration and flows by gravity through a 23-mile transmission line to a service area of 90 square miles with a population of 105,000. The watersheds and the management practices used on them are described, including use of watershed lands for recreation and educational purposes.

*Araman, Philip A., and Edwin L. Lucas.
1975. **An automated rough mill for the production of interior furniture parts.** USDA For. Serv. Res. Pap. NE-335. 5 p., illus.

An automated rough mill has been designed for producing interior furniture parts. In this mill the lumber is gangsaw-ripped into full-length strips of standard width before the strips are marked for defects and automatically crosscut to desired lengths. Requiring only three workers, the mill was designed to reduce the need for human decisions that can be costly in converting lumber into parts.

*Auchmoody, L. R., and K. P. Hammack.
1975. **Foliar nutrient variation in four species of upland oaks.** USDA For. Serv. Res. Pap. NE-331. 16 p.

A study of 60-year-old red, white, chestnut, and scarlet oaks in West Virginia suggests that easier-to-reach foliage from the lower crown is well suited for nutrient sampling. Variability was evaluated from samples ob-

tained from the terminal shoot, from each cardinal point in the upper and lower crown, and from the interior. Concentrations of K, Ca, and Mg were generally higher in the lower than in the upper crown, while N, P, Mn, and Fe concentrations were unrelated to position. Tree-to-tree variation was approximately the same for all crown positions. A standard field sampling procedure is suggested.

*Barger, Jack H., and Kenneth Helrich.
1975. **Field test with helicopter applications of Gardona against gypsy moth in Pennsylvania.** USDA For. Serv. Res. Pap. NE-314. 6 p.

Gardona was evaluated as a candidate toxicant for gypsy moth suppression in a field test. Egg-mass counts and defoliation estimates were made before and after spraying. Qualitative and quantitative spray-deposit assessments were conducted. A chemical assay of leaves, soil, and water was made to determine residues. Data suggested that Gardona failed to affect the gypsy moth.

Bauer, Curtis H.
1975. **The consultant's role in municipal watershed management.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 135-140, illus.

The activities of consulting forestry firms include formulation of watershed-management policy and objectives, financing forestry services, management plans, maps, boundaries, timber sales, timber harvesting, logging control and supervision, watershed protection, esthetics, and public relations. Consultants can manage most forest watersheds to satisfy municipal policies and objectives.

Baumgras, John E.
1975. **How to avoid axle-weight overloads on tandem-axle log trucks.** North. Logger 24(3): 14-15, illus.

The results of a logging truck axle-weight study and recommendations for improving the distribution of load weight on tandem-axle logging trucks. Logging trucks weighed in West Virginia carried so much weight on the rear axles that payloads could not be maximized without exceeding the legal axle-weight limits. Improved weight distribution would enable loggers to increase legal payloads.

*Bay, Roger R., and J. S. Krammes.
1975. **Research needs related to management of municipal watersheds.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 193-196.

Major research needs in municipal-watershed management now center around the quality of water supplies, particularly the interactions between human activities on municipal watershed lands and water quality. We need to know the impacts of various intensive and extensive recreational activities and pressures on a number of water-quality factors. Knowledge is also needed on the effects of urbanization, on-site reservoir use, and other human activities.

Bergey, Hans T.
1975. **Current management practices on the Providence Municipal Watershed.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 115-123, illus.

The water supplied by the City of Providence (RI) Water Supply Board is obtained from a 92.8-square-mile watershed on the north branch of the Pawtuxet River. Management of departmental watershed and forest lands include forest culture and harvest practices; forest protection; and care of related facilities such as fire lanes, access roads, fences, turfed areas, and dams; and resolution of a myriad of associated people problems in an urbanizing environment.

Berry, Frederick H., and Winand K. Hock.
1975. **Walnut anthracnose.** U.S. Dep. Agric. Handb. 470: 92-94, illus.

Walnut anthracnose, caused by the fungus *Gnomonia leptostyla* (Fr.) Ces. & de. N. is a destructive disease of certain walnut species, particularly the eastern black walnut. Leaves, nuts, and occasionally shoots of the current season's growth are attacked by the fungus. When climatic conditions are favorable, trees

are heavily defoliated. Walnut anthracnose can be controlled by periodic spraying with fungicides such as dodine (Cyprex).

*Blanchette, Robert A., and Edward M. Sharon.
1975. *Agrobacterium tumefaciens*, a **promoter of wound healing in** *Betula alleghaniensis*. Can. J. For. Res. 5: 722-730, illus.

Agrobacterium tumefaciens was evaluated as a promoter of wound healing on mechanically inflicted basal wounds on 50 greenhouse-grown and 45 field-grown yellow birch. Inoculated and uninoculated wounds were wrapped with a clear plastic. Treated wounds showed a 4-fold to 5-fold increase in wound closure after 30 days for greenhouse-grown trees and after 45 days for field-grown trees. Compartmentalization of the wounded tissue was stimulated by treatment with *A. tumefaciens*. Abundant vessel plugging and an enhanced zone of cells, which formed after wounding, served to compartmentalize the wound.

*Bones, James T., and James E. Blyth.
1975. **Pulpwood production in the Northeast and North Central States for 1974.** North. Logger 24 (3) : 8, 29.

Pulpwood production between 1973 and 1974 increased 11 percent in the 21-state area. An outstanding production advance of 16 percent over the previous year in the Lake States was partially offset by a production decline in the Central States. These statistics and others resulted from a complete canvass of woodpulp mills conducted annually by the Forest Service Experiment Stations in the East. The article contains 1974 pulpwood statistics by states and sources of pulpwood, and the number of mills that were operating.

*Bones, James T., and George H. Pierson.
1975. **Wood recovery during land-clearing operations in New Jersey.** J. For. 73: 360-363, illus.

During a resurvey of New Jersey's timber resources, a study was made to measure losses of wood fiber attributable to clearing of forest land. An estimated 120 million cubic feet of growing stock were destroyed on the 164,000 acres of commercial forest land cleared between 1955 and 1971. Most of the recovered industrial wood fiber came from forest lands converted to agricultural use, and most of the recovered firewood came from home-building sites.

*Bowen, David K.
1975. **Soil conservation—A parameter of quality water yields.** *In* Municipal Water shed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 162-166.

Reviews (1) soil conservation methods used by landowners, (2) conservation objectives in small watershed projects, (3) conservation work in multicounty resource conservation and development projects, (4) the use of soil surveys as natural resource-planning aids, and (5) a newly authorized system of land inventory and monitoring.

Brasier, C. M., and J. N. Gibbs.
1975. **Variation in** *Ceratocystis ulmi*: **significance of the aggressive and nonaggressive strains.** *In* Dutch elm disease: 53-66, illus. USDA For. Serv. Northeast. For. Exp. Stn., Upper Darby, Pa.

Discovery of two strains of *C. ulmi* in Britain raised a question about the origin of the aggressive strain in the current epidemic: did it arise by genetic change within an endemic nonaggressive gene pool, or was it introduced? The aggressive strain has apparently declined in northwestern Europe, but not in North America.

*Burdekin, D. A., and H. M. Heybroek [ed.].
1975. **Dutch elm disease.** USDA For. Serv. Northeast. For. Exp. Stn., Upper Darby, Pa. 94 p.

Dutch elm disease research and control, past and present, and prospects for the future were the subjects of this interdisciplinary meeting. The proceedings contain four lead papers that deal with: (1) chemical control of the pathogen; (2) chemical and biological control of the beetle vectors; (3) aggressive and nonaggressive strains of the pathogen; and (4) sanitation as a disease control measure. Also included are discussion comments from conference participants.

Byrne, Kevin J., William E. Gore, Glenn T. Pearce, and Robert M. Silverstein.

1975. **Porapak-Q collection of airborne organic compounds serving as models for insect pheromones.** J. Chem. Ecol. 1(1): 1-7.

Organic compounds with properties resembling those of insect pheromones can be removed from an airstream by absorption on Porapak-Q and recovered from the absorbent by extraction. When this procedure is applied to aeration of live insects, the Porapak extract represents a concentration of the chemical.

*Campbell, Robert W.

1975. **The gypsy moth and its natural enemies.** U.S. Dep. Agric. Inf. Bull. 381. 27 p., illus.

Patterns of gypsy moth behavior are described, especially those related to population density. Natural mortality-causing factors that operate against this insect are also described. Several agents kill subadult male and female gypsy moths at different rates. Major determinants of year-to-year changes in gypsy moth numbers are described.

*Campbell, Robert W.

1975. **The bimodality of gypsy moth, *Porthetria dispar* (L.) (Lepidoptera: Lymantriidae) populations.** J. N.Y. Entomol. Soc. 83(4): 287-288.

Populations of the gypsy moth in North America have two numerical phases. A population may remain in an innocuous phase for many years, yet an outbreak phase may develop and continue for as much as a decade. A procedure was developed to determine at what point during the generation the numerical differences appear between a sparse population in an outbreak area and one in an innocuous area.

*Campbell, Robert W., David L. Hubbard, and Ronald J. Sloan.

1975a. **Patterns of gypsy moth occurrence within a sparse and numerically stable population. Environ.** Entomol. 4: 535-542, illus.

Patterns of subadult gypsy moth occurrence within a sparse, numerically stable population that was studied in 1965 were modelled as functions of insect stage and components of environmental structure. Results imply that: (1) Once newly hatched larvae find suitable foliage, they tend to stay on or near it until after they have molted into instar III. (2) These insects begin to wander sometime before reaching instar IV, and continue to do so until suitable daytime resting locations are found. (3) Most of the insects pupate in the locations used earlier for resting sites. (4) Bark flaps may have provided less hazardous resting sites for the growing larvae and pupae than other potential resting sites.

*Campbell, Robert W., David L. Hubbard, and Ronald J. Sloan.

1975b. **Location of gypsy moth pupae and subsequent pupal survival in sparse, stable populations.** Environ. Entomol. 4: 597-600.

About 90 percent of the gypsy moth pupae found in a series of sparse stable populations studied between 1965 and 1968 were either beneath bark flaps or in the litter. Male larvae were more likely to pupate in bark flaps than females. Pupal survival was usually higher among pupae beneath bark flaps than among those in the litter, and bark flaps provided virtually the only pupation locations in the whole environment, within the highest density stratum studies, where female pupae had a reasonable survival probability. Adult gypsy moth production in these populations could be accurately estimated from knowledge of pupal density and sex ratio and the number of bark flaps per 0.01 acre. Bark flap removal is suggested as a potentially useful technique for preventing outbreaks.

*Church, Thomas W., Jr.

1975. **Steam up with old crossties? Maybe!** South. Lumberman 231 (2872): 78, illus.

Disposal of old crossties costs the Nation's railroads millions of dollars each year. Studies of crosstie weights and heat outputs revealed that the old ties might be a valuable source of industrial fuel. Nationwide, the production of steam from discarded ties could replace the consumption of 4½ million barrels of fuel oil. A preliminary cost analysis indicates that this practice could be profitable.

Clark, F. Bryan.

1975. **La plantation du noyer noir a bois.** Bull. de la vulg. for. 75/2: 50-51.

A translation into French of USDA Forest Service Leaflet 487, "Planting black walnut for timber" (1971 revision). The leaflet contains advice on selecting the right site, preparing the planting area, planting seedlings or seed, providing adequate growing space, and tending the trees. Also notes on where to obtain professional advice.

*Corbett, Edward S., and John M. Heilman.

1975. **Effects of management practices on water quality and quantity: The Newark, New Jersey, municipal watersheds.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 47-57, illus.

The 36,000-acre Pequannock Watershed owned by the City of Newark provides about one-half of the water supply of Newark and adjacent cities. The collection and delivery of high-quality water to the city is the primary management objective. A cooperative study of effects of chemical control of vegetation on water quality and yield is described.

Corbett, Edward S., James A. Lynch, and William E. Sopper.

1975. **Forest-management practices as related to nutrient leaching and water quality.** Non-Point Sources Water Pollut. Conf. Proc.: 157-173. Va. Polytech. Inst. and State Univ. Va. Water Resour. Res. Cent., Blacksburg.

The effects of forest-management practices on water quality in the eastern United States are reviewed. Changes in stream nutrient concentrations, water temperature, turbidity, and sedimentation are quantified. Stream nutrient and temperature gradients from the headwaters to the mouth of both forested and clearcut watersheds are evaluated.

Corbett, E. S., W. E. Sopper, and J. A. Lynch.

1975. **Watershed response to partial area applications of simulated rainfall.** Proc. Int. Symp. Hydrol. Charact. River Basins (Tokyo). IASH-AISH Publ. 117: 63-73.

Application of simulated rainfall to a 7.9-hectare watershed showed that during the rising limb of a storm hydrograph, stormflow came first from the channel area, then from farther upslope as soil saturation extended upslope. The duration of peakflow and the rate of decline of the recession limb until quickflow ended were controlled by the upper slope. Most of the runoff was as quickflow, and different parts of the watershed contributed different proportions of it.

*Corbett, Edward S., and Warren Spencer.

1975. **Effects of management practices on water quality and quantity: Baltimore, Maryland, municipal watersheds.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 25-31, illus.

The City of Baltimore is conducting research on the effects of vegetation management on water yield and quality. Three small watersheds, ranging in size from 22 to 38 acres, have been selected. Converting open land to a pine forest caused a substantial reduction in water yield. The effects of removing riparian-zone vegetation and thinning young pine plantations are evaluated.

*Craft, E. Paul.

1975. **Construction-grade hardwood plywood industry: an Appalachian opportunity.** Plywood & Panel 16(5): 26-28, illus.

Because of the large volume of surplus low-grade hardwoods in the Appalachians, the feasibility of producing construction-grade plywood from low-grade timber was investigated. Veneer from 10 species of Appalachian hardwoods was made into 44 different species combinations of plywood test panels, bonded with a standard pine-type phenolic adhesive mix. Twenty specimens from each panel were tested for glue-line quality, and 16 of them met the PS 1-66 standards for structural C-D plywood; 12 of these panels also met the requirements for exterior plywood.

*Cuppett, Donald G., and E. Paul Craft.

1975. **Low-temperature forced air drying of Appalachian hardwoods.** USDA For. Serv. Res. Pap. NE-328. 10 p., illus.

A guide for commercial application of low-

temperature forced-air drying of Appalachian hardwood lumber, providing (1) descriptions of dryer design and construction, (2) drying schedules and estimated drying times for different thicknesses of commercially important species, and (3) detailed instructions for dryer operation.

*Cuthbert, R. A., W. N. Cannon, Jr., and J. W. Peacock.

1975. **Relative importance of root grafts and bark beetles to the spread of Dutch elm disease.** USDA For. Serv. Res. Note NE-206. 4 p.

Root-graft transmission of Dutch elm disease is sometimes ignored in both research studies and control programs. Our results indicate that elms adjacent to 1-, 2-, or 3-year-old stumps have a disease rate three to five times higher than elms not adjacent to stumps. We conclude that in Detroit, which has elm plantings typical of many United States cities, root grafts were probably responsible for more than 50 percent of the disease transmission in 1973.

*Cuthbert, Roy A., and John W. Peacock.

1975. **Attraction of *Scolytus multistriatus* to Pheromone-baited traps at different heights.** Environ. Entomol. 4: 889-890.

Trap height has an important effect on the number of *Scolytus multistriatus* captured at pheromone-baited traps. Stikem-coated traps, baited with synthetic pheromone, were placed at heights of 3, 7, and 12 meters on healthy elms during the 1st beetle flight period and on both healthy and diseased elms during the 2nd flight period. Traps at 3 m were clearly the most effective in catching beetles on both healthy and diseased trees during both flight periods.

Czapowskyj, Miroslaw M.

1975. **Book review of Forstliche Pflanzenernaehrung und Duengung,** by Hans J. Fiedler, Wolfgang Nebe, and Friedrick Hoffman; Fischer Verlag, Jena. Soil Sci. 120: 314.

This book is a scholarly treatise on forest nutrition, fertilization, and melioration, with emphasis on research findings in Germany and Central Europe where intensive silviculture is practised. (In German.)

*Dale, Martin E.

1975. **Effect of understory removal on growth of upland oak.** USDA For. Serv. Res. Pap. NE-321. 10 p., illus.

The amount of additional growth attributed to complete eradication of all woody understory vegetation varied for several widely scattered upland oak stands. Based on paired-plot comparisons of 10 or more years' results, basal-area and cubic-volume growth usually increased slightly when the understory was eradicated. The amount of increase was related to (1) geographical stand location, (2) stand age, and (3) residual stocking of overstory trees. The greatest response to understory removal was found in very young stands located in the western part of the oak range where residual density of stocking after thinning was about 50 percent. For most upland oak stands, understory removal would not greatly increase stand growth.

*Darrach, Alfred.

1975. **State technical assistance programs.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 181-184.

Each of the 12 Northeastern States provides some technical assistance for municipal-watershed management. The state forester supplies technical help on forested land. Other state agencies concentrate on public health, fish and wildlife, ground water, and law enforcement. Few state foresters feel that an intensive municipal watershed program is needed.

Davidson, Walter H.

1975. **Amendments aid reclamation plantings on bituminous mine spoils in Pennsylvania.** Pa. For. 65: 101-104.

Treatments of lime, fertilizer, and hardwood bark mulch were applied to four spoil areas in the Bituminous Region of Pennsylvania. The plots were planted to red pine and seeded to a mixture of weeping lovegrass, K-31 tall fescue, and Korean lespedeza. Pine survival did not benefit from the amendments. Establishment of weeping lovegrass and K-31 tall

fescue was better on amended subplots than on control subplots. Korean lespedeza did poorly on all subplots.

Demeritt, M. E., Jr., H. D. Gerhold, and E. H. Palpant.

1975. **Genetic evaluation of two-year height of Scotch pine seedlings.** Northeast. For. Tree Improve. Conf. Proc. 22: 148-158.

Genetic analyses of 2-year height of full- and half-sib Scotch pine seedlings (*Pinus sylvestris* L.) from inter- and intraracial matings were performed to estimate heritability, within-plot variance, and to see if nursery selection would be effective. Interpopulation heritability estimates were greater than intrapopulation matings, probably due to differences in gene frequencies between populations used. In general, with greater diversity in germplasm there was larger variation within plots. Estimates of heritability indicated that mass selection for early height growth would be effective under the conditions of this experiment.

Demeritt, M. E., Jr., and H. W. Hocker, Jr.

1975. **Influence of seed weight on early development of eastern white pine.** Northeast. For. Tree Improve. Conf. Proc. 22: 130-137.

Three eastern white pine seed sources were grown for 2 years in the field as a result of direct-seeding and in pots in a greenhouse to see what effect seed weight has on seedling development. Seed weight among sources influenced the size of 2-year-old direct-seeded seedlings, but not greenhouse-grown seedlings. Seed weight within sources influenced the size of 2-year-old greenhouse grown seedlings.

Dissmeyer, George E., F. S. Corbett, and W. T. Swank.

1975. **Summary of municipal watershed management surveys in the eastern United States.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 185-192, illus.

The U.S. Forest Service conducted two municipal-watershed-management surveys in the eastern United States, using mailed questionnaires to (1) determine the importance of surface-water supplies, (2) inventory the land uses allowed in these watersheds, (3) inventory the nature and extent of various land-management problems related to water supplies, and (4) determine what information and management practices are needed to improve watershed management and water supplies.

Dochinger, Leon S.

1975. **Improving city air quality with trees.** *In* Forestry issues in urban America. Soc. Am. For. Proc. 1974: 113-120.

In addition to esthetic and climatic amenities of greenbelts in urban communities, trees may condition contaminated air and reduce daily pollution levels. Planning approaches toward minimizing toxic concentrations in urban areas are considered. Research priority must be given to delineating inherent potentials of trees for cleansing urban environments. Then realistic interpretations and subsequent greenspace implementation can be developed, which in turn will facilitate the filtration and dispersion of aerial toxicants by trees in urban America.

*Dochinger, Leon S., and Keith F. Jensen.

1975. **Effects of chronic and acute exposure to sulphur dioxide on the growth of hybrid poplar cuttings.** Environ. Pollut. 9: 219-229, illus.

Hybrid poplar clones were fumigated in controlled-environment chambers with either 5 ppm sulphur dioxide for 1½, 3, and 6 hours or with 0.25 ppm sulphur dioxide for 6 weeks. Multivariate analyses were made from shoot-growth data before and after treatment and on the foliar injury induced by SO_2. Both short- and long-term fumigation produced similar plant-behavior responses to the two SO_2 concentrations.

Dochinger, Leon S., and Thomas A. Seliga.

1975. **Acid precipitation and the forest ecosystem.** J. Air Pollut. Control Assoc. 25: 1103-1105.

Acid precipitation is of increasing concern among international scientists because of its

potential long-term injurious effects on the growth and production of agricultural crops. In conjunction with The Ohio State University, the Experiment Station cosponsored the First International Symposium on Acid Precipitation and the Forest Ecosystem. The findings will establish the state of knowledge of the acidity phenomenon and help to determine research priorities.

*Douglass, James E., and Wayne T. Swank.
1975. **Effects of management practices on water quality and quantity: Coweeta Hydrologic Laboratory, North Carolina.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 1-13, illus.
Results from nearly 40 years of watershed experiments at Coweeta are summarized. An equation is presented for predicting the annual increase in streamflow from the percent basal-area cut and from the theoretical extraterrestial radiation load for the watershed. Timing of the increased flow from watershed experiments depends on the magnitude of the increase, but results consistently show that much of the increase appears in the low-flow season.

Echelberger, Herbert E., George H. Moeller, and Raymond E. Leonard.
1975. **Recreation problems and opportunities.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 154-161, illus.
Demand for water-oriented outdoor recreation continues to increase, especially near urban areas. As these demands rise, municipal watershed managers can expect to feel increased pressure for recreational use of land and water resources under their jurisdiction. The authors discuss some of the problems associated with recreational use of municipal watersheds and present some ideas for managers who anticipate recreational use pressures.

*Eschner, Arthur R., and Donald L. Mader.
1975. **Management implications of other hydrologic research in the Northeast.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 66-78, illus.
Research results from a wide array of institutions are reviewed, mostly about the effects of various activities on the amount of water and the timing of its availability; information about the impact on water quality is more limited. Interception effects caused by tree species, the characteristics and water-storage capacities of their associated humus layers, significance of sources of storm runoff, and effects of management of streamside vegetation are discussed.

*Fay, Stephen.
1975. **Ground-cover vegetation management at backcountry recreation sites.** USDA For. Serv. Res. Note NE-201. 5 p.
Increasing use of remote backcountry recreation sites in the Northeast is resulting in a loss of the thin soil mantle and destruction of the ground-cover vegetation. Fencing, fertilization, and liming and a combination of all three were tested as means of reestablishing ground-cover vegetation on bare mineral soils of the Tuckerman Ravine shelter site on Mount Washington in New Hampshire. Results indicate that fencing would be a slow means of reestablishing ground-cover vegetation. Fertilization and liming were not very effective in producing an increase in ground vegetation.

*Federer, C. A.
1975. **Evapotranspiration.** Rev. Geophys. and Space Phys. 13: 442-445, 487-494.
This report to the International Union of Geodesy and Geophysics summarizes progress in research on evapotranspiration from 1970 through 1974, with emphasis on the United States contribution. The control of transpiration by plants through stomatal closure has been studied intensively, using diffusion porometers and pressure chambers. The rough surface of forests increases stomatal control of transpiration and increases interception loss of rain, when compared with lower plant covers.

*Frost, Richard E., and Hollis R. Large.
1975. **Pallet repair and salvage.** USDA For. Serv. Res. Pap. NE-323. 7 p.

Efficient unit-load handling with permanent pallets requires a well-organized pallet-repair program. To provide basic information on pallet damage that could be used in establishing repair standards, 1,700 damaged pallets at four repair facilities were inspected. All damage was recorded by type, severity, and location. This survey determined that missing deckboards at the ends of the pallet account for more than 50 percent of the total deck damage, and longitudinal breaks and splits outside the stringer notches account for more than 80 percent of the total stringer damage.

*Gabriel, William J.

1975. **Allelopathic effects of black walnut on white birches.** J. For. 73: 234-237, illus.

Heavy mortality and poor growth among repeated plantings of white birches were associated with toxic conditions produced by black walnut trees. Variation in response to toxicity was observed. Lethal effects were most prominent in the immediate vicinity of residual black walnuts, but some individuals survived in these areas, suggesting differences among trees in their levels of toxin tolerance. Birch trees were larger at greater distance from the source of toxicity, indicating a relationship between growth inhibition and toxin concentrate.

*Galford, Jimmy R.

1975. **Red oak borers become sterile when reared under continuous light.** USDA For. Serv. Res. Note NE-205. 2 p.

Red oak borers, *Enaphalodes rufulus* (Haldeman), reared under continuous light for 12 weeks, became sterile. Sterility is thought to have been caused by light destroying vitamins essential for fertility.

*Garrett, Lawrence D., Howard Duchacek, Frederick M. Laing, and James W. Marvin.

1975. **Test results of a maple sap preheater and modified oil burner arch with wood chips.** Natl. Maple Syrup Dig. 14(1): 14-15.

Conventional sap evaporators are only 50 to 65 percent efficient. Installation of maple sap preheaters on conventional open-pan syrup evaporators increased efficiency by 15.5 percent. Also, the study determined stack losses to be 14 to 20 percent, with an additional 7 percent loss to vaporizing water contained in fuel. Increases in economic returns to operators using preheaters ranged from 10 to 12 percent. Pilot test of chip-fired evaporators revealed comparative fuel efficiency of 12 gallons of No. 2 fuel oil and 300 pounds of wood chips at 35 percent moisture.

*Garrett, Peter W., and H. C. Kettlewood.

1975. **Variations in juvenile oak.** USDA For. Serv. Res. Note NE-204. 4 p.

Data from research on 13-year-old trees in an oak planting in southeastern Pennsylvania indicate that survival and growth are not correlated with source latitude within all species tested. A complete listing of species and seed origins, along with performance of progenies, is presented for persons interested in oak improvement.

Gerhold, H. D., A. J. Long, and M. E. Demeritt, Jr.

1975. **Genetic information needed for metropolitan trees.** J. For. 73: 150-153.

A genetic information system, based on performance testing of trees in metropolitan regions, is needed because of deteriorating environments and the rapid inclusion of new species and clones into the trade. The proposed system offers a method for recognizing disease and adaptation problems before they become widespread. A survey indicated that municipalities and highway departments in the region invest $12 million annually in planting programs involving more than 300,000 trees.

*Gibson, Harry G., and Cleveland J. Biller.

1975. **A second look at cable logging in the Appalachians.** J. For. 73: 649-653, illus.

Cable logging, once used extensively in the Appalachians, is being reexamined to see if smaller more mobile systems can help solve some of the timber-management problems on steep slopes. A small Austrian skyline was tested in West Virginia to determine its feasibility for harvesting eastern hardwoods. The short-term test included both selection and clearcut harvesting. Both yarding costs and environmental effects were analyzed.

*Gill, John D., Jack W. Thomas, William M. Healy, James C. Pack, and H. Reed Sanderson.

1975. **Comparison of seven forest types for game in West Virginia.** J. Wildl. Manage. 39: 762-768.

Forest type was used for classifying observations of turkeys, gray squirrels, whitetailed deer, and ruffed grouse on an 8,100-hectare study area. All game counts differed from counts that would be expected if locations of game were independent of forest type. Counts were converted to ratios, and comparisons were made directly between all pairs of forest types for any game species and all species/type combinations.

Gore, William E., Glenn T. Pearce, and Robert M. Silverstein.

1975. **Relative stereochemistry of multistriatin (2,4-dimethyl-5-ethyl-6, 8-dioxabicyclo [3.2.1] octane).** J. Organ. Chem. 40: 1705-1708.

The relative stereochemistry of the four multistriatin isomers were investigated. Stereochemical assignments for the C-2 and C-4 methyl groups in the four isomers were dedetermined on the basis of chemical and spectrometric data.

*Gregory, Garold F., and Thomas W. Jones.

1975. **An improved apparatus for pressure-injecting fluid into trees.** USDA For. Serv. Res. Note NE-214. 6 p., illus.

Our original tree-injection apparatus was modified to be more convenient and efficient. The fluid reservoir consists of high-pressure plastic plumbing components. Quick couplers are used for all hose connections. Most important, the injector heads were modified for a faster and more convenient and secure attachment with double-headed nails.

Gregory, R. A., and J. A. Romberger.

1975. **Cambial activity land height of uniseriate vascular rays in conifers.** Bot. Gaz. 136: 246-253.

Consideration of the various possible types of cell division in the cambium and various facts of wood anatomy led to a working hypothesis: after a coniferous tree having wood with uniseriate rays is released from severe suppression and the radial growth rate suddenly increases, the height of the wood rays will also suddenly increase, but the number of rays per unit of tangential area will stay the same. The hypothesis was tested by analysis of wood samples and was found valid.

*Grisez, Ted J.

1975. **Flowering and seed production in seven hardwood species.** USDA For. Serv. Res. Pap. NE-315. 8 p.

Flowering and seed production of selected trees in northwestern Pennsylvania and southwestern New York were rated visually for several years. The seed crops of white ash and sugar maple were closely related to the amount of flowering, and flowering can be used to predict seed crops in those species. Seed-producing capacity was also related to other measured variables, but not closely enough to make them useful in predicting seed production. Consistency of seed production in species and individuals, and other aspects of seed production are discussed.

*Hanks, Leland F.

1975. **New tools for grading hardwood trees.** South. Lumberman 231(2872): 49-50.

An introduction to the U.S. Forest Service hardwood tree grades for factory lumber. Specifications for these tree grades are presented along with a lumber grade yield table. Tree valuation is discussed and an example is illustrated.

*Hanks, Leland F., and Margaret K. Peirsol.

1975. **Value loss of hardwood lumber during air-drying.** USDA For. Serv. Res. Pap. NE-309. 10 p.

Dry-lumber prices were applied to green and air-dried lumber that was measured with a dry-board rule. Values were summed by species, lumber grade, and thickness class. Differences between green and air-dried lumber value have been termed value losses and are given in dollars and in percentages. The percentages have been separated into loss due to shrinkage and loss due to degrade. Data for 10 hardwood species are included.

*Hart, Irving A.

1975. **Current management practices on the Hartford Municipal Watershed.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 111-114.

Hartford has an upland reservoir gravity-flow system servicing 391,000 people, an average of 53 million gallons daily. Total watershed area is 133,664 acres, of which 30,424 are owned; practically all is forested. Employees number 56, including 11 uniformed patrolmen. The superintendent is a professional forester, assisted by a second forester and a full-time forestry crew of three men with modern equipment. Standing timber is marked and sold by bid under formal contract. Vegetative manipulation for improvement of water supply is minimal. An active recreation area is located on one reservoir not used for drinking water.

Hartley, Brent A.

1975. **Current management practices on the Baltimore Municipal Watersheds.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 84-97, illus.

The City of Baltimore supplies water to an estimated 1.5 million people in a 215-square-mile service area. The City has developed three sources of supply and maintains three municipal watersheds. Management of Baltimore's watersheds differs from that of many others in the Northeastern States in that we harvest timber on our watersheds and operate our own sawmill. We have also tried to provide recreational opportunities.

Heagy, James F.

1975. **Current management practices on private municipal watersheds.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 124-128, illus.

Since 1954, sawtimber, pulpwood, and mine props have been harvested from 17 forested watersheds in Pennsylvania. Drainage from 15 areas flows into reservoirs used as sources of supply serving 14 communities. Potable water delivered from 8 of these reservoirs is not filtered. The harvesting and cultural practices used in the upland oak and bottomland hardwood types are emphasized. Other watershed programs discussed include recreational use, problem areas, and use of herbicides.

Healy, W. M., and E. J. Goetz.

1975. **Imprinting and video-recording wild turkeys—new techniques.** Wildl. Soc. Northeast. Sect. Trans. 31: 172-182.

Managing brood range of turkeys requires knowing the habits of free-ranging poults; but poults with hens are difficult to observe in the wild. To overcome this problem, we hatched turkey eggs from game farm and wild stock, imprinted the poults to ourselves, and observed poult behavior in the field. Feeding rates and other behavior were quantified and used to evaluate various habitats. Portable video-tape equipment allowed easy recording of many observations that would have been difficult to record any other way. This approach could be applied in many studies of animal behavior and ecology.

*Healy, William M., Richard O. Kimmel, and Ellen J. Goetz.

1975. **Behavior of human-imprinted and hen-reared wild turkey poults.** Natl. Wild Turkey Symp. Proc. 3: 97-107. San Antonio TX.

A general description of behavior patterns is given for human-imprinted and hen-reared wild turkey poults (*Melcagris gallopavo silvestris*) from hatching until 4 months of age. Poults fed primarily on insects during the first 6 weeks of life; and by the 11th week, plants accounted for about half the diet. The behavior of hen-reared and human-imprinted poults indicated the dependability of human-imprinted turkeys for controlled experimentation.

Hejnowicz, Z.

1975. **A model for a morphogenetic map and clock.** J. Theor. Biol. 54: 345-362.

A model system is proposed in which morphogenic waves of varying lengths but similar periods interact to form standing wave envelopes that serve as the basis of morphogenic maps. Wave-based morphogenic maps are seen as underlying both patterns and

rhythms in organisms. This theory arose from biophysical interpretation of extensive studies of the cellular basis of wavy grain patterns in wood.

*Herrick, Owen W.

1975. **A profile of logging in the Northeast.** Part I. Crew size and equipment investment. North. Logger 24(4): 14-15, illus.

Characteristics of logging operations in 14 Northeastern states are summarized to give an up-to-date look at the combinations of men, equipment, and activities involved in cutting timber and moving it from stump to mill.

*Herrick, Owen W.

1975. **A profile of logging in the Northeast.** Part II. North. Logger 24 (5): 20-21, illus.

A continuation of the above, giving summary data on area logged, volume removed, product value, and skidding and hauling distances, with a generalized composite profile of the logging jobs now being carried on in the region.

Hock, Winand K., and Frederick H. Berry.

1975. **Sycamore anthracnose.** U.S. Dep. Agric. Handb. 470: 88-91, illus.

Sycamore anthracnose, caused by the fungus *Gnomonia platani* Kleb., is the most serious disease of sycamore. The four distinct stages of sycamore anthracnose—twig, bud, shoot, and leaf blight—are discussed. The prevalence and severity of attack are governed by weather conditions—frequent rains and cool temperatures favor rapid spread. There are two control procedures: sanitation and chemical sprays.

Hooper, Robert G., E. Frank Smith, Hewlette S. Crawford, Burd S. McGinnes, and Vernon J. Walker.

1975. **Nesting bird populations in a new town.** Wildl. Soc. Bull. 3(3): 111-118, illus.

Within four types of suburban habitats, the densities of breeding birds seemed to be related directly to the cubic feet of space occupied by shrubs below 12 feet high; however this relationship did not explain the variation in bird densities between habitats. It was hypothesized that clumping of vegetation was of equal or more importance than amount of vegetation. A direct relationship was also found between the number of species per acre and the cubic feet of space occupied by shrubs below 12 feet; and an inverse relationship was found between breeding birds and percentage of the plot covered by asphalt, cement, and buildings.

*Hornbeck, James W.

1975. **Streamflow response to forest cutting and revegetation.** Water Resour. Bull. 11: 1257-1260, illus.

Experimental cuttings on two small hardwood-forested watersheds in New England showed that annual streamflow can be increased as much as 41 percent. Most of the increase occurred in summer and early autumn when additional streamflow is most needed. Revegetation caused the annual increases to nearly disappear within 4 years after complete forest clearing.

Hornbeck, James W., and C. Anthony Federer.

1975. **Effects of management practices on water quality and quantity: Hubbard Brook Experimental Forest, New Hampshire.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 58-65, illus.

A hypothetical dialogue between forest hydrologists and a municipal watershed manager illustrates the knowledge gained from research at Hubbard Brook. When forest vegetation is cut, water yield increases, especially when it is most needed during critical low-flow periods in late summer and early autumn. Unless measures are taken to control regrowth, the water yield returns to pretreatment levels within several years.

*Hornbeck, J. W., G. E. Likens, R. S. Pierce, and F. H. Bormann.

1975. **Strip cutting as a means of protecting site and streamflow quality when clearcutting northern hardwoods.** *In* Forest soils and forest land management. North Am. For. Soils Conf. Proc. 4: 209-225, illus. Quebec.

Changes in vegetation and streamflow as a result of the first cycle of a progressive strip cutting in northern hardwoods were determined on a 36-hectare mountainous watershed in New Hampshire. Timber was harvested in October 1970 by clearcutting 25-meter-wide strips alternating with 50-meter-wide uncut strips.

Hornbeck, J. W., R. S. Pierce, G. E. Likens, and C. W. Martin.

1975. **Moderating the impact of contemporary forest cutting on hydrologic and nutrient cycles.** Assoc. Int. Sci. Hydrol. Symp. Publ. 117: 423-433, illus.

Smaller-than-anticipated water yield increases and lower ionic concentrations of streamwater after a progressive strip-cutting indicate that the impacts of complete harvest of all trees can be significantly moderated by changing the time span and configuration of the cutting.

Hornbeck, J. W., R. S. Pierce, and C. W. Martin.

1975. **Forest cutting in New Hampshire increases volume and ionic concentrations of streamflow.** *In* Forestry issues in urban America. Soc. Am. For. Proc. 1974: 195-199.

Effects on streamflow of three intensities of forest cutting have been determined in central New Hampshire by using the ecosystem approach and small hardwood-forested watersheds. Complete elimination of forest vegetation for a 3-year period increased annual streamflow by 32 percent and caused 3- to 50-fold rises in concentration of major stream nutrients.

*Houston, David R.

1975. **Beech bark disease.** J. For. 73: 660-663, illus.

Stands of American beech in Maine—severely damaged by the beech bark disease in the 1930s and 1940s—were surveyed in 1973-4. Both disease agents (the scale *Cryptococcus fagi* and the fungus *Nectria coccinea* var. *faginata*) are now endemic, but few trees are dying. Another scale (*Xylococculus betulae*) is also abundant on all size classes of trees. Beech has become more numerous since the disease because death of large trees released sprout thickets. As they grow, young trees will be more susceptible to the disease. The stage seems to be set for a new severe outbreak.

*Houston, David R.

1975. **Soil fumigation to control spread of *Fomes annosus*: results of field trials.** USDA For. Serv. Res. Pap. NE-327. 4 p., illus.

A field trial was made to test the hypothesis that a band of roots killed by soil fumigation with methyl bromide would block the underground spread of *Fomes annosus* from diseased trees to healthy trees. After 4 years, the fungus had crossed the fumigation line in only 2 of 11 infection centers in red pine plantations.

*Houston, David R.

1975. **Occurrence of basal canker of white pine in Maine.** Plant Dis. Rep. 59: 74-76, illus.

Basal canker of white pine was found in young plantings established as living snow fences along Interstate Route 95 in Maine. The ecological similarities between this situation and that described previously for development of the disease in north-central New York were remarkably comparable. The results indicate that factors leading to the disease complex are more common and widespread than realized formerly.

*Hoyle, M. C.

1975. **High yield birch—nurture and nourish.** North. Logger 24(1): 20, 21, 36, 37, 38, illus.

The increasing demands for wood are viewed against the srinking land base for growing timber in the upland forests of northern New England. The solution to this problem is generally proposed to be intensive management. One type of intensive management—plantation management of paper birch and yellow birch—is being pilot-tested in the field. Three-year results show growth increases 2-fold (yellow birch) and 4-fold (paper birch) over controls as a result of deep liming and com-

plete fertilization. Harvestable trees are expected in 20 years.

*Huyler, Neil K.
1975. **Tubing vs. buckets: a cost comparison.** USDA For. Serv. Res. Note NE-216. 5 p., illus.
Equipment investment for tubing-vacuum systems was significantly less than that for bucket systems. Tubing-vacuum systems required about 22 percent less labor input, the major labor input being completed before sap-flow periods. Annual cost of operation was less for tubing-vacuum than the bucket system. Small tubing-vacuum operations showed more profit potential than small bucket operations. Also, tubing-vacuum operations showed a 28-percent increase in sap volume yield as compared to bucket systems.

*Jensen, Keith F.
1975. **Sulfur content of hybrid poplar cuttings fumigated with sulfur dioxide.** USDA For. Serv. Res. Note NE-209. 4 p.
Hybrid poplar cuttings were fumigated with sulfur dioxide ranging in concentration from 0.1 to 5 ppm for periods of 5 to 80 hours. At the end of the fumigation periods, the cuttings were harvested and the sulfur and chlorophyll contents of the leaves were measured. At 0.1 ppm and 0.25 ppm the sulfur content initially increased, but decreased as fumigation continued. At 3 ppm and 5 ppm the sulfur content of the leaves significantly increased, and foliar injury was apparent. No statistically significant change in chlorophyll content was observed.

Jensen, K. F., and T. T. Kozlowski.
1975. **Absorption and translocation of sulfur dioxide by seedlings of four forest tree species.** J. Environ. Qual. 4: 379-382, illus.
Rates of absorption of SO_2 and translocation of absorbed sulfur were measured in sugar maple, bigtooth aspen, white ash, and yellow birch seedlings. Initially, bigtooth aspen, a sensitive species, had the highest absorption rate; and sugar maple, a tolerant species, had the lowest. After 20 hours or more of fumigation, absorption rates declined in all species except white ash, which is intermediate in sensitivity. Sulfur was concentrated in the leaves initially but had been translocated throughout the plants by the 8th day.

*Jensen, Keith F., and Roberta G. Masters.
1975. **Growth of six woody species fumigated with ozone.** Plant Dis. Rep. 59: 760-762, illus.
White birch, yellow birch, bigtooth aspen, eastern cottonwood, Japanese larch, and white spruce seedlings were fumigated with 25 pphm ozone for 110 days. Height growth of the white birch seedlings was reduced, but not by a significant amount; growth of the other species was not affected. The number and size of white birch leaves were also reduced during the fumigation period.

*Johnson, Roy R.
1975. **Use of herbicides in timber—and reservoir—management programs.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 167-169.
Herbicides *can* be used in timber- and reservoir management programs. Knowledge of herbicides, application methods, timing, and nature of the area to be managed will enable the land manager to control and manage watershed vegetation with minimum contamination of water and minimum impact on the environment.

Jones, Thomas W.
1975. **The Dutch elm disease: challenges and solutions in urbania.** *In* Forestry issues in urban America. Entomol. Soc. Am.. Proc. 1974: 124-127.
Dutch elm disease threatens to eliminate elms as a major shade and street tree species in the urban landscape. But this esthetic and economic catastrophy is not inevitable. Existing control measures could minimize tree losses in many situations, and recent research developments offer the possibility of even more effective and versatile Dutch elm disease control.

Jumper, Gene A., and William N. Cannon, Jr.
1975. **Spermatogenesis in the smaller European elm bark beetle,** *Scolytus multistriatus*. Entomol. Soc. Am. Ann. 68: 733-740.

Testicular volume of *Scolytus multistriatus* (Marsham) increased rapidly during the larval and early pupal stage, reached its maximum during the pupal stage, and decreased in the adult stage. Spermatocytes, spermatids, and spermatozoa were all found in the adult, indicating that spermatogenesis continues into this stage of development. Spermiogenesis was studied during the prepupal, pupal, and adult stages, using light and electron microscopy.

*Keiser, George M.

1975. **Using a sugar refractometer.** Natl. Maple Syrup Dig. 14(3): 16-17, illus.

Instructions on use of the refractometer for determining sugar concentration in maple sap.

Kiang, Y. T., and P. W. Garrett.

1975. **Successful rooting of eastern white pine cuttings from a 17-year-old provenance planting.** Northeast. For. Tree Improve. Conf. Proc. 22: 24-34, illus.

The rooting response of cuttings from 40 eastern white pines representing 7 geographic sources was studied. Timing the collection of cuttings was the most important factor in rooting success. Cuttings collected in early May rooted as much as 88.3 percent in 160 days. Cuttings collected as early as mid-January can be rooted with moderate success, but late April to early June should be considered the most favorable time for collecting cuttings in the northeastern United States.

*Kingsley, Neal P.

1975. **The forest-land owners of New Jersey. USDA For. Serv. Resour. Bull. NE-39.** 24 p., illus.

A statistical-analytical report on a mail canvass of the owners of privately owned commercial forest land in New Jersey. Statistical findings are based on responses by owners to a questionnaire. Trends in forest-land ownership and the attitudes and intentions of owners regarding reasons for owning forest land, timber management, timber harvesting, recreational use, etc., are discussed.

*Kingsley, Neal P., and James C. Finley.

1975. **The forest-land owners of Delaware.** USDA For. Serv. Resour. Bull. NE-38. 19 p., illus.

A statistical-analytical report on a mail canvass of the owners of privately owned forest land in Delaware, based on a study made in conjunction with the second forest survey of Delaware. Statistical findings are based on responses by owners to a questionnaire. Trends in forest-land ownership and the attitudes and intentions of owners regarding reasons for owning forest land, timber management, timber harvesting, and recreational use are discussed.

*Knutson, Robert G.

1975. **The highway market for mulch—an opportunity for bark producers.** North. Logger 23(12): 13,32-33.

Only a few state highway departments permit the use of bark mulch for roadside seeding and planting projects. But, because of the excellent performance of bark mulch in a variety of horticultural uses, more states may permit its use. The highway market for mulch has good potential for bark producers because it is a large-volume outlet, and the bark requires only minimum processing.

*Knutson, Robert G.

1975. **Trends in the highway market for wood products.** USDA For. Serv. Res. Note NE-210. 4 p., illus.

Forty-eight million cubic feet of wood products, worth about $50 million were used in the Nation's highway construction program in 1972. Expenditures for highway construction increased 2½ times from 1954 to 1972. The volume of wood products used in highway construction changed little during this period because other materials were substituted for wood products for both structural forms and structure members.

*Kochenderfer, James N., and Gerald M. Aubertin.

1975. **Effect of management practices on water quality and quantity: Fernow Experimental Forest, W. Virginia.** *In* Municipal Watershed Management Symposium

Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 14-24, illus.

Results of 22 years of forest hydrology research. Forest influences were measured on quantity and timing of streamflow and parameters of water quality such as turbidity, temperature, specific conductance, pH, alkalinity, and nutrient concentrations. It is not practical to manage forest land for both sustained increased water yield and merchantable timber products, yet forest land can be managed for a variety of uses without impairing water quality.

Konar, R. N.

1975. **In vitro studies on *Pinus* II. The growth and morphogenesis of cell cultures from *Pinus gerardiana*.** Phytomorphology 25: 55-59.

Pinus gerardiana cells were continuously cultured in a liquid suspension system. Growth was monitored by following increase in cell populations with a hemacytometer. When plated onto an agar medium under specified conditions, cells formed colonies that grew into callus masses. The latter could then be transferred to other agar media supplemented with coconut water, casein hydrolysate, and hormonal substances. Under suitable conditions root and shoot primordia differentiated in the callus masses.

*Kottke, Marvin W., Malcolm I. Bevins, Gerald L. Cole, Kenneth J. Hock, and Wilbur F. LaPage.

1975. **Analysis of the campground market in the Northeast. Report III. A perspective on the camping-involvement cycle.** USDA For. Serv. Res. Pap. NE-322. 35 p.

A report on a study of the national camping market, conducted in 1973, updating findings of a similar survey conducted in 1971. Based on a nationally representative sample of 2,213 households, the total camping market is estimated to include 14.3 million households of active campers, 6.1 million who are temporarily inactive, and 6.1 million who are potential additions to the market. A detailed analysis of the popular image of camping as held by each of the major segments of the market is included, and the reasons for permanent and temporary dropping out of the camping market are examined.

Krawczyszyn, J., and J. A. Romberger.

1975. **Wood grain patterns allow study of the time aspect of slowly migrating morphogenic waves in cambia trees.** Chronobiologia 2: Suppl. 1: 38-39. (Abstr., Soc. Chronobiology Int. Conf. 12, Washington, D.C.)

Earlier studies in Poland and at Beltsville established the general principles of migrating cambial domains and explained the anatomical basis of wavy grain and interlocked grain in wood. This study of interlocked grain patterns in *Nyssa* and *Liquidambar* provides a basis for interpreting interlocked grain as a long-term biological rhythm. The period of the rhythm is nearly constant at 10 to 12 years even in paired *Nyssa* stems of the same age but of greatly different growth rates.

*LaPage, Wilbur F., Paula L. Cormier, George T. Hamilton, and Alan D. Cormier.

1975. **Differential campsite pricing and campground attendance.** USDA For. Serv. Res. Pap. NE-330. 6 p.

Price differentials, including a premium for waterfront campsites and a preferential rate for state residents, were introduced at a New Hampshire state park in 1973. Total revenue increased by 61 percent. Permit data before and after the change showed that attendance by state residents increased significantly. The differentials did not produce longer or more frequent visits by state residents, nor a decline in the use of waterfront sites. Declines in visit length and party size appeared to be independent of fee policies.

*Larsen, David N., and David A. Gansner.

1975. **Pennsylvania's private woodland owners: an important group of decision-makers.** Pa. For. 66(1): 10-12.

Private noncorporate owners—farmers, small businessmen, white-collar workers, retirees and others—own three-quarters of Pennsylvania's woodlands. This paper describes the characteristics, attitudes, and actions of this important group of decision-makers and dis-

cusses their key role as suppliers of forest products and services.

*Larsen, David N., and David A. Gansner.
1975. **Simple models for estimating local removals of timber in the Northeast.** USDA For. Serv. Res. Pap. NE-319. 7 p., illus.

A practical method of estimating subregional removals of timber is applied to a typical problem. Stepwise multiple-regression analysis is used to develop equations for estimating removals of softwood, hardwood, and all timber from selected characteristics of socioeconomic structure.

*Leak, W. B.
1975. **Age distribution in virgin red spruce and northern hardwoods.** Ecology 56: 1451-1454, illus.

Age distributions of trees in virgin stands (by species) take one of three forms: Stable populations show a linear relationship between the logarithm of stem number and the logarithm of age; a concave age distribution indicates an increasing population; and a convex to bell-shaped distribution indicates a declining population. *P. rubens*, *A. balsamea*, *B. papyrifera* var. *cordifolia*, and *S. americana* all had linear age distributions in a virgin spruce-fir stand. In a virgin stand of northern hardwoods, *F. grandifolia* was stable, *A. saccharum* increasing, and *P. rubens* and *B. alleghaniensis* declining.

*Leak, William B., and Stanley M. Filip.
1975. **Uneven-aged management of northern hardwoods in New England.** USDA For. Serv. Res. Pap. NE-332. 15 p.

Three main aspects of uneven-aged management in northern hardwoods are discussed: (1) choice of cutting method, including selection, group selection and patch selection; (2) control of yields, which involves the establishment of structural goals, the control of marketing operations, and the prediction of allowable harvest; and (3) the transportation or removal of products—truck roads, skidroads, and harvesting precautions.

*Leak, William B., and C. Wayne Martin.
1975. **Relationship of stand age to streamwater nitrate in New Hampshire.** USDA For. Serv. Res. Note NE-211. 5 p.

Streamwater nitrate content of six watersheds during spring and summer was apparently related to stand age or age since disturbance. Nitrate concentration averaged 10.3 ppm right after cutting, dropped to a trace in medium-aged stands, and then rose again to a maximum of 4.8 ppm as stands became overmature.

*Leak, W. B., and D. S. Solomon.
1975. **Influence of residual stand density on regeneration of northern hardwoods.** USDA For. Serv. Res. Pap. NE-310. 7 p.

In a study of hardwood regeneration, experimental plots were treated to produce residual densities of 40, 60, 80, and 100 square feet of basal area per acre with 30, 45, and 60 percent sawtimber. After 9 years, numbers of stems and percentage of stocking were estimated for each species, and plots were rated for reproductive potential under different residual densities. Data from a 3-year patch cutting are given for comparison.

Lewis, F. B.
1975. **Dosage effect on target insect populations (short- and long-term).** *In* M. Summers (ed.), Baculoviruses for pest control: safety considerations. Am. Soc. Microbiol. p. 143-144.

The immediate direct effect of introducing *Baculoviruses* into pest populations for immediate control effects is contrasted with the long-range effect on populations due to virus carry-over and resultant population regulation over time. The long-term effect of the introduction of the virus of the European pine sawfly is contrasted with the short-term effect of the viruses of gypsy moth and several agricultural pests.

Little, Silas.
1975. **Japanese honeysuckle: persistent efforts required to combat this robust immigrant.** Brooklyn Bot. Gard. Handbk. Weed Control in Home Gard. [Plants and Gardens 31(2): 55.]

This paper, a revision of a 1967 article, describes for homeowners the growth of honeysuckle and possible measures of control: pulling by hand, bulldozing with a root-rake, mowing, and herbicides. Though effective herbicides are discussed briefly, the homeowner is advised to consult a responsible state agency on current status and permissible use of any chemical for honeysuckle control.

Little, Silas.

1975. **Book review of "Handbook of vegetation science. Part V. Ordination and classification of communities. Part VIII. Vegetation dynamics."** Torrey Bot. Club Bull. 102: 79-80.

The two volumes reviewed are the first ones published of an 18-part handbook prepared by an international committee of ecologists and phytosociologists to summarize current knowledge. In the reviewer's opinion, use of these books will be limited primarily to readers versed in the technical jargon, and their value is reduced by certain omissions and a few inaccuracies. Even so, the volumes will be highly valuable references for specialists.

*Lucas, Edwin L., and Philip A. Araman.

1975. **Manufacturing interior furniture parts: a new look at an old problem.** USDA For. Serv. Res. Pap. NE-334. 6 p., illus.

The yields of interior furniture parts from four manufacturing sequences were compared. In three of the sequences, gang-ripping was the first step; in the fourth, the lumber was crosscut first. Though the grade of lumber used affects the percentage yield of parts, the manufacturing sequence used does not—but it will affect the cost per part. The selection of the best method must be based on factors other than parts yield.

Lynch, J. A., E. S. Corbett, R. J. Hutnik.

1975. **Water resources.** *In* Clearcutting in Pennsylvania: 51-64. Pa. State Univ. Coll. Agric. Sch. For. Resour.

The factors influencing the quality and quantity of water yielded from forested lands are outlined. The effects of clearcutting on stream nutrient concentrations, water temperature, turbidity, water yield, and stormflows are evaluated. Recommendations are made for protecting water resources when clearcutting is used as a forestry practice.

Lynch, James A., W. E. Sopper, E. S. Corbett, and D. W. Aurand.

1975. **Effects of management practices on water quality and quantity: the Penn State experimental watersheds.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 32-46, illus.

The results of phases one and two of a three-phase clearcutting experiment on a 106-acre watershed in central Pennsylvania are reported. Phase one involved removal of vegetative cover on 21.3 acres of a lower-slope portion of the watershed. Phase two consisted of clearcutting an additional 27.0 acres on a mid-slope portion of the watershed. Effects of these treatments on water quality, quantity, and streamflow timing have been evaluated.

Lynch, James A., William E. Sopper, and Edward S. Corbett.

1975. **Watershed behavior under controlled simulated rainfall.** Pa. State Univ. Inst. Res. Land and Water Resour. 71 p.

To investigate the hydrologic behavior and response of a small natural forested drainage basin, an irrigation system was designed and installed to apply a uniform amount of simulated rainfall to any or all parts of a 20-acre watershed. The effects of antecedent soil moisture and storm size on the disposition of simulated rainfall and storm-hydrograph characteristics were analyzed. The hydrologic behavior and response of the watershed to controlled applications of simulated rainfall were also evaluated.

*McCauley, Orris D., and George R. Trimble, Jr.

1975. **Site quality in Appalachian hardwoods: the biological and economic response under selection silviculture.** USDA For. Serv. Res. Pap. NE-312. 22 p.

The percentage value response after 12 years of selective cutting on low- and high-quality sites amounted to a 119-percent increase on

the low-quality site and 145 percent on the high-quality site. The low-quality site increased in value only $76/acre while the high-quality site increased $233/acre. Current trends in species composition indicate that selective cutting practices will change the species composition toward a climax stand favoring shade-tolerant, slower-growing, lower-valued species.

McGee, Charles E., and F. Bryan Clark.
1975. **Harvesting and reproducing yellow-poplar.** Hardwood Res. Counc. 3d Annu. Hardwood Symp. Proc.: 26-31.
The authors offer these guidelines: (1) Harvest the existing stand by clearcutting or group selection; if the cut is much less than an acre, other species will probably be interspersed with the poplar. (2) Whatever harvesting system is used, control leftover unmerchantable material, preferably using chemicals on undesirable species to reduce sprouting.

*McGinnes, E. A. Jr., and A. L. Shigo.
1975. **Electronic technique for detecting discoloration, decay, and injury-associated ring shake in black walnut.** For. Prod. J. 25(5): 30-32, illus.
A new approach for detecting discoloration, decay, and injury-associated ring shake in black walnut and other species is described. A wire probe energized with a pulsed electric current is inserted into a small hole drilled 8 to 10 inches into the tree, and the changing pattern of resistance readings indicates areas of sound wood or wood in various stages of discoloration and decay.

*Marquis, David A.
1975. **Seed storage and germination under northern hardwood forests.** Can. J. For. Res. 5: 478-484.
Seed in excess of 1 million per acre were found to be common, the number of seed of a particular species depending on the number of seed-bearing trees of that species in the overstory and on the length of time seed of that species will remain viable in the forest floor. Sugar maple, eastern hemlock, and American beech normally germinate the year after seed dispersal and do not remain viable in the forest floor. Black cherry, white ash, yellow-poplar, red maple, and birch normally germinate over a period of several years after dispersal; and storage in the forest floor for 2 to 5 years is common.

*Marquis, David A.
1975. **The Allegheny hardwood forests of Pennsylvania.** USDA For. Serv. Gen. Tech. Rep. NE-15. 32 p., illus.
A history of the changes that have occurred in the Allegheny hardwood forests of northwestern Pennsylvania from the days of the Indian through the era of white settlement and industrial development up to the present time. Both the problems now faced in regenerating new stands and the bounty of timber and deer now obtained from these forests had their origin in events that occurred many years ago.

*Marquis, David A., Ted J. Grisez, John C. Bjorkbom, and Benjamin A. Roach.
1975. **Interim guides to the regeneration of Allegheny hardwoods.** USDA For. Serv. Gen. Tech. Rep. NE-19. 14 p., illus.
Regeneration of Allegheny hardwoods is difficult to obtain because of excessive deer browsing on tree seedlings. Density of advance seedlings, density of competing plants, soil drainage, and the importance of esthetic and recreation uses affect the choice of silvicultural system and cutting procedure for obtaining satisfactory regeneration. The authors provide guides needed for evaluating the regeneration potential and prescribing the most appropriate treatment for cherry-maple stands on the Allegheny Plateau of Pennsylvania and New York.

*Martin, A. Jeff.
1975. **T-H-A-T-S: Timber harvesting and transport simulator.** USDA For. Serv. Res. Pap. NE-316. 31 p., illus.
A detailed description of a FORTRAN IV computer program for simulating a typical timber-harvesting operation. Designed as a user's manual, the paper includes program development and operation, instructions for use, and output from an example problem. Flow charts are also included.

*Martin, A. Jeff.

1975. **A first look at logging residue characteristics in West Virginia.** USDA For. Serv. Res. Note NE-200. 3 p.

In 1973 and 1974, the Forest Products Marketing Laboratory obtained some preliminary information about characteristics of logging residues in West Virginia. Sixteen 1-acre plots were measured in conjunction with a test of the line-intersect sampling method. Findings from the 16 plots showed that hardwood residue volumes ranged from 100 to 1,300 cubic feet per acre, an average of 467.

*Martin, A. Jeff.

1975. **REST: A computer system for estimating logging residue by using the line-intersect method.** USDA For. Serv. Res. Note NE-212. 4 p.

A computer program was designed to accept logging-residue measurements obtained by line-intersect sampling and transform them into summaries useful for the land manager. The features of the program, along with inputs and outputs, are briefly described, with a note on machine compatibility.

*Martin, A. Jeff.

1975. **Predicting logging residues: an interim equation for Appalachian oak sawtimber.** USDA For. Serv. Res. Note NE-203. 4 p.

An equation, using dbh, dbh^2, bole length, and sawlog height to predict the cubic-foot volume of logging residue per tree, was developed from data collected on 36 mixed oaks in southwestern Virginia. The equation produced reliable results for small sawtimber trees, but additional research is needed for other species, sites, and utilization practices.

Martin, A. Jeff, and Victor J. Rudolph.

1975. **Evaluating northern hardwood timber stand improvement opportunities in northern lower Michigan.** Mich. State Univ. Agric. Exp. Stn. Res. Rep. 267. 10 p., illus.

Data collected from 25 small woodlands were used as the basis for a decision-tree analysis of 20 timber-stand-improvement options facing each owner. The internal rates of return used to evaluate the options ranged from less than 1 percent to more than 20 percent, averaging 8½ percent over all owners for the best five alternatives.

Mazzone, H. M.

1975. **An analysis of serological studies on the nucleopolyhedrosis and granulosis (capsule) viruses of insects.** *In* M. Summers (ed.), Baculoviruses for insect pest control: safety considerations. Am. Soc. Microbiol. p. 33-38.

The need for better control of insecticides has placed the natural enemies of insects in a unique position. The nucleopolyhedrosis and granulosis (capsule) viruses seem eminently qualified as natural control agents for pest insects. The author evaluates the serological studies that have been conducted on these organisms and considers what action should be taken to hasten their use as regulators of insect populations.

Mazur, A. R., T. D. Hughes, and J. B. Gartner.

1975. **Physical properties of hardwood bark growth media.** Hortscience 19(1): 30-33.

Physical properties of various hardwood bark-soil mixes for containers were compared to a soil-peat-perlite mix. Bark-soil mixes containing a wide range of bark particle sizes were found to possess superior physical properties initially and remained satisfactory after a 13-month incubation period. However, bark-soil mixes were much less stable and deteriorated to a significantly greater extent. It was concluded that use of hardwood bark in golf green mixes is not feasible.

*Melhuish, J. H., Jr., and E. Hacskaylo.

1975. **Fatty acid composition of ectomycorrhizal fungi in vitro.** Mycologia 67: 952-960, illus.

Mycelia of five ectomycorrhizal fungi—*Hebeloma sarcophyllum, H. crustuliniforme, Suillus cothurnatus, Pisolithus tinctorius,* and *Cenococcum graniforme*—growing *in vitro* were analyzed for fatty acid composition by GLC and TLC methods. The major fatty acid in each fungus was a di-unsaturated 18-carbon acid; 16:0 and 18:0 fatty acids were also present in each fungus; and an 18:1 fatty acid was detected in all fungi except *S. cothurnatus.*

Moeller, George H.

1975. **The Delphi technique: an approach to identifying events that will shape the future of outdoor recreation.** *In* Indicators of change in the recreational environment—a national research symposium: 211-220. Pa. State Univ. HPER Ser. 6. University Park.

A critique of the Delphi research technique and an example of how it was applied in a study to probe for relevant technological, managerial, and institutional events that are likely to influence recreation-resource management to the year 2000. The technique was used to develop a consensus of expert opinion and stimulate thinking toward formulating policies to deal with future recreation-resource management problems.

*Moeller, George H., Gerald S. Walton, and Elwood L. Shafer, Jr.

1975. **Dimensions of recreation resource planning decisions.** Recreation Rev. 4 (2): 24-35, illus.

To determine the meanings of 10 concepts that are involved in most recreation resource decisions and to identify the roles that these elements play in the process, factor analysis of semantic differential data was used to build a structure of semantic space with three factor axes—harmony, activity, and conventionality. Statistical analysis revealed four groups of elements that operate in the decision process: physical characteristics; recreation supply opportunities; recreation demand pressures; and political influences.

Neely, Dan.

1975. **Sanitation and Dutch elm disease control.** *In* Dutch elm disease: 76-87. USDA For. Serv. Northeast. For. Exp. Stn.

Sanitation is an important factor in Dutch elm disease control programs. This paper describes some experimental studies upon which sanitation practices are based, discusses the practical application of these research studies, and details the effects of sanitation as a disease-control measure in a number of communities.

Nelson, James C., Benjamin A. Roach, O. Lynn Frank, and Wilber Ward.

1975. **Timber management.** *In* Clearcutting in Pennsylvania: 33-49. Pa. State Univ. Coll. Agric. Sch. For. Resour.

Clearcutting, properly prescribed and carried out, is not forest devastation but a standard forestry measure used as the best means of regenerating a forest stand under certain conditions. It promotes a higher proportion of intolerant species and, where reproduction is prompt, results in faster development of the new stand than any other cutting method. Its use will be necessary for Pennsylvania's citizens to obtain maximum benefits from their forests. This report lists cautions to be observed in its use and describes certain situations in which it should not be used.

Nolley, Jean W.

1974. **Christmas trees: A bibliography.** (1974 supplement) Am. Christmas Tree J. 19(2): 21-28.

1974 supplemental listing of published information on the Christmas tree industry.

Nolley, Jean W.

1975. **Christmas trees: A bibliography.** (1975 supplement) Am. Christmas Tree J. 19(2): 21-27.

1975 supplemental listing of published information on the Christmas tree industry.

*Northeastern Forest Experiment Station.

1975. **Dutch elm disease.** USDA For. Serv. Northeast. For. Exp. Stn. 94 p., illus.

Proceedings of the IUFRO (International Union of Forest Research Organizations) conference on Dutch elm disease, held at Minneapolis-St. Paul in September 1973.

*Northeastern Forest Experiment Station.

1975. **1974 at the Northeastern Station.** USDA For. Serv. Gen. Tech. Rep. NE-18. 48 p.

A summary report on highlights of research activities and accomplishments by the Experiment Station in 1974, including an annotated list of publications.

Northeastern Forest Experiment Station.
1975. **Hubbard Brook: an outdoor forest lab.** N.H. For. Notes Winter 1975-6 (124): 20-22, illus.
A generalized description of the Northeastern Station's Hubbard Brook Experimental Forest at West Thornton, N.H., and the research being carried on there in various land-, forest-, and water-management measures to see what effect they have on local forest and water conditions.

*Northeastern Forest Experiment Station.
[1975] **Green vistas . . . black diamonds.** Northeast. For. Exp. Stn. 7 p.
A folder based on a slide presentation, describing work being done by a team of Forest Service researchers at Berea, Ky., on reclamation of strip-mined lands.

*Northeastern Forest Experiment Station.
[1975] **How to kill your tree.** Northeast. For. Exp. Stn. 1 p.
A leaflet listing 16 ways (plant too deep, plant too shallow, overfertilize, etc.) in which a tree can be damaged or inhibited.

*Northeastern Forest Experiment Station.
[1975] **How to keep your trees healthy.** Northeast. For. Exp. Stn. 1 p.
A leaflet listing 14 ways to help keep a tree healthy.

*Northeastern Forest Experiment Station.
[1975] **How to treat wounds to prevent decay.** Northeast. For. Exp. Stn. 1 p.
A leaflet listing eight ways to treat a tree wound to minimize decay and help the tree remain healthy.

*Parker, Johnson, and Roy L. Patton.
1975. **Effects of drought and defoliation on some metabolites in roots of black oak seedlings.** Can. J. For. Res. 5: 457-463, illus.
In two separate experiments, starch levels in roots were lower in defoliated watered black oak seedlings than in undefoliated watered seedlings. Starch in unwatered undefoliated seedlings was lower only when drought was severe. Drought and defoliation together resulted in lower starch levels than either one alone. Reducing sugars, several amino acids, and certain phenolics were higher in unwatered seedlings than in undefoliated watered ones. Catechin was lower in defoliated than in undefoliated seedlings regardless of watering. Fertilizer additions resulted in lower carbohydrate levels.

Patric, James H.
1975. **Announcement: report on lysimeter studies at San Dimas Experimental Forest.** For. Sci. 21(2): 195.
Announces the availability of a 143-page report on the lysimeter studies conducted at San Dimas from 1938 to 1960—the most extensive lysimeter study carried out in the country. The report is available from the author.

*Patric, James H., and David W. Smith.
1975. **Forest management and nutrient cycling in eastern hardwoods.** USDA For. Serv. Res. Pap. NE-324. 12 p., illus.
The literature was reviewed for reports on nutrient cycling in the eastern deciduous forest, particularly with respect to nitrogen and effects of forest management on the nutrient cycle. The nutrient content of the forest stand is a relatively small part of the total nutrient pool contained in soil. Under present practices of harvesting wood on a 50- to 100-year rotation, nutrient deficiency as a result of crop removal seems unlikely on most forest land.

*Patric, J. H., and W. R. Studenmund.
1975. **Some seldom-reported statistics on precipitation at Elkins, West Virginia.** W.Va. Agric. & For. 6(2): 14-16.
Start and stop times for precipitation were tabulated to the nearest hour from records on file at the Elkins airport. Graphical analysis showed that storms are most likely to occur between midnight and sunrise. Spells of wet or dry weather seldom persist for longer than 1 week, rarely for 2 weeks. Measurable precipitation can be expected during 1 day in 3 at the airport. Similar relationships can be computed from data on file at any National Weather Service installation having a recording rain gage and a full-time observer.

Payne, Brian R., and Richard M. DeGraaf.

1975. **Economic values and recreational trends associated with human enjoyment of nongame birds.** *In* Symp. Manage. For. and Range Habitats Nongame Birds Proc. USDA For. Serv. Gen. Tech. Rep. WO-1: 6-10. Washington DC.

Total direct expenditures for the enjoyment of nongame birds in 1974 were estimated to be $500 million. Expenditures for birdseed, binoculars, and camera equipment constituted 95 percent of the total. Continued moderate growth is predicted.

Payne, Brian R., Richard C. Gannon, and Lloyd C. Irland.

1975. **The second-home recreation market in the Northeast.** U.S. Dep. Inter. Bur. Outdoor Recreation. 27 p.

Recent rapid growth in construction of second homes has had great impacts on rural areas, accelerating change in land use out of farming and forestry. Economic effects on local communities have probably been positive; social and environmental effects may be negative. Policy issues and possible responses are identified.

Peacock, John W.

1975. **Research on chemical and biological controls for elm bark beetles.** *In* Dutch elm disease: 18-49. USDA For. Serv. Northeast. For. Exp. Stn., Upper Darby, Pa.

Past and current elm-bark-beetle research, as well as current beetle-control recommendations, are discussed. Current research on insecticides, parasites and other biological control agents, feeding stimulants and deterrents, attractants, and male sterilization are highlighted in the discussion.

Peacock, J. W., and R. A. Cuthbert.

1975. **Pheromone-baited traps for detecting the smaller European elm bark beetle.** USDA Coop. Econ. Insect Rep. 25(24): 497-500.

A simple and efficient beetle-detection system is described that utilizes pheromone-baited traps. Included is a discussion of the significance of trap catches in determining beetle distribution and abundance.

Peacock, J. W., R. A. Cuthbert, W. E. Gore, G. N. Lanier, G. T. Pearce, and R. M. Silverstein.

1975. **Collection of Porapak Q of the aggregation pheromone of *Scolytus multistriatus* (Coleoptera: Scolytidae).** J. Chem. Ecol. 1(1): 149-160, illus.

The attractive volatiles in the air around virgin female smaller European elm bark beetles tunneling in elm logs can be collected by passing the air through a column of Porapak Q. These volatiles can be removed by Soxhlet extraction with hexane, yielding an extract that is attractive to in-flight beetles. Analyses of this and an extract of virgin female frass indicate that the aeration extract contains active chemicals that are not in the extract of frass.

Pearce, G. T., W. E. Gore, R. M. Silverstein, J. W. Peacock, R. A. Cuthbert, G. N. Lanier, and J. B. Simeone.

1975. **Chemical attractants for the smaller European elm bark beetle *Scolytus multistriatus* (Coleoptera: Scolytidae).** J. Chem. Ecol. 1(1): 115-124, illus.

The secondary attractant for the smaller European elm bark beetle is a mixture of three compounds: (−)4-methyl-3-heptanol (I); 2, 4-dimethyl-5-ethyl-6, 8-dioxabicylo (3.2.1) octain (II); and (−)α-cuberbene (III). The novel structure assigned to compound II was confirmed by synthesis. All three compounds were isolated from volatile compounds collected on Porapak Q by aerating elm bolts infested with virgin female beetles.

Pennock, Rogert [Roger], Jr., Gene W. Wood, Paul W. Shogren, Jr., Kenneth Reinhart, Vernal C. Miles, Paul Younkin.

1975. **The forest soil.** *In* Clearcutting in Pennsylvania: 21-32. Pa. State Univ. Coll. Agric. Sch. For. Resour.

Effects of different timber-harvesting methods on erosion, compaction, temperature, moisture, and nutrient content of forest soils are reviewed. Erosion and soil compaction are mainly confined to skidtrails and hauling roads. Clearcutting may increase summer soil temperatures as much as 60°F and may cause

some seedling mortality in winter. By reducing transpiration it may increase streamflow for 5 years or more. It apparently does not cause serious or irreplacable nutrient losses in Pennsylvania, but care should be taken to insure prompt revegetation.

*Plass, William T.

1975. **An evaluation of trees and shrubs for planting surface-mine spoils.** USDA For. Serv. Res. Pap. NE-317. 8 p.

Fifty-five tree and shrub species were evaluated on two surface-mine sites in eastern Kentucky. After 4 years' growth, comparison of survival and growth was used to identify the promising species for planting on acid surface-mine spoils. Three species of birch and three *Eleagnus* species survived and grew well on a range of sites. Noncommercial tree species and shrubs adapted to acid surface-mine spoils included silktree, tree-of-heaven, French tamarisk, Japanese fleeceflower, and Amur privet.

*Pogge, Franz L.

1975. **Sassafras for wildlife.** Pa. Game News 46(7): 17-19, illus.

Sassafras is a highly preferred food for deer, rabbits, and several other mammals, and for many game and nongame birds. This nontechnical paper tells how people have used sassafras since the 16th century, how sassafras grows and reproduces, and gives management recommendations. For propagating sassafras, root cuttings are best.

*Pottle, William H., and Alex L. Shigo.

1975. **Treatment of wounds on *Acer rubrum* with Trichoderma viride.** Europ. J. For. Pathol. 5: 274-279, illus.

Wounds on 90 *Acer rubrum* trees were inoculated with *Trichoderma viride* in July and August 1973 to determine the effect of the fungus on the development of decay. The trees were 45 years old and 15 cm diameter at 1.4 m above ground. Each tree had 12 wounds, 1.4 cm in diameter and 5 cm deep. After a year, 28 trees were harvested and isolations were made from the discolored and decayed wood associated with each wound. *Trichoderma viride* was reisolated from all wounds that were inoculated with it. Hymenomycetes were isolated frequently from decayed wounds not inoculated with *T. viride*. No Hymenomycetes were isolated from wounds inoculated with *T. viride*.

Purchasing World.

1974. **How pallets stand.** Purch. World 18(9): 68.

Although the supply of wooden pallets has improved, it is expected to remain snug over the next few years. It is suggested that pallet users take a closer look at the economics of pallet use. Pallet life increases much faster than price, up to $10 per pallet. Therefore better and more expensive wooden pallets cost less per use. Compared with other materials, wooden pallets still offer a hard-to-beat economic advantage.

Rast, Everette D.

1975. **Preliminary hardwood log veneer grades for yellow birch and sugar maple face veneer.** Hardwood Res. Counc. 3d Annu. Hardwood Symp. Proc.: 84-94, illus.

Each veneer mill generally has its own veneer-log grading system containing 2 to 6 grades. Some are similar, but many differ significantly. The proposed system is an initial attempt to correlate face-veneer yields with exterior log characteristics for yellow birch and sugar maple. The preliminary system separates the logs into 3 grades based on the yield of 2 Faces Sound and Better dry veneer.

Reinhart, Kenneth G.

1975. **Throughout the Northeast—an overview.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 79-83, illus.

Forest watershed research has shown how management practices in the Northeast affect water quality (sediment, temperature, and nutrients), water yield, and stormflow. It has demonstrated how water quality can be protected and overland flow controlled. It has not yet shown how vegetation management can be used in a practical way to achieve the big potential for increased water yield.

*Richenderfer, James L., William E. Sopper, and Louis T. Kardos.

1975. **Spray-irrigation of treated municipal sewage effluent and its effect on the chemical properties of forest soils.** USDA For. Serv. Gen. Tech. Rep. NE-17. 24 p., illus.

Several forested areas on two soil types at the Waste Water Renovation and Conservation Project at The Pennsylvania State University were irrigated with treated municipal sewage effluent for 9 years (1963-71). Soil samples were collected to a depth of 5 feet in 1963, 1967, and 1971. These samples were analyzed to determine if any significant changes had occurred in the chemical properties of the soils as a result of the effluent irrigation. No detrimental effects were observed.

Riddle, Jane.

1975. **Opportunities for reclaiming strip-mined forest lands.** For. Farmer 35(4): 6-8, illus.

A generalized description of the research being carried on at the Northeastern Station's research center at Berea, Ky., encompassing more than 60 studies by a team of researchers in forestry, soil science, geology, engineering, hydrology, biology, range management, wildlife management, microbiology, and economics.

Roach, Benjamin A.

1975. **Foreword.** *In* Clearcutting in Pennsylvania: ix-xii. Pa. State Univ. Coll. Agric. Sch. For. Resour.

This introduces a committee report describing the impacts of clearcutting on six major forest resources of Pennsylvania. It tells why the committee was organized and what it hoped to accomplish, and defines the type of clearcutting that was examined in detail in the rest of the report.

*Roach, Benjamin A.

1975. **Scheduling timber cutting for sustained yield of wood products and wildlife.** USDA For. Serv. Gen. Tech. Rep. NE-14. 13 p., illus.

Maintaining stable wildlife populations throughout eastern hardwood forests will require adjusting and regulating timber age classes by much smaller units of land (approximating the home ranges of the species involved) than would be needed for sustained yield of timber alone. The key to successful regulation for combined timber and wildlife production, with minimum impact on costs and timber yields, is long-term planning of cutting schedules and comparison of yields under alternative schedules for small units of land.

*Romberger, J. A., and C. A. Tabor.

1975. **The *Picea abies* shoot apical meristem in culture. II. Deposition of polysaccharides and lignin-like substances beneath cultures.** Am. J. Bot. 62: 610-617.

Shoot apical meristems of *Picea abies* growing as organ cultures release soluble precursors of polysaccharides and lignin-like substances. The precursors diffuse into or through supporting cellulose ester filter membranes and are condensed and deposited as insoluble products at sites remote from living cells. Little deposition occurs beneath a dialysis membrane. The system may be useful in studying synthesis of cell wall components and control of shoot apical development.

*Sanderson, H. Reed.

1975. **Den-tree management for gray squirrels.** Wildl. Soc. Bull. 3(3): 125-131.

Den requirements of gray squirrels *(Sciurus carolinensis)* and den-formation processes are reviewed. One squirrel per 4 acres is suggested as a minimum population goal. At least one den per 2 acres—suitable for winter shelter and litter rearing—is recommended to compensate for interspecies competition for and inadequate distribution of dens. Options at four different levels of management intensity are discussed, although designed for even-aged forests, the more intensive of these options can be applied in any forest stand where dens are needed.

Sarles, Raymond L.

1975. **New equipment for bark application.** For. Prod. Res. Soc. Tech. Options in Bark Util. Proc. P-73/74-11: 7-24.

Though shredded bark performs well as a mulch over grass seedings, the lack of equipment to apply it at low cost, and general

unavailability of bark, keep bark from being specified and used more widely in the East. These problems are discussed, with particular emphasis on equipment. Machine-design features and performance specifications are prescribed for new bark application equipment. Four prototype machines now under test are described.

*Seegrist, Donald W.

1975. **A multivariate model and statistical method for validating tree grade lumber yield equations.** USDA For. Serv. Res. Pap. NE-320. 20 p.

Lumber yields within lumber grades can be described by a multivariate linear model. A method for validating lumber-yield prediction equations when there are several tree grades is presented. The method is based on multivariate simultaneous test procedures.

Shafer, Elwood L., Jr.

1975. **The impact of human needs on the natural environments for recreation.** *In* Indicators of change in the recreational environment—a national symposium: 328-334. Pa. State Univ. HPER Ser. 6. University Park.

The need to incorporate man-environment relationships into public land-use policy decisions is discussed. The model of Spaceship Earth provides a framework within which to develop greater public awareness, understanding, and action programs to solve environmental problems. Broad-scale land-use planning cannot be undertaken until a working model of Spaceship Earth has been developed based on biological, political, social, and physical relationships defined through research.

*Shigo, Alex L.

1975. **Biology of decay and wood quality.** 2nd Int. Congr. Plant Pathol., Sess. Wood Prod. Pathol. Proc. 15 p., illus. Springer-Verlag, Berlin.

A model of the decay process has been developed, based on events from time of tree wounding to total decomposition of wood, including (1) host response, (2) invasion by pioneer organisms, and (3) decay of dead cells. Electrical engineering techniques and tools are now being used as aids to understanding the biology of decay in trees and wood products.

*Shigo, Alex L.

1975. **Heartwood and discolored wood.** North. Logger 25(2): 28-29, illus.

Heartwood is wood changed by normal aging processes. Discolored wood is wood changed as a result of injuries. Differences between heartwood and discolored wood are described.

*Shigo, Alex L.

1975. **Wood decay.** *In* McGraw Hill Yearbook of Science and Technology: 417-419, illus.

A new concept about how decay begins and develops in wood is described. The decay process is no longer seen as a simple relationship between wood and fungi, but as a complex succession of events that involve chemical reactions, bacteria, different kinds of fungi, and discoloration. Research on this new concept has revealed the unique ways in which a tree reacts to its wounds by sealing off the affected tissues. Even though a tree may be rotten at the core, it may still live on to produce healthy new wood for a long time.

*Shigo, Alex L.

1975. **Compartmentalization of decay associated with *Fomes annosus* in trunks of *Pinus resinosa*.** Phytopathology 65: 1038-1039.

Decay associated with *Fomes annosus* in 26 *Pinus resinosa* trees was compartmentalized in the trunks. The decay was confined to the wood present in the trunk at the time the fungus grew from the root into the root collar. The new wood that continued to form in the trunk was not infected. The healthy wood was associated with vigorous lateral roots.

*Shigo, Alex L., and Paul Berry.

1975. **A new tool for detecting decay associated with *Fomes annosus* in *Pinus resinosa*.** Plant Dis. Rep. 59: 739-742, illus.

An electrical meter that produces pulsed current and measures electrical resistance of

wood to it detected decay associated with *Fomes annosus* in *Pinus resinosa*. Detection was based on the resistance pattern recorded as a special probe tip came in contact with decayed wood and resin-soaked wood. Resin-soaked wood had high resistance, and decayed wood had low resistance. A pattern of both high and low measurements as the probe was inserted into the tree indicated infection by *Fomes annosus*. Patterns of measurements that did not change abruptly indicated sound healthy wood.

Shigo, Alex L., and David Carroll.
1975. **What's the name of that tree?** Reader's Digest 107 (641): 155-162, illus. [September 1975.]
Brief generalized descriptions of America's foremost tree families; text and captions based on information from Shigo, illustrations by Carroll.

Shigo, Alex L., and Edwin vH. Larson.
1975. **Anatomy of a wound.** Weeds, Trees and Turf 14(7): 20-22, illus.
City trees are especially vulnerable to wounding, and any wound can open the way to the complex processes that can cause decay within the tree. The authors describe how a tree reacts to a wound and how a succession of microorganisms are involved in the decay process. Suggestions for treating and caring for a tree after it has been wounded.

*Shiner, James William, and Elwood L. Shafer, Jr.
1975. **How long do people look at and listen to forest-oriented exhibits?** USDA For. Serv. Res. Pap. NE-325. 16 p., illus.
The time that visitors spent looking at and listening to exhibits at the Adirondack Museum in New York was compared with the time actually required for reading exhibit material and listening to taped messages. Time spent ranged from 15 to 64 percent of time actually required.

Shull, Kenneth E.
1975. **Meeting current and future drinking-water quality standards.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 142-153.
Drinking-water standards, first adopted by the U.S. Public Health Service in 1914, have been endorsed by the American Water Works Association and are enforced by most state departments of health. The standards were revised in 1925, 1942, 1946, and 1962. Standards are again under revision, and this time an effort is being made to legislate them so they will legally apply to all waters throughout the country.

Smith, H. Clay, and N. I. Lamson.
1975. **Grapevines in 12- to 15-year-old even-aged Central Appalachian hardwood stands.** Hardwood Res. Counc. 3d Annu. Hardwood Symp. Proc.: 145-150.
Twelve- to 15-year-old even-aged hardwood stands on 3 site classes were examined for number of saplings with grapevines. On good sites (SI 70), 75 percent of these stems had grapevines; on excellent (SI 80) and fair sites (SI 60), 50 and 2 percent had grapevines respectively. Grapevines per acre averaged 897 on good sites, 456 on excellent sites, and 16 on fair sites. Good quality saplings averaged 33, 53, and 67 percent on good, fair, and excellent sites. Grapevine-related sapling damage was more serious on good and excellent sites than on fair sites. Grapevine control measures are recommended.

*Smith, H. Clay, and Paul M. Smithson.
1975. **Cost of cutting grapevines before logging.** USDA For. Serv. Res. Note NE-207. 4 p., illus.
To reduce damage to hardwood stems by grapevines, it is recommended that grapevines be cut near ground level several years before the harvest cutting. Cost of completing this practice on 117 acres supporting 22 vines per acre was found to be about $3.50 per acre.

*Solomon, Dale S.
1975. **A test of point-sampling in northern hardwoods.** USDA For. Serv. Res. Note NE-215. 2 p.
Plot- and point-sampling were compared with a complete inventory of two different stands of northern hardwoods. Prisms with basal-

area factors of 5, 10, 20, 30, and 40 and a ¼-acre plot were used. Only the 5-factor prism gave a significantly different estimate. Therefore, a prism factor of 10 or greater is suggested for use in northern hardwoods.

Spencer, Bruce A.

1975. **Current management practices on metropolitan Boston's municipal watersheds.** *In* Municipal Watershed Management Symposium Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 105-110.

The Metropolitan District Commission is a state-municipal agency that directs an active management program to supply water, sewerage, park, and some police needs for 32 towns and cities of the metropolitan Boston area. Four major aspects of the management program are described: watershed management, regulation and control of management activities, silvicultural practices, and wildlife management proposals.

Spomer, L. Art.

1975. **Availability of water absorbed by hardwood bark soil amendment.** Agron. J. 67: 589-590, illus.

This laboratory investigation determined the availability of water absorbed by hardwood bark soil amendment. Water retention isotherms on a volumetric basis were determined on bark samples of seven different species with a water pycnometer and a thermocouple psychrometer. Available water was assumed to be the volume held between 0 and —15 bars. Hence, about three-fourths of the water absorbed by bark is unavailable to plants.

Staley, David H., William R. Holt, and William N. Cannon, Jr.

1974. **Necessary and sufficient condition for a model insect population to go to extinction.** Math. Biol. Bull. 36: 527-533, illus.

A necessary and sufficient condition on the parameters for a model population to become extinct is presented. The mathematical model describes an insect population with overlapping generations where the females are polyandrous and the males are subject to autosterilization. The relationship between the values of the parameters of the model and the time to extinction is illustrated.

Stern, E. George.

1975. **Design of pallet deckboard-stringer joints. Part II. Reinforced aspen pallet joints and aspen pallets.** Va. Polytech. Inst. and State Univ. Wood Res. and Wood Constr. Lab. Pallet and Container Res. Cent. Publ. 133. 24 p.

Aspen-pallet joints were tested for their static deckboard-stringer separation and shear resistance, and 48-by-40-inch aspen pallets were tested for their static stiffness and impact rigidity. The results obtained seem to justify the use of a large number of relatively light wood species that previously were considered poorly suited for this use.

Stern, E. George, and Walter B. Wallin.

1975. **Design of aspen pallet deckboard-stringer joints.** For. Prod. J. 25(2): 51-54.

Results of tests on the ultimate impact torsional and shear resistance and the torsional rigidity and shear stiffness of aspen pallet deckboard-stringer joints as well as the static stiffness and impact rigidity of 48-by-40-inch aspen pallets. These tests indicate that properly designed aspen pallets can be at least 1⅓ times as stiff and 1⅓ times as rigid as comparative oak pallets of the same basic design.

Stipes, R. J.

1975. **Chemical control of *Ceratocystis ulmi* —an overview.** *In* Dutch elm disease: 1-15. USDA For. Serv. Northeast. For Exp. Stn.

Chemical control of Dutch elm disease and its beetle vectors is an integral part of successful disease-control programs. This paper emphasizes the chemical management of the disease with fungitoxicants. Techniques for application of toxicants—including methods for foliar, bark, stem, and root administration—are described. The strengths and weaknesses of the various techniques are discussed.

Stuart, Gordon, and William M. Alden.

1975. **Current management practices on National forest watersheds: White Mountain National Forest.** *In* Municipal Watershed Management Symposium Proceedings.

USDA For. Serv. Gen. Tech. Rep. NE-13: 129-134, illus.

The Berlin, N.H., municipal supply is an example of current management practices on the White Mountain National Forest. Part of the Kilkenny Management Unit, this will be the first area under the current planning program to develop a fully integrated management unit for obtaining a good balance of resource use as related to land capability and resource demands. The unit has been and will continue to be managed for water, timber, wildlife, and recreation. Recreation use—primarily hunting, fishing, and off-road vehicle use—is not generally restricted. No campground development is planned, but hiking use is expected to increase.

*Timson, Floyd G.

1975. **Forwarders come to the Appalachian Mountains.** North. Logger 24(2): 14, 15, 36, 37, illus.

Discusses operation of an off-the-road log-moving vehicle in the Appalachians, based on a case study, and describes ability of the forwarder to work under mountain logging conditions. Data on machine availability.

*Timson, Floyd G.

1975. **Weight/volume ratios for Appalachian hardwoods.** USDA For. Serv. Res. Note NE-202. 2 p.

Weight volume relationships are presented in both English and metric systems for 15 commercial species of Appalachian hardwoods. Two ratios are presented: weight of wood volume alone, and weight of wood plus bark.

*Trimble, George R., Jr.

1975. **Summaries of some silvical characteristics of several Appalachian hardwood trees.** USDA For. Serv. Gen. Tech. Rep. NE-16. 5 p.

The author summarizes the following silvicultural characteristics of a number of Appalachian hardwood species: shade tolerance, susceptibility to epicormic branching, susceptibility to frost damage, diameter-growth rates, and seed dormancy in the forest floor.

*Valentine, H. T., and R. W. Campbell.

1975. **A simulation model of gypsy moth-forest interaction.** For. Sci. 21: 233-238.

An empirically based simulation model produces estimates of gypsy moth egg-mass density, defoliation, and subsequent tree condition and mortality for the oak forests of New England. The assumptions and rationale of the model are described in detail. Probability distributions of expected defoliation produced by the model can be used in decision-making about gypsy moth suppression.

Vogel, Willis.

1975. **Requirements and use of fertilizer, lime, and mulch for vegetating acid mine spoils.** Natl. Coal Assoc. Symp. on Surface Min. & Reclam. Proc. 3: 152-170. Louisville, Ky.

Mulch, in addition to lime and N and P fertilizers, was required for successful establishment of grasses and legumes seeded on extremely acid spoils (pH 2.2 to 3.5) in eastern Kentucky. With only lime and fertilizer, a sparse vegetative cover (mostly grass) became established; but where a mulch of shredded bark also was applied, a good cover of grasses and legumes was established. The plants were rooted only in the layer of spoil into which the lime had been incorporated (2 to 4 inches deep). The mulch reduced evaporation and maintained moisture in this rooting zone.

Wagar, J. Alan.

1975. **Effectiveness in interpretation.** Interpreter 7(3): 6-11, illus.

Summaries of existing knowledge and new studies show that interpreters' effectiveness can be improved by (1) defining clear objectives, (2) using attention-holding techniques, and (3) evaluating the extent to which objectives are achieved.

Wallin, W. B., E. G. Stern, and J. J. Strobel.

1975. **Pallet exchange-program research findings indicate need for pallet standards.** Va. Polytech. Inst. and State Univ. Wood Res. and Wood Constr. Lab. Pallet and Container Res. Cent. Publ. 134. 12 p.

Findings of pallet-exchange-program re-

search indicate that the performance of warehouse and exchange pallets depends on the quality of the pallet shook, the deckboard-stringer fasteners and fastening system, the construction design specifications, and the conditions of use. The two requirements of a successful pallet exchange system are guaranteed uniform-value pallets and an agency to provide the guarantee to the pallet user. To insure this, the pallets must be produced and procured under the auspices of a third-party inspection and certification system.

*Walters, Russell S.

1975. **Collecting maple sap with plastic pipelines and vacuum pumps.** Natl. Maple Syrup Dig. 14(3): 14-17, illus.

Plastic pipelines for collecting sugar maple sap work well and offer cost- and labor-saving advantages over the traditional buckets. Due to natural vacuum, the closed system outyielded the vented system and buckets. Attaching a vacuum pump to the closed system gave even greater sap-yield increases. Doubling the sap yield by using a vacuum pump is possible. The recommended system is the aerial or suspended closed pipeline, using droplines that are at least 18 inches long. Use of a vacuum pump is strongly recommended.

*Walters, Russell S., and H. Clay Smith.

1975. **Sugar maple sap volume increases as vacuum level is increased.** USDA For. Serv. Res. Note NE-213. 4 p., illus.

Maple sap yields collected by using plastic tubing with a vacuum pump increased as the vacuum level was increased. Sap volumes collected at the 10- and 15-inch mercury vacuum levels were significantly higher statistically than volumes collected at the 5-inch level. Although the 15-inch vacuum yielded more sap than the 10-inch vacuum, the difference was not statistically significant. An efficient vacuum system should have a vacuum level of at least 10 inches of mercury at the taphole.

*Wargo, P. M.

1975. **Lysis of the cell wall of *Armillaria mellea* by enzymes from forest trees.** Physiol. Plant Pathol. 5: 99-105.

Partially purified preparations of the enzymes chitinase and β-1, 3-glucanese, concentrated by ammonium sulphate precipitation from healthy stem and root tissue of sugar maple, red oak, black oak, and white oak lysed the hyphal walls of *Armillaria mellea*. The enzymes were extracted from the phloem of both stem and root, but yields, especially of chitinase, were usually higher from stem tissues. Presence of enzymes in healthy trees that can lyse the hyphal walls of *A. mellea* suggests a protective mechanism that may account for the resistance of healthy tissues to invasion by *A. mellea* and possibly by other microorganisms.

*Wargo, Philip M.

1975. **Estimating starch content in roots of deciduous trees—a visual technique.** USDA Forest Serv. Res. Pap. NE-313. 9 p. illus.

A visual technique for determining starch content in roots of forest trees, based on iodine-staining of starch granules, was compared with a chemical method. Although the chemical method was more precise, roots could be sorted with the visual method into groups that are probably biologically important. The visual technique is simple and can be adapted for use in the field.

Wargo, Philip M., and H. Richard Skutt.

1975. **Resistance to pulsed electric current: an indicator of stress in forest trees.** Can. J. For. Res. 5: 557-561, illus.

Resistance to pulsed electric current was measured in stem tissues of white, chestnut, black, and red oak trees that had been defoliated by the gypsy moth, and their resistance was compared with that of undefoliated trees. Resistance to pulsed current was affected by tree species, diameter, crown class, and crown condition. However, regardless of species, diameter, crown class, or crown condition, defoliated trees had higher resistances than undefoliated trees. The relationship of resistance to pulsed current and tree vigor is discussed.

*Wartluft, Jeffrey L.

1975. **Double-drum sawdust stove.** USDA For. Serv. Res. Note NE-208. 4 p., illus.

An inexpensive home-made stove for burning loose sawdust is described. The stove, which is in common use in other parts of the world, can heat a room 20 feet square for 6 to 10 hours without tending.

*Wendel, G. W.

1975. **Stump sprout growth and quality of several Appalachian hardwood species after clearcutting.** USDA For. Serv. Res. Pap. NE-329. 9 p., illus.

Results of a 10-year study showed that stumps from 50- to 60-year-old red oak, black cherry, yellow-poplar, white oak, and chestnut oak trees sprouted vigorously. A high percentage of the dominant sprouts had good stem form, and many had excellent height and diameter growth. For all species, the proportion of stumps sprouting, number of sprouts per stump, and dominant-sprout height were not correlated with parent-tree vigor or parent-tree dbh. In red oak, sprouting was not related to season of cutting or site quality.

*Wendel, G. W., and E. C. Cech.

1975. **Recovery of herbicide-damaged eastern white pine.** Tree Planters' Notes 26(4): 18-20, illus.

About 3 percent of the white pine in a plantation were killed with 2,4,5-T. Several hundred other seedlings were damaged but have recovered and are growing well 3 years after treatment. Competing blackberries, greenbriers, and hardwood sprouts were killed or satisfactorily controlled; and 90 to 95 percent of the white pine are free to grow.

Wendel, G. W., and W. J. Gabriel.

1975. **Sugar maple provenance study: West Virginia outplanting 6-year results.** Northeast. For. Tree Improve. Conf. Proc. 22: 163-171.

As part of a range-wide sugar maple provenance study, seedlings from 15 provenances, each represented by 7 or 8 parent trees, were outplanted on a previously forested site on the Fernow Experimental Forest near Parsons, WV. After 6 years, survival was 97 percent. Tree heights ranged from 3.5 meters for the Lewis County NY provenance to 2.5 meters for the Cass County MN provenance. 1972 height growth ranged from 86.2 cm for the Franklin County VT provenance to 60.1 cm for the Cass County MN provenance. Incidence of cold injury was slight, as was damage from insects or diseases.

Wiant, Harry V., Jr., Miguel A. Ramirez, and Joseph E. Barnard.

1975. **Species composition as a predictor of site quality in mixed Appalachian hardwoods.** Hardwood Res. Counc. 3d Annu. Hardwood Symp. Proc.: 80-83.

The large numbers of tree species constituting Appalachian hardwood forests and their different ecological requirements seem to result in more-or-less distinct associations on sites of given quality. With data collected at more than 100 sample locations, tree species occurrences were treated as dummy variables and related to oak site index. A procedure for easy field application of the method is presented.

*Wilkinson, Ronald C.

1975. **Silicone antitranspirant increases susceptibility of eastern white pine to the white-pine weevil.** USDA For. Serv. Res. Pap. NE-326. 5 p., illus.

An attempt to increase oleoresin exudation pressure of eastern white pine, and hence resistance to the white-pine weevil, by using a silicone antitranspirant was unsuccessful. Internal tree water balance of treated trees was increased; but apical shoot growth of trees treated with the antitranspirant was retarded, and the trees were much more susceptible to white-pine weevil attack than other trees used as controls.

*Worley, David P.

1975. **Multiple use on municipal watersheds? One way to find an answer.** *In* Municipal Watershed Management. Proceedings. USDA For. Serv. Gen. Tech. Rep. NE-13: 170-180, illus.

A sampling of the pressures for various multiple-use activities shows the complex situations created by multiple-use management, the concerns that municipal watershed managers should have, and the importance of preplanning, with particular reference to

facilities shared by all the uses eventually selected as the watershed's multiple-use package. A five-step approach is described and illustrated by example for selecting multiple-use activities to feature and for adjusting a package of activities to match the funds available for shared facilities.

Zagórska-Marek, B.

1975. **Growth activity of fusiform initials in storeyed cambium.** Acta Soc. Bot. Pol. 44.

The development of interlocked grain in species having storied cambia poses questions of the mechanics of movement past one another of cell tips in adjacent stories. This was studied in samples of *Entandrophragma* wood. The history of cambial behavior was reconstructed by microscopic study of serial tangential sections. During the deposition of the wood of one left to right inclination change, the mean fusiform cell tip migrated laterally past 9 apposing tips in the adjacent storey. This was accomplished by development of forked tips, followed by preferential growth of one fork according to the prevailing orientational domain.

Zajaczkowski, S., and T. J. Wodzicki.

1975. **Inhibition and requirement of natural stimulator for cambial xylem production in isolated stem segments of** *Pinus silvestris*. Physiol. Plant. 33: 71-74.

When sterile isolated stem segments of *Pinus silvestris* are perfused with a defined culture medium, their cambia will continue to produce new cells for as long as 15 weeks. The segments can be sacrificed at any time and studied anatomically. Thus the effects of auxins, inhibitors, and other substances upon wood formation can be determined in a controlled isolated system. The method is being used to study control of cambial activity.

*Zerillo, Roger T.

1975. **A photographic technique for estimating egg density of the white pine weevil,** *Pissodes strobi* **(Peck).** USDA Forest Serv. Res. Pap. NE-318. 4 p., illus.

Compares a photographic technique with visual and dissection techniques for estimating egg density of the white pine weevil, *Pissodes strobi* (Peck). The relatively high correlations (0.67 and 0.79) between counts from photographs and those obtained by dissection indicate that the nondestructive photographic technique could be a useful tool for determining egg density.

*Zerillo, R. T., and J. D. Podgwaite.

[1975] **Meet the gypsy moth.** USDA For. Serv. Northeast. For. Exp. Stn. 16 p., illus.

This color publication illustrates photographically the life stages of the gypsy moth, *Lymantria dispar* (egg through adult). It was designed as a guide in identifying the insect's life stages as well as explaining its life cycle.

Headquarters of the Northeastern Forest Experiment Station are in Upper Darby, Pa. Field laboratories and research units are maintained at:

- Amherst, Massachusetts, in cooperation with the University of Massachusetts.
- Beltsville, Maryland.
- Berea, Kentucky, in cooperation with Berea College.
- Burlington, Vermont, in cooperation with the University of Vermont.
- Delaware, Ohio.
- Durham, New Hampshire, in cooperation with the University of New Hampshire.
- Hamden, Connecticut, in cooperation with Yale University.
- Kingston, Pennsylvania.
- Morgantown, West Virginia, in cooperation with West Virginia University, Morgantown.
- Orono, Maine, in cooperation with the University of Maine, Orono.
- Parsons, West Virginia.
- Pennington, New Jersey.
- Princeton, West Virginia.
- Syracuse, New York, in cooperation with the State University of New York College of Environmental Sciences and Forestry at Syracuse University, Syracuse.
- Warren, Pennsylvania.