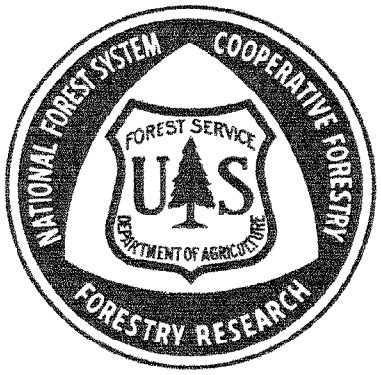
1976 at the NORTHEASTERN FOREST EXPERIMENT STATION



USDA FOREST SERVICE GENERAL TECHNICAL REPORT NE-33
1977

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

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.

1976 at the NORTHEASTERN FOREST EXPERIMENT STATION

CONTENTS

1976: GENERAL

MORE AND MORE of our research is aimed at providing the resource manager with a better understanding of both the resource and the needs expressed by potential users of that resource. Demands for a variety of goods and services from our eastern forests continue to increase and can be expected to do so into the foreseeable future. Though this forest resource is not limitless, it still has the potential to yield more than it is producing today.

Our responsibility, in overly simple terms, is to provide the forest owner and manager with the knowledge that will enable him to make a profit while protecting soil, water, and scenic values. To do this under increasing pressure on supplies of energy and water requires new technology, new economies, and perhaps even new life styles. New problems need new solutions, and these are the aim of dynamic research programs. We believe that our researchers at the Northeastern Station are well on the way to obtaining some of the needed solutions, and we would like to share with you a few highlights of 1976 at the Northeastern Forest Experiment Station.

In anticipation of increased needs for information on plant materials suitable for use in reclaiming mined lands in the East, we are preparing a stripmine revegetation handbook. With the financial support of the Environmental Protection Agency, we were able to remeasure many of the older experimental plantings through the East. These older plantings serve to demonstrate dramatically that trees provide an excellent way to protect, and in the long run improve, mined lands.

With a growing urban population and continued strong public interest in enhancing environment, our urban-forestry-research program is directed toward high-priority urban-forest-management problems. The Pinchot Institute's Consortium for Environmental Forestry Studies continues to coordinate urban-forestry research between the Forest Service and its nine member universities. During 1976, 18 new research grants were funded through the Pinchot Institute program and 23 papers were published to report results of past Consortium research. Among these was "Better Trees for Metropolitan Landscapes", which draws together a wealth of information on how to select and care for trees in urban settings.

Long-range research planning continues to involve the Station's scientists and administrators. Our Northeastern Regional Planning Committee effort, in cooperation with the universities, culminated in the preparation of 15 task-force reports. Results of this work are now being incorporated into a National Program of Research for Forest and Associated Rangelands being sponsored by the Forest Service and the Association of State College and University Forestry Research Organizations. In July 1977, the Station will co-sponsor a work conference to learn of research users needs and priorities for problems of the Northeast.

Forest-inventory activities expanded greatly in 1976. The name of our Forest Survey Unit was changed to Renewable Resources Evaluation to more completely describe increased responsibilities mandated by the Resources Planning Act. Budget increases provide for the additional workload generated by the 1979 RPA assessment. We are preparing for expanded emphasis on multi-resource inventories, ownership studies, identification of management opportunities, and resource analysis. Data-processing was completed for the forest inventories of Kentucky and West Virginia. Field plot work was completed for Maryland and started in Pennsylvania. Data-processing, analysis, and report-preparation are following closely in these states. Recent budget increases for resources evaluation will enable us to reduce the inventory cycle for our 14 states.

We had some changes in key jobs during the year. Our stripmine-reclamation project at Berea, Ky., added two more specialists to the

multidisciplinary research team. Michael Superfesky, a civil engineer, came to us from the Forest Products Laboratory. Charles Cushwa, wildlife biologist, transferred to the Station from Washington and is on special assignment with the Fish and Wildlife Service at Harpers Ferry, W. Va. He is part of a planning team preparing a research-and-development program to reclaim mined areas for enhanced fish and wildlife habitat. There is an increasing need to combine existing knowledge with new technology to improve game and nongame populations in mined and adjacent areas. Dr. Cushwa's presence on this team gives us more opportunities both to identify research needs for our own work and to make our technology and expertise available to users.

Thomas Hamilton, our Assistant Director for Planning and Applications, was transferred to Washington, D.C., to provide national leadership to resources evaluation. His replacement is Albert Foulger, who has spent the last few years in the Washington Office. Before that, he was at the Forest Products Laboratory, Madison, Wis. Al, a native of Scotland, received his basic training at the University of Edinburgh and completed his graduate work at the University of Michigan, specializing in silviculture and physiology.

Hewlette Crawford, wildlife biologist, Gordon Mott, research forester, and Daniel Jennings, entomologist, all transferred to Orono, Maine, to round out our multidisciplinary team doing research on the spruce budworm. This work will be closely coordinated with new efforts of the University of Maine to cope with this destructive pest. We are also working with state, industry, and Canadian associates.

Edwin vH. Larson ("Ted") has retired after having served more than 30 years as writer, editor, and chief of publications at the Station. Ted, who joined the Station in 1946, estimates that he has edited (and got published) more than 8,000 research papers, besides authoring and coauthoring a number of papers on forestry subjects and guides on writing and author-training.

A new editor, Martin J. Jones, has joined our staff. Marty, who came to us from Milwaukee, received his B.A. degree in journalism from Marquette University in 1966 and has worked as writer and editor on newspapers in Illinois and in private industry and public agencies in Milwaukee.

RESEARCH HIGHLIGHTS

Reclamation of Coal Spoils and Other Disturbed Areas

Our research unit at Berea, Ky., continues its work on reclamation of coal-mine spoils and other drastically disturbed areas. A field evaluation of 27- to 30-year-old experimental tree planting on spoil banks in Ohio, Illinois, Indiana, Missouri, Kansas, and Oklahoma showed the importance of planting in re-establishing forest cover. Even volunteer species were more advanced on planted sites. Black walnut, red oak, and yellow-poplar have grown well on some sites. On many of the study plots, soil formation has progressed significantly. Organic matter and potassium have generally increased, though phosphate has decreased during the 30-year period.

Suitability of tree and shrub species for direct-seeding on surface-mine spoils is being evaluated on 700 acres in West Virginia. Initial results indicated that several species can be seeded successfully by helicopter or hydroseeder *(Plass 1976)*. In another study a strain of the fungus *Aspergillus niger*, isolated from coal-mine spoil, was found to be able to break down and release essential plant nutrients from a variety of minerals commonly found in coal overburden strata.

One of our major publications of the year was Miro Czapowskyj's 98-page ANNOTATED BIBLIOGRAPHY ON THE ECOLOGY AND RECLAMATION OF DRASTICALLY DISTURBED AREAS *(Czapowskyj 1976)*.

A New Look at Soil Erosion from the Forest

One of our forest hydrologists, taking an overview look at the question of erosion, found that soil loss from hardwood forests in the eastern United States seldom exceeds 0.1 ton per acre per year. This is less than the geologic norm (0.18 to 0.30) and far less than the rate accepted as tolerable for agricultural land (1 to 5 tons per

acre per year). Responsibly managed timber harvesting causes only minor increases in forest soil erosion, usually from logging roads. Methods of avoiding erosion are well known, but too often are not applied conscientiously *(Patric 1976 a)*.

How Logging Looks Now and How It May Look Later

Some people don't like the messy look of logging. In studying this aspect of forest esthetics, our researchers at Syracuse, N. Y., took two complementary approaches. In one study, eight groups of people were taken out to look at different kinds of cuttings in northern hardwood forests, and their reactions were recorded and analyzed. In general, they preferred partial cuttings to clearcuttings, and they preferred small patch cuttings to strip clearcuttings *(Echelberger 1976)*.

In another study—called PREVIEW—computer graphics were used to show the visual effects of a proposed forest cutting and the subsequent regrowth throughout a rotation. The computer-generated perspective drawings show how changes would look from selected viewpoints. Landscapes are shown as a grid of distorted squares or by symbols representing trees, rock, water, clearings, roads, etc. *(Myklestad and Wagar 1976)*.

Making Use of Logging Waste

In any logging job, after the easily usable logs have been taken out, some woody material is left in the woods as waste. The questions are: How much?; and could some of this material be put to use? Researchers at Princeton, W. Va., studying a logging operation in a mature stand of oak/hickory, found that, for every 1 ton of sawlogs removed, 1.8 tons of woody residue were left in the woods.

After logging was finished, researchers removed and weighed all residues on a 1-acre plot. Pieces of wood considered usable—at least 6 inches in diameter and 4 feet long—were run through a mobile sawmill. This 1-acre plot yielded 69.3 tons of usable wood, including 4,719 board feet (15.1 tons) of lumber and cants suitable for use as pallet stock, blocking, mine timbers, and other such uses; 51.6 tons of chips suitable for pulping, metallurgical, or other uses; and 2.6 tons of sawdust.

GYPCHEK

"GYPCHEK" is an acronym for a biological insecticide that may prove to be useful for checking the gypsy moth. Developed at our laboratory at Hamden, Conn., GYPCHEK is the gypsy moth nucleopolyhedrosis virus (NPV), which we think can be used to help control gypsy moth populations.

GYPCHEK has been submitted to the Environmental Protection Agency (EPA) for registration for general use against the gypsy moth. Data required for EPA registration have been several years in preparation by our researchers and many cooperators. We anticipate that the registration procedure may take 3 to 6 months unless EPA wants additional data. Meanwhile, field trials have shown that the nucleopolyhedrosis virus has effected excellent protection of tree foliage from the gypsy moth and has significantly reduced populations of this forest pest.

When Does Drought Start to Affect Tree Growth?

When does drought start to affect trees? One way to study this is to look at stomata, the tiny pores in leaves through which trees take in carbon dioxide and transpire water vapor. Normally, stomata are wide open during the day; but if the soil gets dry enough, they close part way to keep the tree from drying out.

Scientists at our Hubbard Brook Experimental Forest in New Hampshire caused artificial drought by covering the soil around several trees with polyethylene. Then they watched for the stomata to close; meanwhile they monitored water in both the soil and the trees. This study, which has since been verified on other sites in natural droughts, showed that stomatal closure occurred when the soil-water deficit reached about 3 inches. That means it would take 3 inches of rain to rewet the soil. Transpiration is about 1 inch a week in summer; so, if the soil is initially wet, stomatal closure, and thus reduction in growth, will occur after 3 weeks without rain *(Federer and Gee 1976)*.

A New Way to Make High-Grade Furniture Stock from Low-Grade Logs

One problem of timber utilization in the Appalachian Region is the large volume of low-grade trees. Grade-3 and pole-size hardwood logs have a low stumpage value because sawmillers cannot use them profitably to make high-quality standard lumber. Researchers at Princeton, W. Va., have developed a new way to make high-quality furniture dimension stock from this low-quality timber. They call this method "System 6".

In System 6, the tree stems are bucked into 6-foot-long bolts, which are then sawed into 1-inch boards in sawmills originally designed to make pallet parts. Dried in forced-air dryers and then kiln-dried, the boards are graded and sold according to modified hardwood grade rules. The kiln-dried 6-foot boards are converted into furniture cuttings in newly designed rough mills. System 6 has been used successfully to make interior furniture parts from yellow-poplar and drawer sides from red oak *(Reynolds and Schroeder 1977).*

Skyline Logging Tests Continue

Evaluation of skyline cable logging of Appalachian hardwoods in mountain terrain continued with field study of a small fixed skyline at the Fernow Experimental Forest in West Virginia and analysis of similar cable systems in other areas of Appalachia. This field trial was conducted to find answers to economic, operational, and environmental questions about this type of logging.

Forces in skyline cables were analyzed, and labor mixes were tried to determine optimum crew size and deployment. This included a prerigging experiment and changes of labor mixes for felling, bucking, and choker-setting. Along with watershed and timber-management research units, our engineers studied this skyline system in both clear and selection cuttings, working both downhill and uphill. The system was also tested under mid-slope and ridge-top road conditions to determine effect of landing availability and to test equipment mobility.

Battle Renewed Against Spruce Budworm

Our battle against the spruce budworm, which threatens our northeastern spruce-fir forests, is being waged on a number of fronts. Our scientists, at Orono, Maine, in conjunction with various cooperating agencies, including our Canadian neighbors, are investigating the effects of budworm defoliation on both growth and mortality of trees; various aspects of the predatory role of forest birds against the budworm; the efficacy of the fungus *Entomophthora* spp. in causing budworm mortality; the feasibility of automatic detection and counting of budworm egg masses by optical techniques; the adoption of the New Brunswick model of the budworm system to the Maine situation; and the effects of budworm defoliation on wildlife habitat.

Meanwhile our silvicultural research continues, with emphasis on even-aged systems. Thinning and fertilization studies are under way in young stands of red and black spruce, and fertilization as a cultural practice in plantations is being investigated. In one study we have found that strip clearcutting does not degrade soil properties on spruce-fir sites. The development of a growth model for 50-year-old red spruce is nearing completion, and we plan to expand this to other age classes.

How to Make a Wild Turkey Think You're Its Mother

A Station wildlife biologist at Morgantown, W. Va., discovered how to "imprint" turkey poults as they hatched. Imprinted turkeys adopt the researcher as "mother" and are unafraid of him, yet retain their wild natures. This research makes it possible to record the turkey's behavior in different woodland surroundings, and offers guidelines on how to manage lands efficiently to provide good turkey brood habitat without harming the forest's recreation, timber, and other values. The research findings are applicable throughout most of the eastern half of the United States.

Landowner, What's Your Timber Worth?

The owner of a small woodland—no matter how small it is—is important in meeting our Nation's needs for timber. Yet he is not apt to become a timber producer unless he becomes aware of the value of his timber and the income he might get by managing his forest land.

Economists at our laboratory at Delaware, Ohio, have developed a set of Stand Evaluation Tools (SETS, they call them) to help the landowner and forester estimate the value of timber stands. These tools have been published in a series of three papers that, singly or together, the landowner or forester can use as a basis for deciding whether or not to become a timber producer *(DeBald and Mendel 1976a and 1976b, Mendel et al. 1976).*

Plenty of Tree Reproduction, But Watch Out for Grapevines

Our timber-management researchers at Parsons, W. Va., summarizing the status of reproduction 12 years after a seed-tree harvest cutting in Appalachian hardwoods, found about 250 potential dominant-codominant crop trees on good sites (Site Index 70) and about 500 smaller trees on fair sites (SI 60). The most numerous species on excellent sites were sweet birch, sugar maple, yellow-poplar, and black cherry; on good sites sugar maple, sassafras, red oak, red maple, and yellow-poplar; and on fair sites red maple, red oak, chestnut oak, and sweet birch.

Our researchers concluded that there is more than adequate high-quality reproduction on all sites. However, grapevines are seriously hampering tree development on the better sites *(Smith et al. 1976).*

Harwood Tree Grades for Factory Lumber

Our work on hardwood tree grades has moved ahead with publication of board-foot lumber grade yields for 11 hardwood species: northern red oak, black oak, white oak, chestnut oak, sugar maple, red maple, yellow birch, paper birch, black cherry, yellow-poplar, and basswood. The lumber grade yields, when used with lumber prices, should prove useful for predicting the value of lumber that can be sawed from graded trees.

Ten field trials of the grades and yields were conducted on seven species. For groups of 50 trees, differences between predicted and actual lumber volume averaged about 5 percent, and differences between predicted and actual lumber value averaged about 6 percent. A procedure was developed that a sawmill operator can use to estimate product yields specific to his own processing conditions or to predict product yields for species other than the 11 included in the study *(Hanks 1976a, 1976b, 1976c).*

Juvenility, Aging, Growth, and Seed Production of Trees

A long juvenile growth phase with strong apical dominance and vigorous growth is a desirable trait in forest trees when wood production is emphasized. But when emphasis is on seed production, a short juvenile phase is desired because juvenility is generally incompatible with flowering and seed production. Further, the capability of long-suppressed trees to respond to release depends on retention of a potential for rejuvenescence by shoot meristems. If aging has progressed too far when release comes, there will be no vigorous growth response. Sometimes, though, the root-collar region may have long dormant and hidden buds that can be made to sprout into vigorous juvenile shoots long after the crown is already senescent. Better understanding of and eventual management control over juvenility and aging are necessary.

An analysis was made of the juvenility problem at our research unit at Beltsville, Md. Juvenility was found to be an integral part of the complex: aging, senescence, rejuvenescence, and control of flowering. The complex was resolved into a few discrete physiological questions around which working hypotheses were developed. Four new, or little used, research approaches were found that with modest refinement can be used to study the control of juvenility and aging in trees *(Romberger 1976).*

Viability of Weed Seeds Related to Forest Stand Age

The seeds of weed species that accumulate naturally in the humus of the forest floor have a major effect on plant succession after harvest cutting. In studies of northern hardwoods, our researchers at Durham, N. H., found that the number of viable seeds of raspberry and pin cherry—two of the major weed species in northern hardwood stands—drop off sharply as the age of the stand increases.

For example, the number of pin cherry seeds peaked at forest stand age 40 years with 1,000,000 viable seeds per hectare, dropped to a half-million seeds per hectare at age 90, and became negligible at age 180 years. Thus, because of intense weed competition, northern hardwoods clearcut at short rotations of 40 to 60 years may have a lower probability of regenerating successfully to commercially valuable pioneer species [such as paper birch] than stands clearcut nearer the normal rotation age of 100 to 120 years.

Get the Weight Off Your Rear Axle

Logging trucks used to carry Appalachian hardwoods are often overloaded on the rear axles. From a study of 543 loads carried by 14 trucks, researchers at our laboratory at Princeton, W. Va., found that 93 percent of the payload was carried on the rear axles. This poor weight distribution caused 58 percent of the loads to exceed the legal axle-limit weight even though only 2 percent of the loads exceeded the GVW (gross-vehicle-weight) limit.

Loggers could change the distribution of their load weights by placing all logs against the headboard. Such a loading practice would increase payloads and allow truckers to haul extra volume without overweight penalties.

Even so, maximum legal payloads could be increased by as much as 3 tons if truck-body designs were changed. By using study data on wheelbase length and axle-to-headboard distance, our researchers developed equations to show the mean load center of gravity and the percent payload weight on the rear axles. These values were translated to a graphic truck-design guide. By using this guide, loggers can choose a body and chassis style that will enable them to maximize payloads and minimize unit hauling costs *(Baumgras 1976)*.

An Effective Control for Spread of the Oak Wilt Disease

In studies conducted with the cooperation of the West Virginia Department of Agriculture Division of Plant Pest Control and Northeastern Area State and Private Forestry, cacodylic acid was pressure-injected into the xylem of trees infected by oak wilt to determine the effectiveness of this chemical in preventing development of oak bark beetles and fungus mats and the spread of the pathogen to healthy oaks. The treatment reduced the number of trees infested with oak bark beetles by 75 percent and the number producing fungus mats by 61 percent. During the last 2 years of the study the number of diseased trees was reduced by 48 percent, and the number of active infection centers was reduced by 38 percent. However, researchers at Delaware, Ohio, point out that care should be exercised in urban areas when injecting diseased trees in the vicinity of healthy ones because the chemical can be transmitted through root grafts to damage adjacent healthy trees.

Studies of Pheromone Continued in War against Dutch Elm Disease

A synthetic pheromone is being tested against the elm bark beetle, vector of the Dutch elm disease. The synthetic pheromone was developed through identification of the natural sex lure emitted by female beetles.

Studies were continued in Evanston, Ill., and Ft. Collins, Colo., to develop strategies for using pheromone-baited traps to reduce beetle populations. These studies were designed to determine if the placement of traps in a barrier around an area to be protected will (1) lure beetles out of the area, or (2) intercept beetles coming into the area.

In Evanston, it was clear that barrier trapping did manipulate the beetle population. Mean catches at traps inside the barrier clearly decreased from 1975 to 1976, while catches at locations outside the barrier almost doubled, indicating a reduction in the beetle population within the barrier. Despite this apparent reduction of the beetle population, incidence of Dutch elm disease did not decrease in Evanston in 1976.

At Ft. Collins, barrier traps are having an impact in reducing beetle populations in the core area. However, there is no evidence yet that intensive trapping in 1975 and 1976 has had any effect in reducing levels of Dutch elm disease.

Sanitation and Injections for Controlling Dutch Elm Disease

Sanitation methods for preventing spread of Dutch elm disease are the subject of a 3-year study in Detroit, Mich. Four methods have been evaluated: (1) girdle the tree and remove it within 20 days of disease detection; (2) remove the tree promptly without girdling; (3) use insecticide spray on tree at first sign of disease and remove the tree; and (4) remove the tree without insecticide spraying. Our studies showed that plots where the trees were girdled had a lower mean disease rate than plots where trees were not girdled.

In Washington, D.C., elms showing symptoms of Dutch elm disease were injected with Lignasan®, and diseased branches were pruned off. By the second year of the study, of 30 trees treated, 9 had to be removed (one because of storm damage). Of the 21 remaining trees, 11 were re-injected because of recurring symptoms; the other 10 elms injected in 1975 had no Dutch elm disease symptoms in 1976.

Using Everything But the Rustle of the Leaves

Researchers at our laboratory at Princeton, W. Va., have experimented with what they call a "near complete" harvesting of timber, in comparison with traditional single-product and multiple-product logging.

Whole-tree chippers were used to increase the harvest of wood by using nearly all parts of small trees and the tops and limbs of trees cut for sawtimber. The per-acre recovery of wood fiber from a 60-year-old stand of cove hardwoods was 55 tons of sawlogs, 4 tons of pulpwood, and 63 tons of chips. This total yield was 104 percent more than if only sawlogs had been taken; 71 percent more than if pulpwood had also been taken from poletimber trees; and 27 percent more than if everything larger than 4 inches in diameter had been taken for pulpwood.

Who Gets the Timber - the Landowner or the Bugs?

The timber owner may have to compete with insects to see who gets the value out of the timber; so our economists at Delaware, Ohio, studied the economic impact of losses due to insect damage. They found that defoliators striking an oak stand early in its life may produce a thinning effect, resulting in little or no impact; but when their attacks are concentrated late in the life of an oak stand, the owner has little opportunity to recover a serious financial loss.

The economic effect of insects that affect seeds and seedlings is to delay the development of the new stand up to 5 years. Landowners with short custodial tenure are unlikely to notice the loss, but public or industrial owners or individuals with long tenure may expect an economic loss amounting to 5 to 13 percent. Insects that affect timber quality—like wood borers—reduce timber values by as much as 40 percent of the harvest value. They are our most damaging type of insect. Timber-value losses due to the other sorts of insects are less than half those due to oak borers *(Donley and Worley 1976)*.

Key Indicators of Successful Logging

What makes for a successful logging job? We're now in a better position to answer that question, thanks to a recent study by one of our economists. Characteristics of logging operations in 14 Northeastern States have been analyzed. Among 22 characteristics studied, total timber harvest, hauling distance, crew size, and distance from the preceeding job were key determinants of the most successful jobs *(Herrick 1976a)*.

PUBLICATIONS

in 1976 by staff members and cooperators of the Northeastern Forest Experiment Station, Forest Service, U.S. Department of Agriculture

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

*Adams, Edward L.

1976. **The adjusting factor method for weight-scaling truckloads of mixed hardwood sawlogs.** USDA For. Serv. Res. Pap. NE-344. 7 p., illus.

A new method of weight-scaling truckloads of mixed hardwood sawlogs systematically adjusts for trends that affect the weight/volume ratio of logs coming into a sawmill. A conversion factor is based on the running average of weight/volume ratios of randomly selected sample loads. To test the method, 500 truckloads of logs were weight-scaled. The results of this test indicated that the weight-scaled volume should average within 3.5 percent of the actual volume.

*Anderson, R. Bruce.

1976. **Factors influencing selection of office furniture by corporations and universities.** USDA For. Serv. Res. Pap. NE-343. 5 p.

Evaluation of the factors that influence the selection of office furniture by large corporations and universities shows that quality, appearance, and purchase price have the most important influence on the purchase decision. The intended use of the furniture and the appearance of the furniture were the key factors in the purchase of wooden furniture.

Andresen, John W.

1976. **Selection of trees for endurance of high temperatures and artificial lights in urban areas.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 67-75.

In urban areas, high temperature and artificial light may adversely affect the growth and survival of trees already under various forms of stress. Trees close to radiative surfaces such as pavements, walls, and heat vents are especially susceptible to heat damage. However, harmful effects upon urban-grown trees by prolonged illumination are yet to be experimentally determined. Specific selection or breeding programs to identify species or cultivars with resistance to thermal and light pollution are not economically warranted. However, some research on heat resistance could be combined with drought studies, and light influences could be included in studies of low-temperature effects on trees.

Araman, Philip A.

1975. **Program SIRSP—An inventory control simulation program for the STUB (Short Temporarily Upgraded Boards) rough mill concept.** M.S. thesis. Va. Polytech. Inst. and State Univ., Blacksburg. 146 p.

A computer program was developed to simulate the operation of a furniture-plant rough mill that uses the STUB rough-mill concept. In a STUB rough mill, short upgraded boards are produced from low-grade lumber and then the short boards are converted into parts. Required

input data include short-board clearcuttings (CIF) and a list of required furniture parts (cutting order). Resulting parts yields and other data are provided by the program.

*Aubertin, Gerald M., Benjamin C. Thorner, and John Campbell.

1976. **A precipitation collector and automated pH-monitoring system.** USDA For. Serv. Res. Note NE-220. 8 p., illus.

A sensitive precipitation collector and automated pH-monitoring system are described. This system provides for continuous monitoring and recording of the pH of precipitation. Discrete or composite rainwater samples are manually obtainable for chemical analyses. The system can easily be adapted to accommodate a flow-through specific conductance probe and monitoring components.

*Auchmoody, L. R.

1976. **Accuracy of band dendrometers.** USDA For. Serv. Res. Note NE-221. 4 p., illus.

A study to determine the reliability of first-year growth measurements obtained from aluminum band dendrometers showed that growth was underestimated for black cherry trees growing less than 0.5 inch in diameter or accumulating less than 0.08 square foot of basal area. Prediction equations to correct for these errors are given.

*Barger, Jack H.

1976. **Dutch elm disease and methoxychlor.** USDA For. Serv. Res. Pap. NE-353. 5 p., illus.

Elm trees were sprayed with methoxychlor, some by helicopter and others by mist blower. Bioassays showed that methoxychlor residues persisted and accumulated. There was no difference in disease incidence between treatment techniques, but it was dramatically lower for the treated trees than for untreated controls. The difference persisted for several years after the last treatment.

Barnard, Joseph E.

1975. **Sampling with partial replacement contrasted with complete remeasurement inventory designs: an empirical examination.** Symp. Monitoring For. Environ. through Successive Sampling Proc.: 384-390. Syracuse, N.Y.

The sampling with partial replacement (SPR) and complete remeasurement inventory designs were compared for efficiency, using data from the forest inventories of Delaware and Rhode Island. Results shows SPR to be more than twice as efficient for volume estimates and up to 8.9 times as efficient for area estimators.

*Baumgras, John E.

1976. **Better load-weight distribution is needed for tandem-axle logging trucks.** USDA For. Serv. Res. Pap. NE-342. 9 p., 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.

*Berry, Frederick H.

1976. ***Phlebia chrysocrea* causes a heart rot of oaks and other hardwoods.** Plant Dis. Rep. 60: 308-311, illus.

A heart-rot fungus, recently identified as *Phlebia chrysocrea,* is one of the most important decay fungi of oak in the central hardwood region. It has also been isolated from sassafras, black cherry, and hardwood slash. The fungus gains entry through various kinds of wounds, dead branches, and parent stumps; and it causes a white pocket or white mottled rot of the heartwood.

Blum, Barton M.

1976. **Symposium on the Intensive Culture of Northern Forest Types, held in Orono, Maine.** North. Logger 25(6): 12-13.

A summary report of the symposium held at Orono, Maine, to address three questions: (1) what are the current needs for intensive forest management to increase wood yields?; (2) what methods and technologies are now available?; and (3) how do we plan for and implement intensive forest culture?

*Blyth, James E., and James T. Bones.

1976. **Pulpwood production in the Northeast and North Central States in 1975.** North. Logger 25(5): 8.

Pulpwood production between 1974 and 1975 decreased 22 percent in the 21-state area. Massachusetts showed the only production in-

crease, which was due to a 59-percent increase in chips from manufacturing residues. These statistics and others resulted from a complete canvass of eastern woodpulp mills conducted annually by the Forest Service Experiment Stations. The article contains 1975 pulpwood production statistics by states and sources of pulpwood, and the number of mills that were operating.

*Bones, James T.
1976. **Potential sources of wood fiber in the Northeast.** For. Prod. J. 26(2): 30-32.
Industry is constantly searching for additional inexpensive sources of wood fiber. As the technology of harvesting, transporting, and converting timber products advances, new sources of raw material become economically available. Potential sources of wood fiber in the Northeast were ranked by their potential for adding to the region's industrial wood supply. Three of the most promising sources are the existing timber supply, the logging residues left in the woods, and the timber removed in land-clearing.

*Bones, James T., and David R. Dickson.
1976a. **Pulpwood production in the Northeast—1974.** USDA For. Serv. Resour. Bull. NE-42. 22 p., illus.
An annual report based upon canvasses of pulpwood production in the Northeast, containing data about pulpwood production from roundwood in the 14 Northeastern States by counties and species groups, and pulpwood chip production from plant residues. Comparisons are made with the previous year's production data. Trends in pulpwood production for the past 12 years are shown. Also included is a list of the woodpulp mills that were operating in the region in 1974.

*Bones, James T., and David R. Dickson.
1976b. **Pulpwood production in the Northeast—1975.** USDA For. Serv. Resour. Bull. NE-45. 21 p., illus.
An annual report based upon canvasses of pulpwood production in the Northeast, containing data about pulpwood production from roundwood in the 14 Northeastern States by counties and species groups, and pulpwood chip production from plant residues. Comparisons are made with the previous year's production data. Trends in pulpwood production for the past 13 years are shown. Also included is a list of the woodpulp mills that were operating in the region in 1975.

*Bones, James T., and Robert B. Redett.
1976. **The timber industries of Ohio.** USDA For. Serv. Resour. Bull. NE-40. 26 p., illus.
The results of a complete survey of the timber industries in Ohio, including statistics about industrial roundwood production and receipts, and production and disposition of the manufacturing residues that result. Comparisons are made with the most recent previous surveys, and trends in industrial wood output are noted.

Brush, Robert O.
1974. **Recent developments in landscape assessment research with implications for managing forest land for recreation.** *In* Outdoor recreation research: applying the results. USDA For. Serv. Gen. Tech. Rep. NC-9: 83-86.
Several recent studies in psychophysics, forest esthetics, and landscape assessment are reviewed which suggest that forest vegetation can be managed as a visual resource. On flat and undulating land, as found along the Great Lakes and Atlantic Seaboard, the visual interest in the landscape depends largely upon the distribution of open and forested land. Patterns of open and forest land are considered that would enhance the visual interest and spatial variety on flat forested land for those recreational activities involving movement through the landscape.

Brush, Robert O.
1976a. **Perceived quality of scenic and recreational environments: Some methodological issues.** *In* Perceiving environmental quality: research and applications: 47-58. Plenum Press, New York.
Can indices be developed to measure the quality of environment that are based on the perceptions of people who experience them? This chapter reviews what is currently known about how people perceive and evaluate scenery and recreational environments and considers some of the problems regarding the methods used to obtain perceptual responses to scenic and recreational environments.

Brush, Robert O.
1976b. **Wildlife research needed by landscape architects.** North. Am. Wildl. and Nat. Resour. Conf. Trans. 41: 561-563.

Aspects of the practices of landscape architecture relevant to wildlife research and wildlife management are described in the context of metropolitan environments. Three problem areas are noted where wildlife research is needed to provide information useful to landscape architects: to identify patterns of open space in urban areas that might benefit wildlife; to describe the form and structure of vegetative edge; and to develop guidelines for managing urban open space for wildlife.

*Brush, Robert O.

1976c. **Spaces within the woods: managing forests for visual enjoyment.** J. For. 74: 744-747, illus.

Forests near urban centers are often valued as visual resources. Recreational experiences involving movement through the woods can be enhanced by spaces created through conventional silvicultural practices.

Brush, Robert O., and Thomas A. More.

1976. **Some psychological and social aspects of trees in the city.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 25-29.

Recent studies in environmental perception indicate that the meaning and function of forest vegetation in the city may not be the same for urban residents as it is for rural and suburban residents. These studies suggest advantages for collaboration between behavioral scientists and forest geneticists in planning future research. Several possible psychological and social benefits of urban trees are discussed. Further behavioral studies may indicate desired attributes of trees bred especially for inner-city environments.

*Campbell, Robert W.

1976a. **The bimodality of gypsy moth, *Porthetria dispar* (L.) (Lepidoptera: Lymantriidae) populations.** J. N.Y. Entomol. Soc. 83: 287-288.

North American gypsy moth populations have two numerical phases. They may either remain innocuous for many years, or outbreaks may persist for as much as a decade. Changes from innocuous to outbreak and vice versa, however, are usually abrupt. Conclusions about the major determinants of this bimodality are based on a procedure developed to determine at what points, during a generation, the numerical differences appear between a sparse population in an outbreak area and one in an innocuous one.

*Campbell, Robert W.

1976b. **Comparative analysis of numerically stable and violently fluctuating gypsy moth populations.** Environ. Entomol. 5: 1218-1224, illus.

Sparse gypsy moth populations studied in the vicinity of Glenville, N.Y., between 1958 and 1964 tended to increase rapidly to outbreak levels. Equally sparse populations studied in the vicinity of Eastford, Conn., between 1965 and 1971 tended to remain sparse. Study results imply that predators played a major role in maintaining the Eastford populations at innocuous levels.

Campbell, Robert W.

1975. **The role of trial and error in developing an integrated pest population management system.** Symp. Monitoring For. Environ. through Successive Sampling Proc.: 316-320.

A discussion of biological control of forest insects and an approach toward a management system for effecting biological control.

*Campbell, Robert W., Marilyn G. Miller, Edward J. Duda, Cynthia E. Biazak, and Ronald J. Sloan.

1976. **Man's activities and subsequent gypsy moth egg-mass density along the forest edge.** Environ. Entomol. 5: 273-276.

When gypsy moth egg-mass density was low (less than 50 egg masses/acre), density was 10 times higher along the forest edge than within the forest. Man-made objects along the forest edge in suburban areas contained half of the egg masses found at low densities. Objects that were rough, dry, or protected from light contained more egg masses than those that were smooth, moist, or exposed to light. Rough, dry objects that were protected from light contained the most egg masses. These bark flaps provide a degree of protection for the growing larvae and pupae.

*Campbell, Robert W., and Ronald J. Sloan.

1976. **Influence of behavioral evolution on**

gypsy moth pupal survival in sparse populations. Environ. Entomol. 5: 1211-1217.

It is postulated that the insect exhibits behavior that enables it to evade natural enemies in Europe, but in North America this same trait often assures both death and the destruction of many of the parasites that may have given rise to this trait. It is also postulated that a new behavioral adaptation may be evolving by this pest in response to new conditions in North America.

*Cannon, William N., Jr., and David P. Worley.
1976. **Dutch elm disease control: performance and costs.** USDA For. Serv. Res. Pap. NE-345. 7 p., illus.

Municipal programs to suppress dutch elm disease have had highly variable results. Performance as measured by tree mortality was unrelated to control strategies. Costs for control programs were 37 to 76 percent less than costs without control programs in the 15-year timespan of the study. Only those municipalities that conducted a high-performance program could be expected to retain 75 percent of their elms for more than 20 to 25 years.

*Carl, Clayton M., Jr.
1976. **Effect of separation in n-pentane on storability of sugar maple seeds.** USDA For. Serv. Res. Note NE-218. 3 p.

Seeds in samaras separated in n-pentane have been stored successfully for 5-1/2 years. The seeds in the separated samaras germinated equally as well as the unseparated controls, indicating that there was no detrimental effect from the n-pentane.

Carmean, Willard H., F. Bryan Clark, Robert D. Williams, and Peter R. Hannah.
1976. **Hardwoods planted in old fields favored by prior tree cover.** USDA For. Serv. Res. Pap. NC-134. 16 p., illus. North Cent. For. Exp. Stn.

Hardwoods were planted in a long-abandoned field. Growth was poor in a grassy area, better in areas formerly having had natural trees or planted pine, and outstanding in an area formerly having had planted black locust. Improved growth was associated with better soil structure and more foliar nitrogen.

Church, Thomas W., Jr.
1976. **Old crossties—a potential energy source for wood preserving plants.** Am. Wood-Preserv. Assoc. Proc. 1976: 87-97.

The author argues that old wooden crossties, costly for railroads to dispose of, could be used effectively as a source of fuel. Combustion tests showed that they can be burned satisfactorily in existing incinerator-boiler units for producing steam. Stack emissions met EPA standards.

Church, Thomas W., Jr., and John W. Pearce.
1976. **Weights of crossties removed from service.** Cross Ties 57(2): 25-31, illus.

American railroads remove about 20 million crossties annually. Traditional disposal methods have been eliminated because of environmental restrictions; so railroad officials must find new ways to get rid of old ties. A potential market is industrial boiler fuel. If this market develops, sales will be based on weight. Measurements from 800 tie blocks showed that the average crosstie removed from service weighed 189 pounds.

Collins, William H.
1976. **Nursery growing practices as related to selection and production of municipal trees.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 167-177, illus.

The commercial production and selection of trees for municipal plantings are traced from the early phase to the current propagation and cultural techniques that commercial nurseries are now using. Street-tree production is a long cycle, usually 3 to 5 years from the time 5- to 7-foot seedlings are spaced and planted in nursery rows. Clones provide municipal buyers with trees of known desirable characteristics and without the undesirable variability of seedlings. However, 6 to 15 years are needed to evaluate a clone, and many promising selections fail to meet acceptable standards for various reasons. Improved means of vegetative reproduction, especially "own-root" propagation, are needed to permit the more efficient production of desirable clones of various species.

Constantinidou, H., T.T. Kozlowski, and K. F. Jensen.
1976. **Effects of sulfur dioxide in *Pinus resinosa* seedlings in the cotyledon state.** J. Environ. Qual. 5: 141-144.

Cowling, E.B., and L. S. Dochinger.

1976. **The changing chemistry of precipitation and its effects on vegetation and materials.** (Abstr.) Am. Inst. Chem. Eng. 69th Mfg. Booklet Pap. 118e: 176.

Human activities have increased total emissions of strong acids into the atmosphere and subsequent deposition upon the terrestrial and aquatic surfaces of the earth. Atmospheric acidity exerts a decisive effect on growth and development of plants, reproductive capacity of fish, and stability of stone and metal structures. Long-term monitoring programs are needed to measure potential changes in the chemistry of atmospheric precipitation and possible effects on vegetation and materials.

*Craft, E. Paul.

1976. **Utilizing hardwood logging residue: a case study in the Appalachians.** USDA For. Serv. Res. Note NE-230. 7 p., illus.

An Appalachian hardwood timber stand that contained 6,700 board feet per acre of sawtimber was harvested by clearcutting. After the merchantable sawlogs were removed, this stand contained 69.3 tons per acre of green wood residue. Thirty-three and one-third tons of residue were from tops of merchantable sawtimber; 36 tons were from residual trees. Treetop residue yielded 1,800 board feet of marketable sawed products and 26 tons of chippable wood. The residual trees yielded 3,000 board feet of sawed products and 25.6 tons of chippable wood. The overall weight of residue was about 1.8 times greater than the weight of sawtimber removed.

*Crawford, Hewlette S.

1976. **Relationships between forest cutting and understory vegetation: an overview of eastern hardwood stands.** USDA For. Serv. Res. Pap. NE-349. 9 p.

Production of understory vegetation was related to stand type, stand structure, disturbance, and site for Ozark oak-hickory and Appalachian oak-pine stands. Cutting the stand increased the amount of understory vegetation, but the increase was regulated by site quality, stand type, and stand structure. It seems that understory variety and production in managed even-age stands will not differ much from that in natural stands.

*Crawford, Hewlette S., R. G. Hooper, and R. F. Harlow.

1976. **Woody plants selected by beavers in the Appalachian Ridge and Valley Province.** USDA For. Serv. Res. Pap. NE-346. 6 p., illus.

The availability of woody plants and the selection of plants by beavers along mountain streams was studied in four areas of the Appalachian Ridge and Valley Province in Virginia. Beavers' choice of woody plants varied between areas. The topography and abundance of many species of woody plants provide suitable beaver habitat in which the plant and animal variety created by beaver impoundments would add to the esthetic and recreational values of these mountain areas.

Creech, John L.

1976. **Some approaches to collecting ornamental trees and shrubs.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 221-226.

The author discusses some of the potential benefits from collecting seed of trees and shrubs from their native habitats, and the role of arboreta in providing seed material to plant breeders as well as maintaining genetic resources. Some observations on methods of field work.

*Czapowskyj, Miroslaw M.

1976. **Annotated bibliography on the ecology and reclamation of drastically disturbed areas.** USDA Forest Serv. Gen. Tech. Rep. NE-21. 98 p.

This bibliography contains 591 annotated references to literature, mainly on mining effects and reclamation in the coal regions of the United States. Each reference is indexed by area, material (coal, ore waste, etc.), and general subject.

Also available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 001-001-00415-4. Cost is $1.65.

Czapowskyj, M. M., R. R. M. Frank, and R. V. Rourke.

1976. **Strip clearcutting does not degrade soil properties in spruce-fir forests in Maine.** Agron. Abstr. 1976: 183.

Changes in nutrient concentration in the forest floor and in the mineral soil were studied on spruce-fir sites in central Maine in relation to harvesting and slash-disposal methods. Eight years after harvesting, the clearcut areas showed increased pH and increased concentrations of bases and base saturation, but amounts of N and P were comparable to those in the residual forest. Soil-drainage class was the major source of variation. There was no evidence of site degradation from strip-clearcutting.

*Czapowskyj, Miroslaw M., and Edward A. Sowa.

1976. **Lime helps establish crownvetch on coal-breaker refuse.** USDA For. Serv. Res. Pap. NE-348. 6 p.

Lime, fertilizer, and mulch were tried on anthracite coal-breaker refuse in attempts to establish a ground cover of crownvetch. Lime had an effect after 7 years and is considered essential for establishing crownvetch on these highly acid sites. Fertilizer had little effect on survival but enhanced establishment of ground cover. Mulch also provided some benefit. Chemical characteristics of the refuse were improved on areas that received lime and fertilizer treatments.

Daft, M.J., and E. Hacskaylo.

1976. **Arbuscular mycorrhizas in the anthracite and bituminous coal wastes of Pennsylvania.** J. Appl. Ecol. 13: 523-531.

Laboratory studies on the basic physiology of ectomycorrhizal fungi indicated that closely related species can be differentiated from each other by chromatographic analyses of fatty acids. One fatty acid not previously reported in fungi was identified by spectroscopy.

Davis, Donald D., and Henry D. Gerhold.

1976. **Selection of trees for tolerance of air pollutants.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 61-66.

The bases for ranking tree species in susceptible, intermediately susceptible, and tolerant to sulfur dioxide and to ozone are given. While these lists must be used with caution, they do indicate appreciable differences among woody plants in susceptibility. Nurserymen and arborists can use such lists in producing and selecting trees for specific environments. Plant breeders should capitalize on the differences in susceptibility in creating or selecting hybrids and cultivars that are sufficiently tolerant to different sets of environments.

*DeBald, Paul S., and Joseph J. Mendel.

1976a. **An individual-tree approach to making stand evaluations. SETs: Stand Evaluation Tools. 1.** USDA For. Serv. Res. Pap. NE-336. 13 P.

The authors outline a stand-evaluation method that stresses individuality by (1) making on-the-ground projections of individual tree development; (2) summarizing stand values in terms of the individual trees in the stand and their potential development; and (3) tailoring several management possibilities to an individual stand so the owner can choose among them.

*DeBald, Paul S., and Joseph J. Mendel.

1976b. **Composite volume and value tables for hardwood pulpwood. SETs: Stand Evaluation Tools. 3.** USDA For. Serv. Res. Pap. NE-338. 43 p.

Presents 38 composite volume and value tables for hardwood pulpwood, with examples of how they can be applied to individual standing trees or to the pulpwood portions of sawtimber trees.

DeGraaf, Richard M.

1975. **Wildlife considerations in metropolitan environments.** *In* Forestry issues in urban America. Soc. Am. For. Proc. 1974: 97-102. Washington, D.C.

Research needs for creating and managing natural areas in metropolitan environments are presented. Urban foresters and wildlife managers should increase their knowledge of habitat requirements of wildlife species in cities, and management agencies should contribute their resources in establishing natural areas in urban centers. The possibility of creating open green spaces as part of urban renewal programs should be explored; scattered parcels of derelict land could be acquired and managed as "vestpocket" parks and wildlife habitats.

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

1975. **Economic values of non-game birds and some urban wildlife research needs.** North Am. Wildl. and Nat. Resour. Conf. Trans. 40: 281-287.

How much do Americans spend nationally to enjoy songbirds? In 1974, $170 million was spent for birdseed, $15 million for birdhouses and feeders, $7 million for books about birds, $115 million for camera equipment and film. The total amount spent was about $500 million in 1974. This compares well with $300 million spent in the same year by waterfowl hunters for equipment needed to enjoy hunting.

Demeritt, Maurice E., Jr., and Harry C. Kettlewood.

1976. **Eastern white pine seed source variation in the Northeastern United States: 16-year results.** Proc. 12th Lake States For. Tree Improv. Conf. USDA Gen. Tech. Rep. NC-26: 80-87.

After 16 growing seasons, heights and diameters in 12 eastern white pine seed-source plantations throughout the Northeast indicate that the most southern sources (Georgia and Tennessee) will outproduce local seed sources when planted as far north as central Pennsylvania. Nursery stock for plantings farther north should come from seed sources in a more central collection zone. Within the broad collection zones recommended, certain localized areas should be avoided because of poor performance throughout the range of this species.

*Dickson, David R., and Teresa M. Bowers.

1976. **Forest statistics for Connecticut.** USDA For. Serv. Resour. Bull. NE-44. 40 p.

A report on the second inventory of the forest resources of Connecticut, including trends of change in commercial forest-land acreage, volume of growing stock, and sawtimber volume. The report contains 32 tables of statistical data on forest land; timber volume; annual growth, removals, and mortality; and output of timber products.

Dirr, Michael A.

1976. **Salts and woody-plant interactions in the urban environment.** *In* Better Trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 103-111.

The extensive use of de-icing salts in urban environments has resulted in significant plant pollution. Plants growing along highways, on lawns, and along sidewalks exhibit stem dieback, and many are killed. The salts are deposited as spray on buds, stems, and leaves or are accumulated in the root zone. Subsequent injury results from osmotic and specific ion effects. Several woody plants exhibit resistance to abnormal salt levels. Systematic breeding and selection for salt-tolerant plants are recommended.

Dochinger, L.S.

1976a. **Acid rain leaching and other aspects of acid precipitation.** *In* Air pollution and metropolitan woody vegetation, p. 25-26. USDA For. Serv. Pinchot Inst. Environ. For. Stud.

Transfer of acid precipitation over interstate boundaries poses serious problems to the megalopolitan regions of the Northeast. Increased consumption of fossil fuels may cause imbalances in the ecological stability of the urban environment, especially its regenerative abilities and its provision of natural resources and human benefits.

Dochinger, L.S.

1976b. **Cultural. [Approaches for reducing air-pollution damage.]** *In* Air pollution and metropolitan woody vegetation, p. 43-45. USDA For. Serv. Pinchot Inst. Environ. For. Stud.

Urban America, a depository for approximately 60 percent of the contamination released into the atmosphere, will continue to experience low-level pollution in the years ahead. Long-term solutions will involve conditioning factors to influence aerial movement of pollutants in urban situations and the development of pollution-tolerant cultivars. In the interim, chemical protectants and cultural practices should be evaluated for curtailing air-pollution injury to woody plants.

Dochinger, Leon S.

1975. **Marssonina leaf blight of bigtooth aspen. *Marssonina populi* (Lib.) Magn. *Drepanopeziza populorum* (Desm.) v. Hohnel.** U.S. Dep. Agric., Agric. Handb. 470: 95-98, illus.

Brief discussion of symptomatology, life cycle, and control measures of Marssonina leaf blight of bigtooth aspen.

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

1975. **Air pollution.** *In* Forest nursery dis-

eases in the United States. U.S. Dept. Agric., Agric. Handb. 470: 107-113, illus.

Symptomatology of ozone, fluorides, and sulfur dioxide pollutants on forest conifer and hardwood seedlings are described.

Dochinger, L. S., and T. A. Seliga [Ed.]
1976a. **Proceedings of the first international symposium on acid precipitation and the forest ecosystem.** USDA For. Serv. Gen. Tech. Rep. NE-23. 1,074 p., illus.

The increasing acidity of precipitation in northwestern Europe, the northeastern United States, and eastern Canada, caused by emissions of sulfur and other acid-forming compounds into the air, has had serious effects; and scientists are concerned about subtle long-term changes not yet understood. About 300 scientists from 12 countries attended a symposium at Columbus, Ohio, on 12 to 15 May 1975, to consider what is known about atmospheric chemistry, transport, and precipitation, and the effects of acid precipitation on aquatic ecosystems, forest soils, and forest vegetation.

Available from U.S. Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, Va. 22161. Accession No. PB-258645/AS. Paper copy cost is $28.25 and microfiche cost is $3.00.

*Dochinger, Leon S., and Thomas A. Seliga.
1976b. **Workshop report on acid precipitation and the forest ecosystem.** USDA For. Serv. Gen. Tech. Rep NE-26. 18 p., illus.

A report on the workshop held after the First International Symposium on Acid Precipitation and the Forest Ecosystem, held in May 1975 at Ohio State University, Columbus, Ohio. Contains recommendations for research and lists of panel participants.

Available from U.S. Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, Va. 22161. Accession No. PB-261813/AS. Paper copy cost is $3.50 and microfiche cost is $3.00.

*Dochinger, Leon S., and Thomas A. Seliga.
1976c. **Acid precipitation and the forest ecosystem.** BioScience 26: 564-565.

The First International Symposium on Acid Precipitation and the Forest Ecosystem provided the first world forum devoted to consideration of acid precipitation problems on biological systems. This report reflects the biological influences observed, urges strong need to evaluate ecological and possible economic consequences from changes in acidity, and recommends establishment of a sampling network to monitor air chemistry and precipitation in North America.

Dochinger, L. S., and W. H. Smith.
1976. **Gases.** *In* Air pollution and metropolitan woody vegetation, p. 51-52. USDA For. Serv. Pinchot Inst. Environ. For. Stud.

The inherent potentials for woody plants to perform as biological sinks remain to be demonstrated quantitatively. Circumstantial evidence suggests that uptake does occur, but research is necessary to substantiate the ability of trees to significantly reduce gaseous contaminants in the atmosphere. A research program designed to assess the role of trees as sinks for gaseous pollutants is proposed.

Dolby, A. J.
1975. **The disposal of discarded railroad wood crossties—a study of alternatives.** Assoc. Am. Rail. Res. and Test. Dep. 38 p., illus. Washington, D.C.

A feasibility study of old crosstie disposal revealed that chips for pulp or particle board were impractical from mechanical and chemical standpoints. Shredding on the right-of-way and disposal in landfills were expensive and wasteful. Resale of full-length ties as landscape structures provided the highest dollar return per unit, but market demand was not established. Use as industrial fuel showed a net income when compared to oil and provided an outlet for all crossties removed.

*Donley, David E., and David P. Worley.
1976. **Insect impact on production of oak timber.** South. Lumberman 233(2896): 63-66, illus.

Oak borers are the most damaging type of insects, followed in importance by seed destroyers and defoliators. Borers cause a loss equivalent to 40 percent of the 120-year value of oaks. The impact of seed destroyers and defoliators amounts to 15 to 20 percent of the 120-year value. The 40- to 60-percent potential value increases that are possible through the control of oak insect pests ranks with estimates of potential gains in productivity through genetic improvement or first-order timber management.

*Donnelly, John R.

1976. **Carbohydrate levels in current-year shoots of sugar maple.** USDA For. Serv. Res. Pap. NE-347. 6 p., illus.

In leaves, alcohol-soluble sugar concentration was highest in the morning and lowest in late afternoon or early evening; diurnal changes in starch lagged about 5 hours behind changes in sugar. Carbohydrate concentrations in current-year stems did not vary diurnally. In leaves, sugar concentration was higher in September than it had been in June; starch concentration was much higher in June. The opposite was true for current-year stems.

Doshi, Yobesh K.

1976. **Design of a digitally controlled environmental chamber for air pollution effects studies on plants.** Atmos. Sci. Program Rep. EES - 511x - 1. 61 p.

A design of a digitally controlled environmental chamber for controlling atmospheric parameters of temperature, relative humidity, and concentrations of pollutants was developed. It includes a selection of instruments, an interface circuit design for the computer, a methodology for the determination and evaluation of critical constants used in a proportional, integral, and derivative (PID) control algorithm (selected as the process-control technique), and a basic programming procedure for operating the system.

Drnevich, V. P., R. J. Ebelhar, and G. P. Williams.

1976. **Geotechnical properties of some eastern Kentucky surface mine spoils.** Ohio River Valley Soils Seminar Proc.: 1-1/1-13. Lexington, Ky.

Mine spoils having index properties similar to those of soils commonly used for highway fills in Kentucky showed permeabilities four orders of magnitude lower than did the soils. Shear-strength parameters in terms of effective stress and total stress indicated that spoils have more shear strength in the short term but less shear strength in the long term than do soils of similar index properties.

Drnevich, V.P., G.P. Williams, and R.J. Ebelhar.

1976. **Soil mechanics tests on coal mine spoils.** 2nd Kentucky Coal Refuse Disposal and Utilization Seminar Proc.: 47-59. Pine Mountain State Resort Park, Pineville, Ky.

Several conventional soil-mechanics tests are reliable for describing shear strength and permeability of mine spoils. Test data on spoil exhibited trends similar in direction but different in degree from those obtained for soils. Spoils have higher short-term shear strengths, but lower long-term strengths. Permeabilities of spoil materials are lower than those of a similarly graded good highway soil.

*Dubois, Normand R.

1976. **Effectiveness of chemically decontaminated *Neodiprion sertifer* polyhedral inclusion body suspensions.** J. Econ. Entomol. 69: 93-95.

Sodium omadine (sodium salt of 1-hydroxypyridine-2-thione) was used to eliminte bacterial contaminats from *Neodiprion sertifer* (Geoffroy) polyhedral inclusion body (PIB) suspensions. Neither the treatment nor the elimination of the contaminants reduced the effectiveness of the PIB suspensions. At high concentrations, Sodium Omadine alone was lethal to the larvae; at lower concentrations, it caused significantly higher virus mortality than was observed in the controls (10.3%).

Dudley, Theodore R.

1976. **How to name, register, and patent selected cultivars of amenity plants.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 235-243.

A consideration of the historical development of the concept and term "cultivar" precedes a discussion of some aspects of the choice and validation of new cultivar names, methods for the documentation of these names, and a brief survey of plant patents and trademarks. The registration of all cultivar names, through national or international registration authorities, is strongly recommended.

Echelberger, Herbert E.

1976. **Impacts of logging.** Part 3 - public relations. North. Logger 25 (2): 9.

Eight groups of viewers, ranging in composition from a hikers' organization to a group of future foresters and in size from 6 to 38 persons, inspected three areas on which different cutting practices had been used—individual tree selec-

tion, patch clearcutting, and strip clearcutting. Data obtained were analyzed for public reactions to the different kinds of cutting.

Egolf, Donald R.

1976. **The national arboretum introduction program for new and improved shrubs and trees.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 245-252, illus.

The U.S. National Arboretum introduction program is an integrated program that includes the evaluation of potential new cultivars and stock increase of those plants selected for introduction.

*Emanual, David M.

1976. **Hydromulch: A potential use for hardwood bark residue.** USDA For. Serv. Res. Note NE-226. 3 p., illus.

Hardwood bark fines and two hardwood bark fibers were compared with wood-cellulose fiber and paper fiber mulch to determine their effectiveness as hydromulch in revegetating disturbed soil. The results showed that either bark fines or bark fibers can be utilized as a hydromulch to aid in the revegetation of strip mines, highway construction sites, and similar earthmoving operations.

Federer, C. A.

1976a. **Stomatal resistance characteristics for broadleaved trees and shrubs.** (Abstr.) Am. Meteorol. Soc. Bull. 56: 109.

Stomatal resistance and xylem-water potential were measured in natural conditions for 30 species of trees and shrubs in New Hampshire. When neither water nor light limited opening, resistance depended little on size and averaged between 2.2 and 3.8 s/cm for all species except *Spiraea latifolia*, for which resistance averaged 6.2 s/cm. When soil dried to less than -0.8 bar, stomata were partially closed. Stomata of *Betula populifolia* and *Populus* species closed at -15 to -17 bar, while those of *Quercus* and *Prunus* species did not close until potential was less than -20 bar. For all species in which closure was found, the resistance-water potential curve was approximately right-angled.

*Federer, C. A.

1976b. **Differing diffusive resistance and leaf development may cause differing transpiration among hardwoods in spring.** For. Sci. 22: 359-364, illus.

Buds of several *Betula* and *Prunus* species and of *Populus tremuloides* broke before those of other species in spring, exposing green leaves having diffusive resistance as low as 5 s/cm. Leaves of *Acer saccharum* and *Fagus grandifolia* unfolded 10 days later and had resistances around 7 s/cm. *Quercus rubra* and *Q. coccinea* leaves developed still later, were initially chlorotic, and had resistances over 10 s/cm. This initially high resistance may help reduce transpiration in these species until the conducting system of the new annual ring is well developed. Resistance decreased during and after leaf expansion to 3 to 5 s/cm in all species.

*Federer, C. A.

1976c. **Trees modify the urban microclimate.** J. Arboric. 2: 121-127.

A person's comfort is affected by environmental conditions, including solar radiation, air temperature, wind, humidity, longwave radiation, and precipitation. Trees and other vegetation contribute to cooling the air by the evaporative process of transpiration. An urban shade tree can produce as much cooling as five room air-conditioners running 20 hours a day. Lack of vegetation is one reason why cities are often several degrees hotter than the surrounding countryside.

Federer, C. A.

1976d. **Review of "Vegetation and the Atmosphere, vol. 1, Principles" edited by J. L. Monteith.** Am. Meteorol. Soc. Bull. 57: 1161-1162.

The book reviewed is a state-of the art review of plant micrometeorology, as of 1973. Subjects covered include radiation transfer, momentum, mass, and heat transfer, interception and transpiration, particle deposition, layered-canopy models, and instrumentation. The book will be most useful to specialists in these fields.

*Federer, C. A., and G. W. Gee.

1976. **Diffusion resistance and xylem potential in stressed and unstressed northern hardwood trees.** Ecology 57: 975-984.

Stomatal behavior and water status were studied in mature northern hardwood trees. Response to water stress was obtained by

trenching around tree bases and covering the soil with plastic. Stress, as indicated by partial daytime closure of stomata, began after rain was excluded for 2 or 3 weeks. This is the first detailed information on the occurrence of water stress in northeastern hardwoods. In unstressed trees, yellow birch had lower resistance to water loss from its leaves, and thus might have greater transpiration than sugar maple and beech.

Fisher, Edward L., and Harry G. Gibson.
1976. **Helicopter logging moves east—trial results.** Am. Soc. Agric. Eng. Winter Meet. 1976 Pap. 76-1565. 7 p.

Encouraged by results of helicopter logging in other parts of the country, loggers in the East have begun to try it. A test in the Allegheny National Forest was efficient; there were few major delays. Average daily production rate was 110.68 cubic meters.

Flemer, William, III
1976. **Container trees for use in landscaping.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 185-193.

In planting trees, the current trend is to place increasing numbers in containers rather than in the ground. Conditions provided by containers are far from ideal: greater root hardiness is required than in trees planted in the ground. Methods and soil mixtures for improved growth in containers are described. Tree species especially suitable for planting in containers in the various climatic zones are discussed briefly, along with objectives for improving them for container use. Selection and breeding of new clones adapted to container growing are greatly needed.

Frank, Robert M.
1975. **Big balsam fir trees are hard to find: is there a bigger one in Maine?** Maine For. Rev. 8: 2, illus.

The largest balsam fir (*Abies balsamea*) on record is in Michigan. It stands 116 feet tall and has a circumference of 7.0 feet, or a diameter at breast height (dbh) of 26.7 inches. In 1948 a balsam fir that was 77 feet tall and 25.4 inches in dbh was measured on the Green Mountain National Forest in Vermont. In 1957, a balsam fir that was 23.0 inches in dbh was measured in Aroostook County in Maine.

Galoch, E., and M. Michniewicz.
1976. **Comparison of the dynamics of endogenous growth regulators in the shoots of young pines (*Pinus silvestris* L.) being in the vegetative and generative stages of development** Plant Growth Regulators Symp. (Torün, Poland, 1974) Proc. 4: 39-44.

When young Scotch pine trees pass from the vegetative phase of growth to the reproductive phase, there is a large decrease in the amount of auxin extractable from the tissue. Gibberellins increase at the same time, especially during the spring growth flush. No differences in the amount of abscisin-like inhibitors were found between flowering and nonflowering trees.

Gardescu, Paul.
1976. **A landscape architect's view of better trees for urban spaces.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 135-142.

Urban landscape architecture has a strong tradition for the importance of planted open space as an integral part of the city. There is also a strong tradition relating the city landscape to the surrounding region through the use of indigenous plant material. Trees are used as a design material in creating landscaped space. Tree selection is made for overall effect rather than individual characteristics.

Gerhold, Henry D., and Kim C. Steiner.
1976. **Selection practices of municipal arborists.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 159-166.

Selection of species or cultivars for municipal plants involves complex social-political, managerial, architectural, biological, and commercial relationships. A survey of arborists in the northeastern United States indicated that at least 17 characteristics of trees are considered in selecting species or clones for particular planting sites. The relative utility and availability of each type of information is compared. Ways to improve the selection of species and cultivars are suggested.

Gibbs, Carter B., and B. M. Blum.
1975. **Silviculture and the spruce budworm in Maine.** Maine For. Rev. 8: 13-15.
Balsam fir is the most important host of the spruce budworm, and most silvicultural budworm control techniques center around managing for low densities of young balsam fir. The authors point out that we will probably be unable to keep the density of fir so low that the budworm has an inadequate food supply. Losses to budworm may be reduced silviculturally, but not eliminated.

Gill, John D., Robert E. Radtke, and Jack Ward Thomas.
1976. **Forest wildlife habitat management: Ecological and management systems.** *In* The Scientific Base for Silviculture and Management Decisions in the National Forest System: 52-58. USDA For. Serv., Washington, D.C.
Basic ecological concepts are discussed as they apply to principles and strategies used in managing forest wildlife habitat. The general strategy for a given unit of habitat may be either to favor moderate populations of nearly all kinds of wildlife or to favor selected kinds. Neither strategy precludes using any silvicultural practice.

*Goho, Curtis D.
1976. **A study of logging residue at woods landings in Appalachia.** USDA For. Serv. Res. Note NE-219. 4 p., illus.
A study of residue on five woods landings in West Virginia showed that short lengths, poor quality, and low volumes are obstacles to utilization of this material. Short lengths and dirt accumulation also pose serious problems for conversion to chips. Some local use for firewood and specialty products is possible.

Gouin, Francis R.
1976. **Winter injury to container-grown plants.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 179-184, illus.
The overwinter survival of woody ornamental plants growing in containers or in raised planters depends on the cold hardiness of the roots and protection from the cold. Temperatures at which roots of many ornamental plants are killed range from -5°C to -18°C. The temperatures at which roots are killed depend partly on the age and maturity of roots: old roots are more cold-hardy than young roots. Increasing the cold-hardiness of roots through the use of growth regulators or fertilizers seems impractical at present.

Gove, James P., and Merrill C. Hoyle.
1975. **The isozymic similarity of IAA oxidase to peroxidase in birch and horseradish.** Plant Physiol. 56: 684-687, illus.
The relationship of indoleacetic acid oxidase activity to peroxidase activity is complicated by numerous multiple forms of this enzyme system. It is not known if all isozymes of this complex system contain both types of activity. Isozyme analysis of commercial horseradish peroxidase and leaf extracts of yellow birch *(Betula alleghaniensis)* by iso-electric focusing in polyacrylamide gels was used to examine this problem. Horseradish and birch exhibited 20 and 13 peroxidase isozymes, respectively, by staining with benzidine or scopoletin. Guaiacol was less sensitive.

*Grisez, Ted J.
1976. **Black cherry seeds stored 8 years.** Tree Planters' Notes 27: 20-24, illus.
Black cherry seed can be stored for long periods in closed containers in either refrigerators or freezers if seed moisture content is reduced to 5 percent. Germination rates after 8 years were 56 and 66 percent respectively for refrigerator and freezer storage.

*Hanks, Leland F.
1976a. **Field trials of the Forest Service hardwood tree grades.** For. Prod. J. 26(6): 47-49.
The Forest Service hardwood tree grades for factory lumber were tested by predicting the volume and value of lumber sawed during 10 field trials. For most trials, the predicted volumes and values compared favorably with the actual ones. Statistical tests conducted on 11 species indicated that the grading system separates trees into grades that have distinctly different dollar values.

*Hanks, Leland F.
1976b. **Hardwood tree grades for factory**

lumber. USDA For. Serv. Res. Pap. NE-333. 81 p., illus.

The Forest Service hardwood tree grades for factory lumber are described, and lumber grade yields for 11 species are presented. The yields, expressed in board feet, are based on equations in which dbh^2 and merchantable height were used as independent variables. Actual board-foot volumes by lumber grade served as dependent variables. Species included are yellow and paper birch, red and sugar maple, yellow-poplar, black cherry, basswood, and northern red, black, white, and chestnut oaks.

*Hanks, Leland F.

1976c. **How to predict lumber-grade yields for graded trees.** USDA For. Serv. Gen. Tech. Rep. NE-20. 9 p., illus.

A procedure is shown for developing lumber-grade yields to be used with the USDA Forest Service hardwood tree grades for factory lumber. Yield development is followed from the time of selecting trees, through sawing the logs and grading the lumber, to the development of predicted lumber grade yields. By following this procedure, a sawmill operator can develop yields that are representative of both his sawmill and the local timber.

*Hansen, Bruce G.

1976. **Ohio's Christmas tree industry.** Ohio Woodlands 14(4): 12-14, illus.

Seventy-six Christmas tree growers in Ohio took part in a nationwide membership survey conducted by the National Christmas Tree Association. Ohio's growers generally managed more acreage, had been in business longer, and spent more time on a per-acre basis in growing Christmas trees than did their counterparts throughout the nation.

Hansen, Bruce G., and Thomas H. Pendleton.

1976. **The rise and fall of Christmas tree imports.** Am. Christmas Tree J. 20(2): 9-10.

American imports of natural Christmas trees have declined dramatically from a peak of more than 12.5 million in 1956 to fewer than 2.5 million in 1974. The annual rate of decline over the past 10 years has averaged nearly 14 percent. Several reasons for this decline, including the evolution of the American Christmas tree plantation and the development of the polyvinyl chloride artificial Christmas tree, are discussed in detail.

Hay, C. J.

1976. **Arthropod stress.** *In* Air pollution and metropolitan woody vegetation, p. 33-34. USDA For. Serv. Pinchot Inst. Environ. For. Stud.

Insects and mites have been implicated as stress factors on trees affected by pollutants, including the black pineleaf scale, eastern spruce gall aphid, an eriophyid mite (*Setoputus* sp.), white-pine weevil, European pine shoot moth, and gypsy moth. A research approach is suggested.

Heisler, Gordon M., and Lee P. Herrington.

1976. **Selection of trees for modifying metropolitan climates.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 31-37.

The current state of knowledge about effects of trees on microscale and mesoscale metropolitan climate is discussed. Emphasis is placed on the potential role of trees in ameliorating climate for human thermal comfort outdoors and for reducing consumption of energy for heating and air-conditioning buildings. The physics of the energy exchanges that control metropolitan climate are summarized. Suggestions are made for the selection of species and kinds of trees for modifying the climate in metropolitan areas.

*Herrick, Owen W.

1976a. **Key indicators of successful logging jobs in the Northeast.** USDA For. Serv. Res. Pap. NE-352. 5 p., illus.

Characteristics of logging operations in 14 Northeastern States were analyzed to identify key determinants of the most successful logging jobs. Total timber volume harvested, hauling distance, crew size, and distance from the preceding job were the foremost indicators of success.

*Herrick, Owen W.

1976b. **Structure and change in northern U.S. forest industry: a shift-share analysis.** For. Prod. J. 26(8): 29-35.

Between 1967 and 1972, U.S. forest industry had gains in employment and value added that exceeded the national growth rates of all manufac-

turing. But forest industry in the northern region of the United States did not fare so well. Shift-share analysis was used to examine the changes in employment and value added in the North's forest industry since 1958.

Heybroek, Hans M.

1976. **Chapters on the genetic improvement of elms.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 203-213, illus.

The development, goals, and newly released clones of the dutch elm breeding program are described. The merits of clonal and seedling varieties are compared; the latter have some advantages for landscaping purposes. They also contribute to gene conservation. In preparing for future disease risks, however, variability *per se* is valuable, be it through clones or seedlings. The recent variation in the fungus *Ceratocystis ulmi* is discussed; and two types of resistance are described. The value of Asiatic elms is stressed.

Himelick, E. B.

1976. **Disease stresses of urban trees.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 113-125.

The significant causes for disease stresses and decline of trees growing in an urban environment are reviewed. Both the effectiveness of various disease-control procedures and the importance of proper tree selection in reducing future tree maintenance are discussed.

Hornbeck, James W., Gene E. Likens, and John S. Eaton.

1976. **Seasonal patterns in acidity of precipitation and their implications for forest stream ecosystems.** *In* 1st Int. Symp. on Acid Precipitation and the Forest Ecosystem Proc. USDA For. Serv. Gen. Tech. Rep. NE-23: 597-609, illus.

At the Hubbard Brook Experimental Forest in New Hampshire, the mean hydrogen ion content of precipitation ranges between 46 μeq/1 in winter and 102 μq/1 in summer. As summer precipitation passes through the forest canopy, hydrogen ion concentrations are lowered by an average of 90 percent, primarily as a result of exchange with other cations.

Hornbeck, James, and Gordon Stuart.

1976. **When ski trails are cut through forest land, what happens to streamflow?** Ski Area Manage. 15(4): 34-36, 47.

Inferences about the potential impacts of ski-trail construction and maintenance on streamflow are drawn, based on watershed studies at Hubbard Brook Experimental Forest in New Hampshire.

Houston, David R.

1975. **Aerial inventory of forest tree diseases.** Monitoring For. Environ. through Successive Sampling Proc. Symp.: 344-354.

Use of remote-sensing techniques for detecting and evaluating forest tree diseases are reviewed. A number of studies using aerial photography for detecting major tree diseases are summarized, indicating that diseases with greatest potential for detection and evaluation by remote sensing are those that occur in stands approaching monocultures and those where disease development creates unique patterns in affected stands.

*Hoy, Marjorie A.

1976a. **Genetic improvement of insects: fact or fantasy.** Environ. Entomol. 5: 833-839.

The problem of maintaining genetic quality of laboratory-reared insects has become prominent. Some domesticated and semidomesticated insects such as the honey bee and the silkworm have been improved genetically through selection and hybridization; and some parasitoids have undergone selection to improve insectary production or field effectiveness, or both. We can improve insects for laboratory tests by hybridizing two inbred lines; this often yields a vigorous, uniformly variable insect.

Hoy, Marjorie A.

1976b. **Parasite evaluation and management.** *In* Eighth Annual Northeastern Forest Insect Work Conference Proc., USDA For. Serv. Gen. Tech. Rep. NE-27: 18-19.

A summary of the workshop on parasite evaluation, intended to impart information about work going on and to attempt to reach a consensus about the direction the new gypsy moth parasite program should go, with particular reference to priorities in foreign exploration.

Jensen, K. F.

1976. **Other asymptomatic physiological and biochemical alterations.** *In* Air pollution and metropolitan woody vegetation, p. 31-33. USDA For. Serv. Pinchot Inst. Environ. For. Stud.

A review of past research, with recommendations for further research needed.

*Jensen, K. F., L. S. Dochinger, B. R. Roberts, and A. M. Townsend.

1976. **Pollution responses.** *In* Modern methods in forest genetics: 189-216. Springer-Verlag, Berlin-Heidelberg.

Air pollution as a stress factor in the environment is increasing in importance. Sulfur dioxide, ozone, hydrogen fluoride, and several minor pollutants may cause significant vegetative and physiological injury to trees so that their growth and development are altered. To injure the trees, however, the pollutants must be sorbed by the foliage. Thus the trees are cleansing the environment of these contaminants. The susceptibility of trees to pollutant injury varies within and between species and is genetically controlled. Therefore, it will be possible to select or breed trees that are pollutant tolerant.

*Jumper, Gene A., and William N. Cannon, Jr.

1976. **Chromosome number in the smaller European elm bark beetle, *Scolytus multistriatus*.** Entomol. Soc. Am. Ann. 69: 500-502, illus.

Prepupal testicular tissues of *Scolytus multistriatus* (Marsham) were examined. The chromosome complements of the meiotic cells have a haploid number of 6.

Kingsley, Neal P.

1976a. **Research needs related to the future of the forest industry in New England and eastern Canada—some land ownership considerations.** Yale Ind. For. Semin. Proc. 42: 218-221. Univ. Mass., Amherst.

Future development and expansion of forest-based industries will depend heavily on the availability of timber from small privately-owned tracts. However, before these lands can contribute their full potential, four areas need to be investigated: (1) development of management plans for primary objectives other than timber that will make timber available; (2) development of methods to coordinate management and use of lands in fragmented ownership; and (3) development of means to enhance the financial attractiveness of forest-management investments.

*Kingsley, Neal P.

1976b. **The forest-land owners of southern New England.** USDA For. Serv. Resour. Bull. NE-41. 27 p., illus.

A statistical-analytical report on a mail canvass of the owners of privately-owned commercial forest land in Connecticut, Massachusetts, and Rhode Island. The study was conducted in conjunction with the second forest survey of southern New England. 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.

1976c. **The forest resources of New Hampshire.** USDA For. Serv. Resour. Bull. NE-43. 71 p., illus.

A statistical and analytical report on the third forest survey of New Hampshire. Statistical findings are based on the remeasurement of 1/5-acre plots and new 10-point cluster plots. Trends in forest-land area, timber volume, annual growth, and timber removals are discussed; also timber-products output by forest industries based upon a canvass of industries in 1973, and the importance of timber and forests to the State's economy and environment. The report includes a discussion of the outlook for timber supplies during the next 30 years, and forest-management opportunities in the State. The report includes 54 tables of statistical data.

Kozlowski, T. T.

1976. **Drought and transplantability of trees.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 77-90, illus.

Studies on development of water deficits in trees and their effects on stomatal closure, wilting, photosynthesis, shoot growth, cambial growth, reproductive growth, and injury are reviewed. Drought resistance is discussed in terms of drought-avoiding adaptations (stomatal characteristics, production of leaf waxes, root growth characteristics, and leaf shedding),

and desiccation tolerance. Some opportunities available to the plant breeder for producing drought-resistant trees are emphasized.

*Lamson, Neil I.

1976. **Appalachian hardwood stump sprouts are potential sawlog crop trees.** USDA For. Serv. Res. Note NE-229. 4 p., illus.

A survey of 8- and 12-year-old hardwood stump sprouts was made in north-central West Virginia. Species surveyed were yellow-poplar, black cherry, red oak, red maple, and basswood. Of the stumps cut 12 years ago, 66 percent produced at least one dominant or codominant sprout that originated at groundline and was free from forks in the lower 25 feet of the bole. The abundance and quality of these stump sprouts indicated that many of them can be considered as potential sawlog crop trees.

Lanier, G. N., R. M. Silverstein, and J. W. Peacock.

1976. **Attractant pheromone of the European elm bark beetle (*Scolytus multistriatus*): isolation, identification, synthesis, and utilization studies.** *In* Perspectives in Forest Entomology: 149-176. J. F. Anderson and H. K. Kaya, eds., Academic Press, New York

The attractant pheromone of *Scolytus multistriatus* is a mixture of three compounds: 4-methyl-3-heptanol, α-multistriatin, and α-cubebene. Studies have been in progress since 1970 to determine if a synthetic blend of these chemicals, "Multilure", can be used to mass-trap beetles and thereby reduce beetle-vectored Dutch elm disease. Several million beetles have been captured in traps in Ft. Collins, Colo., and Syracuse, N.Y., at the University of Delaware, and at numerous other locations around the U.S.

LaPage, W. F.

1976. **New roles for government and industry in outdoor recreation.** *In* Proc. South. States Recreation Res. Appl. Workshop. USDA For. Serv. Gen. Tech. Rep. SE-9: 218-227.

Examination of some possible future options for public parks and recreation agencies is necessitated by three hard facts: (1) the rising dominance of the private sector; (2) the emerging public revolt against increased tax-supported programs; and (3) the trend toward greater public involvement in agency decision-making. A central role for public parks and recreation agencies is seen to be that of a cooperator with the private sector, taking such forms as joint development planning, increased use of concession-operated public facilities and new directions for public parks and recreation programs.

Leak, William B.

1976a. **Systems analysis III.** Ecology 57: 403-404.

A review of Systems Analysis and Simulation in Ecology, edited by B.C. Pattens. Emphasis is on the perspective provided on various approaches to large-scale multi-disciplinary research.

*Leak, W. B.

1976b. **Relation of tolerant species to habitat in the White Mountains of New Hampshire.** USDA For. Serv. Res. Pap. NE-351. 10 p., illus.

The occurrence of red spruce, hemlock, beech, and sugar maple stands was related to habitat classified by substratum (generally C horizon or parent material), drainage, aspect, and elevation. Softwoods were found on rocky, outwashed, compacted, and poorly drained substrata; hardwoods were common on open glacial tills. Species was related to climate and apparent resistance of the substratum to weathering.

*Leak, William B., and Raymond E. Graber.

1976. **Seedling input, death, and growth in uneven-aged northern hardwoods.** Can. J. For. Res. 6: 368-374.

Seedling input, death, and diameter-growth equations, covering a broad range in stand densitites, were developed from short-term remeasured plot data in northern hardwood stands in New Hampshire. Long-term simulated changes in stand structure based on these equations exhibited logical constrained behavior.

Lederer, Robert F.

1976. **The challenge: an industry together.** *In* Better Trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 253-256.

The allied landscape industry encompasses more than a marketing chain from nurseryman

to consumer: it is a chain with many links. One link is the research community that seeks to develop trees and other plants for a variety of landscape uses. The need for cooperation and communication throughout the industry is emphasized.

Lewis, W. J., Richard L. Jones, Donald A. Nordlund, and H. R. Gross, Jr.

1976. **Kairomones and their role in pest management.** *In* Eighth Annual Northeastern Forest Insect Work Conference Proc., USDA For. Serv. Gen. Tech. Rep. NE-27: 7-14, illus. 27: 7-14, illus.

Chemcial cues emanating from the host insects and acting by themselves or together with host-plant components appear to be the key factors governing host-location by parasites. A summary-analysis of the studies of these kairomones, their involvement in the behavior sequence of host selection by parasites, and the basis for their potential employment in pest management are presented.

*Little, Silas and Robert T. Escheman.

1976. **Nineteen-year changes in the composition of a stand of *Pinus taeda* in eastern Maryland.** Torrey Bot. Club Bull. 103(2): 57-66, illus.

Stands of *Pinus taeda* established on old fields grow rapidly in eastern Maryland, but hardwoods soon invade and are already numerous at 16 years, and by 35 years they form a conspicuous second story. Data on changes in composition in one stand show the strong successional trend to hardwoods. Fires or other measures have to be used if pine stands are to be reproduced.

Lloyd, R. Duane.

1976. **A critique of the paper entitled "Wilderness in the East: problems for research".** *In* Proc. South. States Recreation Res. Appl. Workshop. USDA For. Serv. Gen. Tech. Rep. SE-9: 58-60.

In this critique, Lloyd joins Robert W. Cermak, the author, in a plea that wilderness research be conducted with a broad perspective. The key to wilderness management may lie in nearby non-wilderness. We need to remember, and help the public understand, that wilderness areas were not established for recreational purposes alone.

*Lucas, Edwin L., and Charles J. Gatchell.

1976. **STUB—A manufacturing system for producing rough dimension cuttings from low-grade lumber.** USDA For. Serv. Res. Note NE-222. 5 p., illus.

A rough mill manufacturing system for producing high-value furniture parts from low-value raw material is described. Called STUB (Short Temporarily Upgraded Boards), the system is designed to convert low-grade hardwood lumber into rough dimension parts. Computer simulation trials showed that more than one-third of the volume of parts produced from No. 2 Common oak lumber is recoverable in 40-inch long or longer cuttings. A pilot line of the STUB system is being established to evaluate operator and equipment efficiency, production rates, and cutting yields from other species of lumber.

*McCay, Roger E.

1976. **Ohio trail users.** USDA For. Serv. Res. Note NE-228.3 p.

Hikers, horseback riders, bicycle riders, and motorcycle riders were interviewed on randomly selected trails in Ohio to better understand who they are and why they use trails. Bicycle riders were found to be the most active trail users; bicycle and motorcycle riders were younger than hikers and horseback riders. The majority of hikers and horseback riders preferred single-use trails.

McCay, Roger E.

1975. **Trailer-user conflict.** Third Natl. Trails Symp.: 168-171. Lake Barkley, Ky.

Conflicts arise among different types of trail users who want to use the same trails for different purposes. To resolve such conflicts, four alternatives are considered: (1) rules and regulations, (2) separate trails (3) education, and (4) wider trails. Whatever means are tried should be applied with consideration for the other fellow.

*McCay, Roger, and George Moeller.

1976a. **Trail talk.** Woodlands 14(1): 8-9, illus.

Defines different types of trails, explains the purpose of trails and why people use them, and discusses the number and kind of trails in Ohio.

*McCay, Roger E., and George H. Moeller.

1976b. **Compatibility of Ohio trail users.** USDA For. Serv. Res. Note NE-225. 4 p., illus.

Compatibility indexes show how Ohio trail users feel about meeting each other on the trail. All four of the major types of trail users—hikers, horseback riders, bicycle riders, and motorcycle riders—enjoy meeting their own kind. Separating the average indexes into their components gives important information for trail planners, builders, and managers attempting to optimize the enjoyment of trails.

McIntyre, Thomas.

1976. **Gypsy moth research, development, and applications program: structure objectives, and direction.** *In* Eighth Annual Northeastern Forest Insect Work Conference Proc., USDA For. Serv. Gen. Tech. Rep. NE-27: 15-17.

Because of the urgent need to control forest insect pests, a research-and-development program was established to accelerate research to provide control technology. The facilities, objectives, funding, and organization of the program are described.

Marquis, David A.

1976. **Silviculture of eastern hardwoods.** *In* The scientific base for silviculture and management decisions in the National Forest System, p. 29-38. USDA For. Serv. Washington.

Deciduous hardwood forests of the East represent nearly half of the forested area of the entire United States. There is great diversity in species of trees that grow in these forests and in their ecological requirements, growth rates, and value for timber or wildlife. Because of this diversity and the wide range in land-use objectives for these forests, there is need for a wide range of cutting methods and cultural measures. This report summarizes the silvicultural techniques appropriate under various situations.

*Marquis, David A., Philip L. Eckert, and Benjamin A. Roach.

1976. **Acorn weevils, rodents, and deer all contribute to oak-regeneration difficulties in Pennsylvania.** USDA For. Serv. Res. Pap. NE-356. 5 p.

Studies in Pennsylvania suggest that lack of viable acorns is the reason for failure of oaks to regenerate. On some sites insects and rodents destroy nearly all acorns, even in good seed years; rodents destroyed direct-seeded acorns despite plastic protectors; and planted seedlings have been damaged severely by deer browsing.

*Martin, A. Jeff.

1976a. **Suitability of the line intersect method for sampling hardwood logging residues.** USDA For. Serv. Res. Pap. NE-339. 6 p., illus.

The line intersect method for sampling logging residues was tested in Appalachian hardwoods and was found to provide unbiased estimates. The effects of species, cutting method, slope, road influence, and piece length were found to be nonsignificant. The length of sample line required for various levels of precision is given.

*Martin, A. Jeff.

1976b. **A logging residue "yield" table for Appalachian hardwoods.** USDA For. Serv. Res. Note NE-227. 3 p.

An equation for predicting logging-residue volume per acre for Appalachian hardwoods was developed from data collected on 20 timber sales in national forests in West Virginia and Virginia. The independent variables of type-of-cut, products removed, basal area per acre, and stand age explained 95 percent of the variation in residue volume per acre. A "yield" table was then prepared to show probable residue volumes for four cutting practices and various levels of basal area and stand age.

*Mawson, Joseph C., Jack Ward Thomas, and Richard M. DeGraaf.

1976. **Program HTVOL—The determination of tree crown volume by layers.** USDA For. Serv. Res. Pap. NE-354. 9 p., illus.

A FORTRAN IV computer program is available for calculating, from a few field measurements, the volume of tree and shrub crowns in layers of a specified thickness. Each tree is assigned one of 15 solid shapes, formed by using one of five side shapes and one of three bottom shapes. A test showed that the accuracy of this technique is within acceptable limits if the shape is selected carefully.

*Mazzone, H. M., G. H. Tignor, R. E. Shope, I. C. Pan, and W. R. Hess.

1976. **A serological comparison of the nuclear polyhedrosis viruses of the gypsy moth and the European pine sawfly with**

arthropod-borne and other viruses. Environ. Entomol. 5: 281-282.

The virion fraction and polyhedral protein fraction of the nuclear polyhedrosis virus of the gypsy moth and the European pine sawfly were found to be not serologically related to arboviruses nor to other viruses tested. In addition, no circulating antibodies to the viron and polyhedral protein fractions of either virus were observed in laboratory workers.

Meadows, John C., Jr., and Albert T. Schuler.
1976. **Nonlinear programming and the decreasing marginal utility problem: a goal programming framework for decision.** Annu. Meet. Southeast. Chapter Inst. Manage. Sci. Proc. 12: 307-314.

A review of the application of a preemptive linear goal programming model to the development of national forest management plans indicated two main problems: (1) managers do respond as if there were a decreasing marginal utility to goal attainment; and (2) the assumption of preemptive goal weights is too strong. This study demonstrates that quadratic goal weights are more consistent with the concept of decreasing marginal utility than linear weights.

*Mendel, J. J., P. S. DeBald, and M. E. Dale.
1976. **Tree value conversion standards for hardwood sawtimber. SETs: Stand Evaluation Tools. 2.** USDA For. Serv. Res. Pap. NE-337. 74 p., illus.

Tree-quality index tables are presented for 12 important hardwood species of the oak-hickory forest. From these, tree-value conversion standards are developed for each species, log grade, merchantable height, and diameter at breast height. The method of calculating tree-value conversion standards and adapting them to different conditions is explained. A computer program for calculating tree values for different timber values and conversion costs is included.

Michalski, L.
1976. **Effects of ionizing radiation and post-radiation action of some plant growth regulators on the seed germination and seedling growth of Scotch pine.** Acta Soc. Bot. Boloniae 45: 127-133.

Gamma irradiation of Scotch pine seeds produced a variety of generally inhibitory effects on germination and subsequent growth of pine seedlings. Interactions between effects of growth hormones and radiation effects were also apparent. Gibberellins reduced the inhibitory effects of radiation whereas kinetin increased them. No conditions were found under which seed radiation was generally beneficial to germination and seedling growth.

Michniewicz, M., B. Rozej, and K. Lamparska.
1976. **The role of ferulic acid in the rooting process.** Proc. Fourth Symp. Plant Growth Regulators (Torún, Poland, 1974): 95-101.

Ferulic acid is a naturally occurring plant acid. It is related to lignin and to a variety of phenolic acids. A dilute solution of this acid is a promoter of the rooting process in willow cuttings. The degree of root growth stimulation varies greatly under different experimental conditions, but the process by which ferulic acid promotes root growth seems to be independent of auxin controlled systems. Ferulic acid was earlier reported to promote root growth in pine seedlings.

Moeller, George H.
[1976] **Future trends in recreation resources management.** *In* Environmental attitudes, ethics, values and their communication. 21st Natl. Conserv. Educ. Assoc. Conf. Proc.: 20-21 (N.Y. State Univ. Coll. Environ. Sci. and For.)

A longer look into the future is needed to determine possible results of today's resource decisions. Although such decisions may solve short-run problems, long-run implications may aggravate the problem. A panel of experts provided predictions of future events related to natural resources management, wildland recreation management and population-workforce-leisure, that are likely to shape future demands on forest resources.

*Moeller, George H., Raymond L. Marler, Roger E. McCay, and William B. White.
1977. **Economic analysis of the gypsy moth problem in the Northeast. III. Impacts on homeowners and managers of recreation areas.** USDA For. Serv. Res. Pap. NE-360. 9 p.

The economic impacts of a gypsy moth infestation on homeowners and on managers of recreation areas (commercial, public, and quasi-public) were determined from data collected via interviews with 540 homeowners and 170

managers of recreation areas in New York and Pennsylvania. The approach to measuring the impact of gypsy moth was to determine the interaction of a specific effect of an infestation (tree defoliation, tree mortality, nuisance) with a specific ownership objective (the reason a person has for owning or managing a property). Gypsy moth impact data were also collected on costs of controlling the gypsy moth, on financial losses resulting from infestation, and on person-days of recreational use of property lost by ownership class.

Moore, Gary S., Normand R. Dubois, and Haim B. Gunner.

1975. **The effect of microbial mycolytic agents on *Trichophyton rubrum*.** Mycopathologia 57(2): 93-98.

Chitinolytic microorganisms isolated from forest soil and healthy gypsy moth larvae (*Porthetria dispar* (L.) were screened for their ability to lyse *Trichophyton rubrum* mycelia. A few of these isolates were mycolytic on both autoclaved and on actively growing intact *T. rubrum* mycelia. Supernatants from these isolates, utilizing live *T. rubrum* as the sole carbon source, showed the same mycolytic ability. Assays of the supernatants for enzymatic activity revealed exocellular stable enzymes that released reducing substances including N-acetylglucosamine from the mycelia.

More, Thomas A.

1976. **Urban forest recreation: a strategy for research.** *In* Proc. South. States Recreation Res. Appl. Workshop. USDA For. Serv. Gen. Tech. Rep. SE-9: 61-68.

Recreation pressure on the urban forest is high and is expected to increase. Unfortunately, we know little about this forest or the people who use it. A research program to remedy this will be undertaken in the Northeast to develop a basis of scientific knowledge about recreation in the urban forest.

*Myklestad, Erik, and J. Alan Wagar.

1976. **PREVIEW: Computer assistance for visual management of forested landscapes** USDA For. Serv. Res. Pap. NE-355. 12 p., illus.

The PREVIEW computer program facilitates visual management of forested landscapes by generating perspective drawings that show proposed timber harvesting and regrowth throughout a rotation. Drawings show how changes would appear from selected viewing points and show landscapes as either a grid of distorted squares or by symbols representing trees, clearings, water, rock, etc. PREVIEW can also show roads and other linear features.

Nelson, William R., Jr.

1976. **Esthetic considerations in the selection and use of trees in the urban environment.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 13-24.

The relationship between the physical qualities of trees and esthetics is clarified first by exploring the theory of esthetics; second by a brief overview of the impact of line, form, color, and texture of trees in three categories of compositional scale; and third by the presentation of a digest of esthetic qualities to which people respond on an emotional or intuitive level. The important contributions of the esthetic qualities of trees to various urban situations are outlined.

Nolley, Jean W.

1976. **Christmas trees: a bibliography.** (1976 supplement) Am. Christmas Tree J. 4: 25-28.

1976 supplemental listing of published information on the Christmas tree industry.

Northeastern Forest Experiment Station.

1976a. **Better trees for metropolitan landscapes: symposium proceedings.** USDA For. Serv. Gen. Tech. Rep. NE-22. 256 p., illus.

A report on the symposium held 4-6 November 1975 at the National Arboretum, Washington, D.C., containing 29 papers on selection of trees for metropolitan environments; selection strategies of planters, growers, and breeders; and putting new cultivars into use.

Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 001-001-00421-9. Cost is $3.25.

*Northeastern Forest Experiment Station.

1976b. **Proceedings of the Eighth Annual Northeastern Forest Insect Work Conference.** USDA For. Serv. Gen. Tech. Rep. NE-27. 20 p., illus.

A report on this conference, whose theme was "Techniques for Research, Development, and

Application." It includes discussions of the pilot boll weevil eradication experiment; kairomones and their role in pest management; the gypsy moth research, development, and applications program; parasite evaluation and management; and field and laboratory identification of insect pathogens.

Northeastern Forestry Committee.
1976c. **Forest & air relationships research priorities in the Northeast.** Northeast. Reg. Plan. Comm. 18 p.
Large expanses of forest lands in the Northeast are subject to sublethal concentrations of air pollution during extended periods. Since air pollution trends indicate a continuation of these injurious effects, research investigations are recommended for determining (1) impact of air pollution on northeastern forests, (2) relations between acid precipitation and the forest ecosystem, (3) nature and extent of forest tree cleansing of atmospheric pollution, and (4) genetic bases for air-pollution tolerance in forest tree species.

*Northeastern Forest Experiment Station.
1976d. **Outdoor recreation participation in northeastern Pennsylvania, 1975.** 8 p., illus. USDA For. Serv. Northeast. For. Exp. Stn.
A brochure about the Experiment Station's research program in the Endless Mountains Region and Pocono Mountains Region, including results of a survey of current recreation use.

*Northeastern Forest Experiment Station.
1976e. **1975 at the Northeastern Forest Experiment Station.** USDA For. Serv. Gen. Tech. Rep. NE-24. 39 p.
A summary report on highlights of research activities and accomplishments by the Experiment Station in 1975, including an annotated list of publications.

*Northeastern Forest Experiment Station.
1976f. **How to manage woodlands for birds.** USDA For. Serv. Northeast. For. Exp. Stn. NE-INF-31-76. 8 p., illus.
The central Appalachians provide habitat for about 240 species of birds. This brochure provides tips on planning trails for birdwatching, choosing sites, managing plants, and maintaining the forest habitat for birds. Typical nesting habits of the most common birds are listed.

*Northeastern Forest Experiment Station.
1976g. Ingredients for successful dutch elm disease control. Northeast. For. Exp. Stn. NE-INF-29-76. 6 p., illus.
A brochure describing the essentials for control of the dutch elm disease, based on an analysis of control programs in 39 communities to determine why some control programs succeeded while others failed.

*Northeastern Forest Experiment Station.
1976 h. How to have healthy trees in parks and campgrounds. Northeast. For. Exp. Stn. 1 p.
A leaflet/poster describing the kinds of wounds that can induce disease and decay in trees. The best way to help trees stay healthy is to prevent wounds.

*Northeastern Forest Experiment Station.
1976i. How to recognize and prevent tree hazards. Northeast. For. Exp. Stn. 1 p.
A leaflet/poster telling the landowner how to recognize signs that a tree may be in a hazardous condition and outlining what to do for a tree to prevent its causing damage.

*Northeastern Forest Experiment Station.
1976j. How to prune trees. Northeast. For. Exp. Stn. 1 p.
A leaflet/poster giving the landowner basis instructions about pruning trees. The best way to keep trees healthy and to minimize damage from decay is to prune trees properly throughout their lives. Dead, broken, weak, and diseased branches are the major avenues through which decay-causing organisms can get into a tree.

*Northeastern Forest Experiment Station.
1976k. Research: people/places/projects. Northeast. For. Exp. Stn. 2 p.
A leaflet listing the field units of the Experiment Station and the research projects being carried on.

*Northeastern Forest Experiment Station.
1976l. Research: Northeastern Forest Experiment Station. Northeast. For. Exp. Stn. NE-INF-28-76. 12 p.
An information brochure. The Northeastern

Region is described briefly, and research projects are described that are being carried on at field units at Amherst, Mass., Beltsville, Md.; Burlington, Vt.; Berea, Ky.; Delaware, Ohio; Durham, N.H.; Hamden, Conn.; Morgantown, Parsons, and Princeton, W. Va.; Orono, Me.; Pennington, N.J.; Syracuse, N.Y.; and Warren, Pa.

Nyland, R.D., P.J. Craul, D.F. Behrend, H.E. Echelberger, W.J. Gabriel, R.L. Nissen, Jr., R. Uebler, and J. Zarnetske.

1976. **Logging and its effects in northern hardwoods.** N.Y. State Univ. Coll. Environ. Sci. For., AFRI Res. Rep. 31. 134 p. Syracuse.

Commercial logging crews harvested timber from three locations by individual tree selection, strip clearcutting, and patch clearcutting. Skidding disturbed soil over 5 to 10 percent of the area in partially cut stands, 10 to 20 percent in clearcut stands. Most viewers favored lopped partial cutting and reacted negatively to logging slash.

ODell, Thomas.

1976. **An overview of the Eighth Annual Northeastern Forest Insect Work Conference.** *In* Eighth Annual Northeastern Forest Insect Work Conference Proc., USDA For. Serv. Gen. Tech. Rep. NE-27: 1-2.

The theme of the conference was "Techniques for research, development, and application", and the need for better communication to bridge the gap between research and application.

*ODell, Thomas M., and Ian H. von Lindern.

1976. **A technique for marking first-stage larvae of the gypsy moth for dispersal studies.** USDA For. Serv. Res. Note NE-223. 4 p., illus.

Zinc cadmium sulfide fluorescent particles can be used to mark first stage larvae of the gypsy moth, *Porthetria dispar* (L.), without effecting changes in their development and behavior. Marked larvae dispersed readily; so the technique could be used to correlate dispersed larvae with any particular source point.

Parencia, C. R., Jr.

1976. **The pilot boll weevil eradication experiment.** *In* Eighth Annual Northeastern Forest Insect Work Conference Proc. USDA For. Serv. Gen. Tech. Rep. NE-27: 3-6.

The Pilot Boll Weevil Eradication Experiment was conducted cooperatively with 16 federal, state, and cotton-industry agencies from July 1971 to August 1973. Population-suppression components were late-season insecticide treatments, cultural practices, pheromone traps, insecticide treatment when plants began to square, in-season insecticide treatments, and release of sexually-sterile male boll weevils. The technical guidance committee concluded that it is technically and operationally feasible to eliminate the boll weevil as an economic pest in the United States by use of ecologically acceptable techniques.

*Patric, J.H.

1976a. **Soil erosion in the eastern forest.** J. For. 74: 671-677, illus.

This paper provides an overview of what is known about forest soil erosion in the eastern United States. By most accounts, erosion from undisturbed as well as carefully managed forest land is 0.05 to 0.10 ton/acre/year, less than geologic norm (0.18 to 0.30) and far less than maximum tolerable rates for agricultural land (1 to 5 tons/acre/year). Eroded material is about equal parts of particulate and dissolved matter. Responsibly managed timber harvest causes only minor increases in forest soil erosion, usually from channels and logging roads, but irresponsible timber harvest can increase erosion.

Patric, James H.

1976b. **Book review: Water pollution control in low density areas.** University Press of New England, Hanover, N.H. (William J. Jewell and Rita Swan, eds.) J. For. 74: 171.

This book contains 28 papers grouped into six sections: land treatment of wastewater; septic tanks and their effects on the environment; groundwater problems; rural water-supply problems; nonpoint pollution; and low-cost wastewater treatment for rural areas. Because this material includes little information on pollution stemming from forestry practices, managers of campgrounds or heavily used recreation areas may find this book more useful than foresters.

*Patric, James H., and Ernest M. Gould.

1976. **Shifting land use and the effects on**

river flow in Massachusetts. J. Am. Water Works Assoc. 68(1): 41-45.

A century ago, land formerly cleared for agriculture in Massachusetts began reverting to forest. It was thought that decreasing streamflow contributed to the decline of water power as the prime energy source in Massachusetts. Some further speculation concerns hydrologic effects of urbanization and the 1938 hurricane on flow in these streams.

Patterson, James C.

1976. **Soil compaction and its effects upon urban vegetation.** *In* Better Trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 91-102, illus.

The urban environment imposes severe stress upon vegetation. The problems are many and interactions common, making simple solutions difficult. This author on urban soils discusses the basic soil physics involved, reviews existing literature, and describes several research efforts in Washington. Particular emphasis is placed on soil compaction and ways to minimize its deleterious effects upon vegetation.

Payne, Brian R.

1976. **Landscaping adds dollars to your property values.** New Horizons 1976: 1. Hortic. Res. Inst., Washington, D.C.

Nurserymen sell a desirable product. Trees planted around homes help attract wildlife, increase natural beauty, and may increase property values by as much as 12 percent.

Payne, Brian R., and Steven Strom.

1975. **The contribution of trees to the appraised value of unimproved residential land.** Valuation 22(2) 37-45.

Professional appraisers estimated the value of seven simulated combinations of amount and distribution of tree cover for a 12-acre parcel of unimproved residential land in Amherst, Mass. Arrangements with trees were valued higher than arrangements without trees, and scattered arrangements of trees were valued higher than concentrated arrangements for a fixed percentage of tree cover.

Pearce, G.T., W.E. Gore, and R.M. Silverstein.

1976. **Synthesis and absolute configuration of multistriatin.** J. Org. Chem. 41: 2979-2803.

Multistriatin, 2,4-dimethyl-5-ethyl-6,8-dioxabicyclo [3.2.1] octane (1), was synthesized as a mixture of the four diastereomers 1α-δ. The enantiomeric composition of synthetic (-)- and (+)-1α was determined by ^{13}C NMR with the chiral shift reagent, tris [3-heptafluoropropylhydroxmethylene)-d-camphorato] europium. Natural(-)-1α consisted of a single enantiomer.

Plass, William T.

1976. **Direct seeding of trees and shrubs on surface-mined lands in West Virginia.** Forestation of Disturbed Surface Areas Conf. Proc.: 32-42. Birmingham, Ala.

The suitability of tree and shrub species for direct seeding on surface mining disturbance is being evaluated on 700 acres in West Virginia. Initial results indicate that several species can be successfully seeded by helicopter or hydroseeder.

*Plass, William T.

[1976] **Changes in water chemistry resulting from surface-mining of coal on four West Virginia watersheds.** Natl. Coal Assoc. Surface Mining and Reclam. Symp. 3 (vol. 1): 152-169, illus.

Studies on experimental watersheds provide information about water chemistry for undisturbed watersheds and effects of clearcutting on water quality. Variations in concentrations were related to soil, geology, vegetation, and rate of flow.

Podgwaite, John D.

1976. **Field and laboratory identification of insect pathogens.** *In* Eighth Annual Northeastern Forest Insect Work Conference Proc., USDA For. Serv. Gen. Tech. Rep. NE-27; 20.

The workshop discussions focused on some of the techniques utilized to diagnose disease conditions both in the field and the laboratory and on how these techniques are used in research, development, and application programs.

*Podgwaite, J.D., and B. J. Cosenza.

1976a. **A strain of *Serratia marcescens* pathogenic for larvae of Lymantria dispar: characterization.** J. Invertebr. Pathol. 27: 185-190, illus.

A gram-negative bacillus, pathogenic for gypsy moth larvae, was characterized culturally, morphologically, and physiologically as a

member of the *Serratia* group of the family Enterobacteriaceae. The taxonomic evidence gathered indicates that it is a nonchromogenic variant of *Serratia marcescens*. This is the first report of such a variety infecting gypsy moth larvae.

*Podgwaite, J.D., and B.J. Cosenza.

1976b. **A strain of *Serratia marcescens* pathogenic for larvae of *Lymantria dispar*: infectivity and mechanisms of pathogenicity.** J. Invertebr. Pathol. 27: 199-208.

The ED_{50} of a strain of *Serratia marcescens* for microinjected instar III and IV gypsy moth larvae was 7.5 and 14.5 viable cells, respectively. Percentage and rate of mortality were found to be highly variable among replicates of the same instar and between instars in free-feeding bioassays. Mortality in second instar larvae occurred before ecdysis, whereas practically no mortality occurred in third and fourth instars until the molting period. Histological evidence indicated that the microorganism invaded the hemocoel of healthy or predisposed insects through the gut wall. The rapid multiplication of the bacterium in the hemocoel of infected insects, followed by death in the absence of extensive tissue damage, indicated that mortality was due to septicemia.

Reardon, R.C., and J.D. Podgwaite.

1976. **Disease - parasitoid relationships in natural populations of *Lymantria dispar* [Lep.: Lymantriidae] in the northeastern United States.** Entomophaga 21: 333-341, illus.

Immature *Lymantria dispar* L. were collected from 6 geographically distinct populations over 2 years to determine correlations between parasitoid and disease incidences. Incidence of the nuclear polyhedrosis virus disease was found to be positively correlated with incidences of the parasitoids *Apanteles melanoscelus* (Ratzeburg) and *Parasetigena agilis* (Robineau-Desvoidy).

*Reethof, G., L.D. Frank, and O.H. McDaniel.

1976. **Absorption of sound by tree bark.** USDA For. Serv. Res. Pap. NE-341. 6 p., illus.

Laboratory tests were conducted with a standing wave tube to measure the acoustic absorption of normally incident sound by the bark of six species of trees. Twelve bark samples, 10 cm in diameter, were tested. Sound of seven frequencies between 400 and 1600 Hz was used in the measurements. Absorption was generally about 5 percent; it exceeded 10 percent for only three samples, and then only at 1250 Hz or above. No general trend was evident in the variation of absorption with frequency.

Reethof, Gerhard, and Gordon M. Heisler.

1976. **Trees and forests for noise abatement and visual screening.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 39-48, illus.

Noise pollution is common in metropolitan areas, comes from many sources, and is a problem in human comfort and health. Mechanisms of noise attenuation by forests are discussed, as well as the amount of reduction produced by various plantings. Plantings are more effective as visual screens than as reducers of noise. Plantings occupying relatively narrow strips of land can fully serve screening purposes, whereas plantings usually must be at least 100 feet wide to be significantly effective for noise control.

Rex, Edgar G.

1976. **A municipal arborist selects trees for street planting.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 9-11.

Past experience and published guides provide a basis for present-day selections of trees for planting along municipal streets. Selections that the shade-tree commission of a New Jersey municipality might make, and the reasons for them, are described briefly.

Rexrode, C.O.

1976. **Insect transmission of oak wilt.** J. Arboric. 2(4): 61-66, illus.

A review of the research done in attempts to identify the insect vectors of the oak wilt fungus *Ceratocystis fagacearum*. Oak bark beetles *Pseudopityophthorus* sp. are believed to be the most important vectors of the oak wilt fungus. Nitidulids, sap-feeding beetles, probably aid in the transmission of the fungus when mycelial mats of the fungus develop on diseased trees.

Reynolds, Hugh W.

1976. **Pulpwood for furniture parts.** Furniture Des. Manuf. 48(9): 182-184, 186.

Seven cords of yellow-poplar pulpwood bolts, 6 feet long ranging from 5.6 to 12.5 inches in diameter were sawed to 1x4 and 1x6 boards in a pallet part mill. After air and kiln drying, all the boards were measured for yield of interior furniture parts. This measurement simulated the newest method for making interior parts. Yield was excellent, 72 percent of green board area. Half the boards were sent through the new Drexel plant where 71 and 73 percent yields were measured. Yellow-poplar pulpwood proved to be a good, inexpensive lumber source for making interior parts.

Riddle, Jane R., George H. Moeller, and William H. Smith.

1976. **Breaking new ground in urban America.** Am. For. 83(11): 26-30, 66, illus.

Describes the urban forestry research conducted by a consortium of nine universities and two Forest Service units under the Pinchot Institute of Environmental Forestry Research. Eight working groups—air, water, land-use, wildlife, physical amenities, soil, and forest genetics—contribute to a better understanding of the interaction between man and the urban forest environment.

*Romberger, J.A.

1976. **An appraisal of prospects for research on juvenility in woody perennials.** Acta Hortic. 56: 301-317.

The physiological complexities of juvenility, aging, and senescence are inevitable consequences of the woody perennial growth habit. Some significant questions are: (1) What is the localization of juvenility and aging? (2) What are the consequences of increased size and ramification as the tree grows? (3) Do meristems age? (4) What is rejuvenescence? Four available, but novel or little used, research approaches are proposed that allow attacks on these questions.

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

1976. **A system for studying the synthesis of lignin and related substances by meristem cultures.** Appl. Polymer Symp. 28: 1065-1074, illus.

When *Picea abies* shoot apical meristems are cultured in sterile systems, the tissues release into the substrate soluble precursors of plysaccharide and lignin-like materials. These precursors can diffuse to remote sites before deposition as insoluble polymers or condensation products. These deposits can be collected in Millipore membranes and studied by microspectrophotometry and michrochemical methods. By using membranes of controlled pore size it is possible, in a new way, to study the stepwise biochemical processes involved in cell-wall synthesis and certain aspects of wood formation.

Ross, Robert S.

1976. **Role of cultivars in a roadside planting and maintenance program.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 149-157, illus.

Planting and maintaining roadsides requires flexibility in administration and operation. Financial and technical demands on these programs are ever-changing, and there is a continuing need for plants that, having specific qualities, will meet these changing demands. Controls and techniques of planting and maintenance are discussed, especially their effect on plant materials used.

Ryan, John J.

1976. **Design considerations in the selection of cultivars for metropolitan highways.** *In* Better trees for metropolitan landscapes symposium proceedings, USDA For. Serv. Gen. Tech. Rep. NE-22: 143-148.

The role of the highway landscape designer in developing appropriate plans for tree planting along metropolitan highways is discussed. The need to determine design objectives for each project is emphasized, and the design and visual considerations that must be taken in account for such a determination are explored.

Sabrosky, Curtis W., and Richard C. Reardon.

1976. **Tachinid parasites of the gypsy moth, *Lymantria dispar*, with keys to adults and puparia.** Entomol. Soc. Am. Misc. Publ. 10(2): 126 p.

Comprehensive identification keys to the adults and puparia of the flies of the family Tachinidae that prey on the gypsy moth. Descriptions of 34 species are given, with concise summaries of their distributions, taxonomy, immature stages,

biology, and hosts, and histories as parasites of the gypsy moth, especially in North America. Also brief notes on 47 species that are minor or incidental parasites of the gypsy moth.

Safford, L. O.

1976. **Seasonal variation in the growth and nutrient content of yellow birch replacement roots.** Plant And Soil 44(2): 439-444.

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

1976. **Gray squirrel habitat and nest-tree preference.** Southeast Assoc. Game & Fish Comm. Annu. Conf. Proc. 29: 609-616. St. Louis, Mo.

Among seven forest types in West Virginia, mixed hardwoods, white oak/red oak/hickory, and chestnut oak were most important for gray squirrels. In these types the three most abundant tree species, all oaks, had 75 percent of the nests and 54 percent of the leafnests. Squirrels preferred chestnut snags and sugar maples for nest dens; hickories, yellow-poplar, and maples for leafnests. Diversity of tree species should be maintained to provide dens and mast.

Santamour, Frank S., Jr.

1976a. **Breeding and selecting better trees for metropolitan landscapes.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 1-8.

The development of superior trees for planting in metropolitan areas is in its infancy. Although many of the techniques and methods of plant breeding for other crops can be adapted to this endeavor, there are certain special features that influence the successful production of better trees for people. Some of the problems and prospects of developing better trees are discussed—with emphasis on diversity within and among species, the consequences of clonal uniformity, adaptability (to climatic conditions, pests, stresses, and successful nursery culture), "personality", and reliability of plant materials.

Santamour, Frank S., Jr.

1976b. **Perspectives on improvement strategies for metropolitan trees.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 215-220.

The goals of tree improvement may vary considerably, depending on the genus or species under study. Maximum improvement can be achieved only by an adequate knowledge of the variability present in the gene pool, whether the pool is restricted to a single species or all species of a fairly large genus. Bizarre or atypical trees, although often regarded as ornamental, cannot be considered as significant goals of a scientific breeding and selection program. On the other hand, trees that produce no fruit or seed may be highly desirable in a metropolitan environment.

Schuler, Albert T., and J. C. Meadows

1975. **Planning resource use on national forests to achieve multiple objectives.** J. Environ. Manage. 3(4): 351-356.

Management of forests for multiple objectives presents unique problems to the forest manager. This paper describes a study of an attempt to apply goal programming to allocate 10,641 acres to eight alternative uses in order to meet a set of prescribed goals. The model proved useful in providing important insights into trade-offs among goals and among the various levels of given goals.

Seliga, T. A., and L. S. Dochinger.

1976. **First International Symposium on Acid Precipitation and the Forest Ecosystem.** Int. J. Environ. Stud. 8 (4): 303-306.

An overall summary of the symposium held 12-15 May 1975 at Ohio State University, Columbus. In digesting the many papers presented, the authors discuss the Scandinavian experience with acid precipitation; the atmospheric chemistry and transport of precipitation; effect on aquatic ecosystems; and effects on forest soils and forest vegetation.

*Seliskar, Carl E.

1976. **Mycoplasmalike organism found in the phloem of bunch-diseased walnuts.** For. Sci. 22: 144-148.

Walnut bunch is a yellows-type of witches'-broom disease occurring on Japanese, Manchurian, English, native black walnut, and butternut. An electron-microscope study of the phloem tissure of walnut revealed the presence of a mycoplasmalike organism (MLO) in diseased but not in healthy leaf and stem phloem cells. The MLO are pleomorphic, vary in length

from 150 to 1000 nm, and are enclosed in a plastic trilaminar unit membrane. Spherical or oval shapes predominate, but tubular forms were also evident near sieve plates. Some sections clearly showed the presence of ribosome- and DNA-like material within MLO cells.

*Sendak, Paul E.

1976. **Marketing and marketing research in the maple products industry.** Natl. Maple Syrup Dig. 15(1): 16-17.

Marketing and marketing research are defined and discussed in relation to the maple industry. The maple products marketer should set specific marketing goals, then choose the most efficient course of action to attain these goals. The role of marketing research is to provide information to enable management to make a more intelligent choice for action.

Shaw, Samuel P., and David A. Gansner.

1975. **Incentives to enhance timber and wildlife management on private forest lands.** North Am. Wildl. and Nat. Resour. Conf. Trans. 40: 177-185.

Private woodland owners are not motivated or able to make the investments necessary to provide adequate supplies of timber or wildlife. Incentives offer a legitimate and promising means for getting them to take action. This paper discusses the important role of private woodland owners as suppliers of timber and wildlife. It also presents a practical method for deriving fair incentive payments for timber and wildlife practices and demonstrates its application.

*Shields, Kathleen Stone.

1976. **The development of *Blepharipa pratensis* and its histopathological effects on the gypsy moth, *Lymantria dispar*.** Entomol. Soc. Am. Ann. 69: 667-670, illus.

Blepharipa pratensis eggs, consumed by gypsy moth larvae, hatched by the time they entered the midgut. Maggots penetrated the gut into the hemocoel and 20 hours after ingestion were established within an intersegmental muscle of the gypsy moth larva. Histological sections made at various stages of infection showed a gradual transition in the muscle, characterized by cell proliferation and nuclear and cellular hypertrophy.

*Shigo, Alex L.

1976a. **Compartmentalization of discolored and decayed wood in trees.** Material u. Organismen 3: 221-226.

An expanded concept of decay in trees is described. Trees are compartmented perennial plants that wall-off or compartmentalize injured and infected tissues associated with wounds. Details on anatomy of tree compartments are given. How trees compartmentalize injured and infected tissues is discussed.

*Shigo, Alex L.

1976b. **Mineral stain.** North. Logger 24(8): 18-19.

There is still confusion about what mineral stain is. Mineral stain is discolored wood associated with wounds. The common types of wounds that initiate the processes that result in mineral stains are discussed. In sugar maple, wounds made by sugar maple borers and yellow-bellied sapsuckers are the major types that result in mineral streaks.

*Shigo, Alex L.

1976c. **Microorganisms isolated from wounds inflicted on red maple, paper birch, American beech, and red oak in winter, summer, and autumn.** Phytopathology 66: 599-563, illus.

Fungi isolated most frequently from winter wounds were *Cytospora* spp., from summer wounds *Ceratocystis* spp., and from autumn wounds *Phialophora* spp. Bacteria were isolated frequently from summer and autumn wounds, but seldom from winter wounds. Bacteria and nonhymenomycetous fungi were the only microorganisms isolated from recently inflicted wounds. The first microorganisms to invade wounds inflicted at different seasons in the northeastern USA are different and the time before Hymenomycetes are isolated also differs for wounds inflicted at different times of year.

Shigo, Alex L.

1976d. **Communication of knowledge and needs between researcher and arboriculturist.** J. Arboric. 2(11): 206-208.

Research has produced a wealth of knowledge about trees, but not much of it reaches the people who need it and can use it. Some possible reasons for this are discussed, and the need for

improving communication between researcher and arboriculturist is emphasized.

*Shortle, W. C., and E. B. Cowling.
1976. **Development of discoloration, microorganisms, and decay in living sweetgum and yellow-poplar trees.** Org. u. Holz. 3: 213-220.

Patterns of development of discoloration, decay, and microorganisms were studied in 165 naturally and experimentally wounded sweetgum (*Liquidambar styraciflua* L.) and yellow-poplar (*Liriodendron tulipifera* L.) trees. Yellow-poplar trees formed heartwood; sweetgum trees did not. Both species formed discolored wood which became compartmentalized by a barrier zone of abnormal tissue formed after wounding. Sparse populations of bacteria and small-spored fungi were found in normal sapwood. Increases in these populations occurred after wood became discolored. Some decay fungi induced discoloration of live sapwood *in vitro;* small-spored fungi did not.

*Smith, H. Clay, Robert L. Rosier, and K. P. Hammack.
1976. **Reproduction 12 years after seed-tree harvest cutting in Appalachian hardwoods.** USDA For. Serv. Res. Pap. NE-350. 11 p., illus.

Status of woody reproduction 12 years after a seed-tree harvest cutting was evaluated on three central Appalachian hardwood sites in West Virginia. Data studied include species composition; size, number, and distribution of reproduction; stem quality; effects of early cultural treatments; and influence of grapevines.

Smith, Harvey R., and Peter A. Jordan.
1976. **An exploited population of muskrats with unusual biomass, productivity, and body size.** Conn. Dep. Environ. Protect., State Geol. and Nat. Hist. Surv. Rep. Invest. 7. 16 p., illus.

The muskrat (*Ondatra zibethicus*) population of an estuarine river at New Haven, Conn., is well above average in density, body size, and stability. Despite pollution and disruption of their aquatic surroundings and continual exploitation by trapping, these muskrats show fall densities of 23/hectare (ha) or within their preferred habit where cattail (*Typha latifolia*) predominates, 38/ha. Biomass maximum approaches 52 kg/ha. The relationship between trapping pressure and population structure is examined, and factors underlying long-term stability in this taxonomically simple system are discussed.

Smith, Joseph H., and James H. Patric.
1976. **Skyline cable logging.** Wonderful W. Va. 40(9): 23-24, illus.

This brief article is intended to inform readers in the central Appalachian Region of current research aimed at reducing some of the environmental impacts of logging. It reviews some problems associated with conventional harvesting systems and describes a skyline system now being tested at the Fernow Experimental Forest.

Smith, William H., and Leon S. Dochinger.
1976a. **Capability of metropolitan trees to reduce atmospheric contaminants.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 49-59.

The most damaging levels of air pollution are reached in industrial and urban areas. Atmospheric contaminants in metropolitan areas include both particulate and gaseous pollutants. Since trees have evolved in the presence of numerous materials presently considered air pollutants, and since trees are frequently abundant in urban areas, it has been speculated that trees may function as effective sinks for trace contaminants. Mechanisms for removing particulate matter may include sedimentation onto tree surfaces, impaction on tree surfaces, and precipitation transfer to tree surfaces. Mechanisms for gaseous removal by trees may include uptake via plant pores and surface adsorption. Sufficient potential for this sink function is indicated to justify consideration of this amenity function in tree selection and breeding programs for metropolitan trees.

Smith, W. H., and L. S. Dochinger.
1976b. **Evaluation and ranking of research priorities.** *In* Air pollution and metropolitan woody vegetation, p. 53-54. USDA For. Serv. Pinchot Inst. Environ. For. Stud.

This report provides a program of research designed to achieve an acceptable level of clarification and understanding of the relationships between air pollution and woody

plants in the metropolitan Northeast. Priority ratings are offered for the various research studies proposed.

*Solomon, Dale S., and Alex L. Shigo.
1976. **Discoloration and decay associated with pruning wounds on yellow birch.** For. Sci. 22: 391-392, illus.

Vertical extension of discolored wood associated with 8-year-old pruning wounds on yellow birch was shown by regression analysis to be significantly associated with wound size. All columns of discolored wood were associated with wounds and were confined to the tissues present when the trees were pruned. There were no significant relationships between presence or absence of Hymenomycetes associated with decay and time of closure or size of wound.

*Sowa, Edward A., and Walter H. Davidson.
1976. **A new cover crop for spoil banks.** Pa. Farmer 194(1): 132-133, illus.

Weeping lovegrass was sown with birdsfoot trefoil and Ky-31 tall fescue and tested for providing quick cover on anthracite strip-mine spoil in Pennsylvania. Fertilization of the seedings with N-P-K in all possible combinations also was evaluated. Weeping lovegrass provided quick cover in all fertilizer treatments, but growth was best in the fertilizer treatments that included nitrogen. Growth of birdsfoot trefoil was enhanced most by phosphorus fertilizer. Without fertilizer, vegetative cover was sparse.

Steiner, Kim C., Henry D. Gerhold.
1976. **Testing and evaluating new trees for metropolitan landscapes.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 227-234.

In the landscape-tree industry, genetic variation among species, clones, and other genetic units is most commonly exploited for improvements in appearance traits. The relatively little known of genetic differences in performance traits comes from the personal experiences of arborists and horticulturists. Further genetic improvements in the ability of trees to survive in urban environments require the use of systematic and statistically sound procedures of testing and evaluation. Some fundamental principles of testing and evaluation are reviewed. If selections are to be used in urban localities, it is important that they be tested in those situations, unless clone-environment interaction is likely to be small for the traits, trees, and sites in question. A plan is outlined for coordination of the respective activities of research institution, nurseryman, and arborist in establishing test plantations.

Stern, E. George.
1975. **Aspen pallets with 2-1/4", 2-1/2", and 2-3/4" wide stringers and aspen pallets with oak stringers and leading edge deckboards.** Va. Polytech. Inst. and State Univ. Wood Constr. Lab. Pallet and Container Res. Cent. Publ. 135. 32 p.

Aspen and aspen-oak pallets were tested for static stiffness, load-carrying capacity, and impact rigidity. It was found that aspen and aspen-oak pallets could be designed and constructed that would perform better than similar oak pallets previously tested for stiffness and rigidity. Consequently, it appears to be justified to use a number of light wood species for the assembly of warehouse and exchange pallets, for which these species were previously considered not suitable.

Stern, E. George.
1976. **Performance of pallet nails and staples in 22 southern hardwoods.** Va. Polytech. Inst. and State Univ. Wood Res. and Wood Constr. Lab. Pallet and Container Res. Cent. Publ. 145. 20 p.

The effectiveness of pointless, helically threaded, hardened-steel, 3 by 0.120-inch pallet nails with umbrella heads and 2-1/2-inch, 15-gauge, 7/16-inch crown, plastic-coated pallet staples in 22 hardwoods grown on southern pine sites was determined on the basis of tests on 522 joints. Specific average performance values were derived from the test data for the tested joints made of, and representative for, these 22 hardwood species.

Stern, E. George, and Walter B. Wallin.
1976. **Comparative performance of southern pine pallets.** Va. Polytech. Inst. and State Univ. Wood Res. Wood Constr. Lab. Pallet and Container Res. Cent. Publ. 141. 36 p.

Southern pine pallets, produced in accordance with the proposed Grocery Pallet Council specifications, were used in commercial ship-

ping moves and then laboratory tested to determine the influence of specific grading defects on pallet performance. White rot, decay, large knots, and steep cross-grain as observed in the pallet stringers caused the greatest reduction in stiffness and flexural strength; while the observed brown rot in the stringers was also an influential strength-reducing factor. On the other hand, the low-density criterion for southern pine stringers was found to be too stringent, since fewer than six annual rings per inch were of no adverse influence on pallet stiffness and flexural strength.

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

1976. **Influence of forestland characteristics on spatial distribution of hunters.** J. Wildl. Manage. 40: 500-506.

Effects of 17 accessibility, cover, relief, and game variables on hunter distributions were determined from hunter-interview data. All variables accounted for 33 to 44 percent of the variation among visits by 3 kinds of hunters to contiguous 65-ha blocks of land. The most important variables were: proximity to trails, camping or parking sites, wildlife clearings, or roads; public-land access, and game seen. The findings suggest limits to the effectiveness of management alternatives, and that hunters were strongly influenced by factors other than site characteristics or game-seeking efficiency.

Townsend, Alden M.

1976. **Selection and breeding of maples for urban areas.** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 195-202.

Among its approximately 150 species, the genus *Acer* offers diversity in size, form, color, and adaptability. Genetic improvement of maples for urban environments will require studies of intraspecific variation, interspecific hybridization, and tolerance to *Verticillium* wilt and environmental stresses. Breeding and selection with small exotic maples has been neglected, yet might rapidly yield improved cultivars of high value for urban plantings.

*Trimble, George R., Jr., and H. Clay Smith.

1976. **Stand structure and stocking control in Appalachian mixed hardwoods.** USDA Forest Serv. Res. Pap. NE-340. 10 p., illus.

Uneven-aged management, using a "q" technique for structure control, is discussed for Appalachian mixed hardwoods. The success in attaining stand structure goals with periodic selection cuts was evaluated. For successful control of stand structure, reasonable guidelines must be used for choosing maximum size trees, residual basal area, and a "q" that is applicable to the tree species and stand conditions. Future stands will contain mainly tolerant species that produce lower volumes per acre than those presently composing the overstory.

*Trimble, G. R., Jr., and E. H. Tryon.

1976a. **Grapevine control in young even-aged hardwood stands.** North. Logger 24(9): 12, 13, illus.

The objective of this study was to determine how stand age and tree height affect the regrowth of severed grapevines into the crowns of thinned and unthinned stands of young even-aged hardwoods on good sites. From the results of this study we concluded that grapevines can be eliminated by cutting them in stands as young as 12 years old and out of crop trees 25 feet tall (or perhaps even shorter) under both thinned and unthinned conditions.

Trimble, George R., Jr., and Earl H. Tryon.

1976b. **Grapevine control in even-aged hardwood stands.** W. Va. Univ. W. Va. For. Notes 6: 12-14, illus. Morgantown.

Wild grapevines often cause severe damage to trees in Appalachian hardwood stands. A study for controlling grapevines was made on two unmanaged well-stocked hardwood stands of large sawtimber-size trees on an excellent site on the Fernow Experimental Forest near Parsons, W. Va. Vines were cut near ground level in an effort to kill the grapevines and reduce stump sprouting. Results indicated that grapevines should be cut in mature stands 3 to 4 years before harvest to prevent damage to future stands from grapevines.

*Valentine, Harry T., Carlton M. Newton, and Robert L. Talerico.

1976. **Compatible systems and decision models for pest management.** Environ. Entomol. 5: 891-900, illus.

A decision-tree approach is described as one way to select the best available control-treatment alternative to suppress a forest insect pest. A systems model consisting of a set of differential equations is described as a way to organize available information and notions about the pest-host system into a format that will aid the example of one potential use for decision trees and compatible systems models.

*Vogel, Willis G.

[1976] **Requirements and use of fertilizer, lime, and mulch for vegetating acid mine spoils.** Natl. Coal Assoc. Surface Mining and Reclam. Symp. 3 (vol. 2): 152-170.

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.

1976a. **Achieving effectiveness in environmental interpretation.** *In* South. States Recreation Res. Appl. Workshop Proc. USDA For. Serv. Gen. Tech. Rep. SE-9: 90-105.

To contribute fully to sustained resource benefits, interpretation needs support for recruiting and retaining top-flight interpreters and for research in interpretation. 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.

Wagar, J. Alan.

1976b. **Land-use planning: a view from Holland.** J. For. 74: 13-17, illus.

Participation in a Dutch planning study suggested that public resource decisions require input from at least five groups: diverse specialists, interest groups, analysts, plan builders, and decision-makers. Integrating these inputs requires emphasizing meanings rather than details, careful distinction between facts and values, and a defensible hierarchy of values. A computer mapping technique for identifying and defining alternatives is described.

Wallin, Walter B. and E. George Stern.

1976a. **Eucalyptus warehouse and exchange pallets.** Va. Polytech. Inst. and State Univ. Wood Res. and Wood Constr. Lab. Pallet and Container Res. Cent. Publ. 147. 30 p.

Eucalyptus saligna pallet shook from Hawaii was assembled into nailed and stapled warehouse and exchange pallets and laboratory tested for their static stiffness, load-carrying capacity, and impact rigidity. On the basis of these tests, it appears that eucalyptus pallets can perform satisfactorily as warehouse and exchange pallets and in a manner which is at least equivalent to that of similar pallets made of other acceptable wood species.

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

1976b. **Comparative performance of southern pine pallets. Part II. Va. Polytech. Inst. and State Univ. Wood Res. and Wood Constr. Lab.** Pallet and container Res. Cent. Publ. 142. 20 p.

Based on a sample of 60 southern pine pallets purchased, produced, and used commercially in a severe handling environment for 16 one-way trips, it was found that the pallets performed as predicted. The expected average economic life is 60 one-way uses and the expected average cost per use is $0.18.

*Wargo, Philip M.

1976. **Variation of starch content among and within roots of red and white oak trees.** For. Sci. 22: 468-471, illus.

The variation of starch content within and among roots of red and white oak trees was determined by chemical extraction and estimated visually. Differences in starch content among roots of the same tree as determined by chemical extraction were small, provided the samples were taken at points of similar diameter. Starch content within roots varied inversely with root diameter. As root diameter decreased, the proportion of ray tissue to woody tissue per unit area increased, resulting in a corresponding increase in starch content. Use of a visual histochemical technique eliminated the

diameter factor because judgments were based on starch stored in the ray tissue only.

*Wartluft, Jeffrey L.
1976. **A suggested glossary of terms and standards for measuring wood and bark mill residues.** USDA For. Serv. Res. Note NE-217. 8 p.
Current information about wood and bark residues lacks the consistency needed to enable complete understanding and comparison from source to source. To make information about wood and bark residues more useful for production and marketing decisions, the Forest Products Marketing Laboratory and the Tennessee Valley Authority prepared this glossary of terms and standards for measuring wood and bark mill residues. The International System of Units (SI) is recommended as standard practice for workers in this field. Related conversion factors and principles for the use of SI are presented.

Weidhaas, John A., Jr.
1976. **Is host resistance a practical goal for control of shade-tree insects?** *In* Better trees for metropolitan landscapes symposium proceedings. USDA For. Serv. Gen. Tech. Rep. NE-22: 127-133.
Breeding for trees resistant to insects is an intriguing but difficult possibility. Some research is necessary in even determining that certain trees possess resistance to specific insects, not some form of pseudoresistance. In view of the pressure for research on other phases of breeding better shade trees, the search for and development of insect resistance will be of low priority. The use of insecticides will continue in the foreseeable future to have the primary role in controlling insect pests on shade trees.

*Wendel, G. W., and Franklin Cech.
1976. **Six-year results of a white pine seed-source test in West Virginia.** USDA For. Serv. Res. Note NE-224. 4 p.
The best white pine growth during a 6-year period in a West Virginia outplanting was obtained with seedlings grown from seed collected in Tennessee, Georgia, and North Carolina. These seed sources are recommended for plantings in West Virginia.

Wiant, Harry V., Jr., Joseph E. Barnard, and Miguel A. Ramirez.
1976. **Relating tree species to site quality in mixed Appalachian forests.** W. Va. Univ., For. Notes 6: 17-21, illus.
The presence of various tree species is related to oak site index in mixed appalachian forests. Multiple regression coefficients were developed for predicting site index from species presence. Regression models are presented for eastern, western, and southern portions of West Virginia as well as for the entire state.

*Wilson, Charles L., and Carl E. Seliskar.
1976. **Mycoplasma-associated diseases of trees.** J. Arboric. 2(1): 6-12, illus.
A review of tree diseases that may be caused by mycoplasmas. The symptoms of some mycoplasma associated diseases of trees are discussed. Current need for research in this area is appraised.

Wolf, Charles H., and Jean W. Nolley
1976. **Mechanization bringing broad changes in makeup of labor force in logging.** For. Ind. 103(10): 44-46, illus.
Employment in the logging industry dropped 28 percent between 1950 and 1970, while output of industrial roundwood increased 31 percent. Today's loggers are older, better educated, and more skilled. A large proportion are self-employed, many work less than a full year, and a substantial number have incomes below the poverty level. Mechanization of timber harvesting will continue to affect the size and makeup of the labor force.

Worley, David P.
1975. **TSI—financial and other benefits.** Ky. Gov. Conf. For. Proc. 1975: 23-30.
Whether timber-stand-improvement is a good investment or not depends on the objectives to be served. Timber per se cannot be expected to develop returns for everything. Amenities provided often result in a lower expected return than timber. On an amenity forest a 2- to 4-percent rate of return may be excellent.